# The Rational Optimist Podcast

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**Stephen McBride:** Andrew, what is the most misunderstood thing about space imaging?

**Andrew Peterson:** We've had space imaging for quite some time. We've maybe been doing space imaging for 50 years or so, if you go all the way back to military systems in the Cold War era. I think that the most misunderstood thing in space imaging is how to address the imagery market that exists right now and then how do you shape this into the future.

So we've taken a couple stabs at this. By and large, government customers have funded 95% of all of the space imaging budgets and space imaging programs. They typically want to operate their own constellations of satellites. They want to collect data that's for their use and for their missions and things. And so you have to, if you're gonna serve imagery to them, you probably wanna do that, you know, working directly with them to build satellites.

And then I think on the commercial imagery side, you really need to have something that customers can really want and can really look at. And so that can come in different forms and flavors. But a lot of customers in the commercial industry, they need something a little bit more than an image to be successful.

Oftentimes they'll need some sort of analytic product or drive product from that that kind of tells a little bit more of a story or can plug into a spreadsheet or can be used as some other business function. Looking at an image and counting things probably isn't sufficient to be able to do most of those use cases. So, yeah, I don't know. That's sort of the market and what we have today.

**Stephen:** I always remember that great story about hedge funds using satellite imagery data back in, I don't know, must be 15 years ago now, with counting the cars in Walmart car parks. Do you have a favorite imaging story or use case?

**Andrew:** Yeah, I mean, and that was a really interesting story because it was, because we're not sure how often that really like happened or how repeatable or how easy that was to… It was almost like a fundraising, maybe, fable or something about how we're

going to use this because yeah, it's hard to count all the cars in parking lots and compare that with, you know, looking at analytics data coming from a cell phone or some other way of getting those sort of use case numbers, but yeah, I don't know there's always there's always something different and new and distinct.

But it really depends on what the underlying data source is that you're trying to do and and how that works. I know with our technology and our, you know, satellites we do things a little bit differently than…than existing systems and so probably a little bit biased and sort of what I'm thinking about you know, right now. But yeah, I don't know as many of the sort of straight optical, you know, use cases that have turned out to be really valuable for folks.

**Stephen:** Yeah, so you're building a live 3D map of Earth. That sounds like something straight out of sci-fi. Tell me, has this been possible before? And if not, why? What breakthroughs have made it possible right now?

**Andrew:** Yeah, it's a good question. So yeah, we are building a 3D map of the world. We're using special satellites to go ahead and be able to collect that. And it may be helpful to tell a little bit about the story of sort of how I got here and the company got here to do this.

But suffice it to say, the world of space-based radar, which is kind of where we're able to derive these 3D measurements, has been a little bit slower to catch up or maybe to accelerate with the same velocity that we've seen in areas of the world that use kind of the same underlying technology, right?

So radar derives a lot of its performance and a lot of its benefits and lot of its values from the telecommunications industry. Commercial telecommunications industry and last 20 to 40 years, we've moved from satellite phones the size of your head and car phones and all of these things to now we have cell phones first and now we have smartphones and they're getting smaller every day and all of these things and sort of the radars are sort of like still the same size. They kind of still go on the aircraft. They kind of still operate in the same way.

And so maybe the technology has been there, now that we have the cell phones and all of those things to really make a step forward. But it's been hard. It's been hard to sort of motivate that and accelerate that. You know, some things around defense and kind of the punishing or more difficult research and development environments around that sort of area sort of come to mind. I think it's, you know, maybe this is like the story of space like 20 years ago. Right?

Like before SpaceX, it was kind of like a team of experts and it was all very reliable and it was all very expensive. And we just had a way to do this particular thing and this particular style. And, you know, that was sort of it.

And then you kind of need to make one of these seismic shifts. Like maybe technology is different. Maybe we can do something different, but how do you sort of catalyze that and make it something new and distinct and, and make that kind of step change up from where you were. I don't know if that makes any sense.

**Stephen:** Yeah, for sure. You mentioned SpaceX. Obviously, that's been one of the huge unlocks in space over the past decade or 15 years. Would what you're doing be possible before SpaceX brought down launch costs?

**Andrew:** No, I don't think so. I don't think so. I mean, it's kind of nuts that kind of how we used to do things and kind of how we do things now. But it really kind of goes back to, your launch cadence and your risk posture and some of these other things, right?

If you're building a satellite and you only have one shot to launch it and it's a very, very expensive launch, well, you make sure your satellite works, right? You check it.
And then you check it again and then you recheck it and then you check it 10 times and every time you check it, then you gotta go back and check the other things and check the checking process and all of sudden you got this single satellite, it's still the same thing but the cost is just going up.

And hopefully it's more reliable but oftentimes it's just perhaps checked more which doesn't actually lead to iteration and cadence and all of these things. And so you end up with a very, very expensive launch and a very, expensive satellite. And that's how we go. But now as we've sort of created a faster launch cadence and cheaper launch cadence, if it doesn't work, well, maybe we'll launch another one, right?

And when the whole universe doesn't depend on this one satellite launching this well and this way at this time, you have a couple more bites at the apple, then all of a sudden people can like relax a little bit and they can design things. Maybe they only check it three times instead of 30 or something, and then it can be a lot faster.

So that has spawned a whole industry of people who build satellites. And it sounds really complicated, but the satellite is basically just a computer with a couple of specialized pieces of equipment.

It's a computer with a radio to communicate to Earth and maybe something to steer it around and point it in the right direction. And then maybe it's whatever the satellite is designed to do, the payload for the satellite. And that could be a radar, that could be

some communications equipment, that could be a camera, right, for observing the Earth with optics.

But it doesn't have to be any more complicated than that, right? It's just these couple components, we can build them together, now we can launch them. And you've seen this just massive decrease in cost of getting a satellite up in space that we see now. And yeah, it's wild. It's...

Having come from kind of a little bit before that in my education, my schooling, to where we are now, it's just been remarkable to see all of these things sort of manifest. And now we get to do so much more in kind of a greenfield opportunity, right? Which, I don't know, probably resonates with other different industries, right?

The internet gets created and then bookstore on the internet is an amazing company. Or rooms and shares on the internet is an amazing company or banking on the internet is an amazing thing. But as soon as that happens and all these things start popping up, I think something similar is happening in space.

There's a little bit of investment, more investment time in building a satellite constellation than maybe building a website. But we're starting to come up with many different ideas to try different things, some better than others. But it is moving things forward, I think, all the time.

**Stephen:** When you, let's talk about the business of space for a moment. So people hear about the space economy and how there's, I'm not sure what the latest figures are, about 300 billion, 400 billion dollars spent per year.

Just break that down for us. Like where does most of the money go? What are the biggest businesses in space today? Is it comms, is it imaging, is it launch?

**Andrew:** Yeah, I know different areas of this business probably much better than I understand other areas of the business. I'm not as close to the broader numbers or the individual totals, but I can say a couple of huge things that go on in space.

First and foremost being GPS, which we use every single day, or at least I do every day in our lives. It's how our phones know how to get where the phones need to go. Communications and backhaul and all of those things that we need to have this broadcast television has been in space for 20 or 30 years. All those things are very cool.

And then maybe my corner of the universe, space-based imaging and remote sensing, kind of understanding the physical world through systems we put it in space. There's probably something like 30 to $50 billion a year globally that we spend on Earth observation satellites of some type and of some flavor. But kind of echoing a point that I

said in the beginning of the call, like of that, like a big chunk is NASA and then a larger chunk is defense customers worldwide.

Again, defense customers, the way that defense operates, right, is I think is very strange for most people, right? Because it is very counter to their typical experience as a consumer, right?

A consumer, you have something that I want and I see that you have it and you tell me the price and then I buy it, right? Maybe it's a little bit more elaborate than this. Maybe there are a couple more stages in this progress, but like generally speaking, this is what we're gonna do. You have a product or service. It's already there, it's finished and I can go and I can go claim that.

Government and defense is very, very different from this style. In fact, it's the exact almost opposite, which is like, “I want to create something in the world to go perform a defense mission. I'm going to craft it almost from whole cloth and you, the service provider, are going to help me. So we are going to set out on a journey with a statement of work and some outcomes and how we're going to go discover a new, more better version of an aircraft carrier or an aircraft or a satellite. We're gonna go find some new solution and I'm gonna pay you some money to go develop that thing and go start with what we have and then research into what we want into the future.”

It's like applied research and development is the way that government works. And so we have a research and development sort of budget. We have a procurement budget, like maybe after we've created it together, maybe we're gonna buy some of it, but it's still gonna be pretty custom and we're gonna deliver it there. And then we're gonna sustain it and we're gonna operate this hardware that we've created together, this new tank or this new aircraft or this new satellite on this journey.

You'll notice that none of those buckets is labeled “buy an image.” Buy an image or buy a laptop or buy a thing. This is not really part of the game, right? We're gonna go build somethng that somebody else has never created before. And so when you approach a defense customer and you're like, well, this satellite collects imagery for mining companies and for insurance companies and for all hedge fund traders, and it can also collect an image for you.

They're like, “I don't want this actually. This feels very unnatural.” And you're like, “no, no, no, it's cheaper because, you know, we can serve lots of different industries with the same camera.” And they're like, “I don't think you understand. I don't love this model.”

And furthermore, defense customers are not known for being particularly cost-constrained. Cost constraint in defense procurement is not like the thing, right? It is much more about the capability, right? So you approach them and you're like, okay, you

have the world's highest resolution satellites that can collect amazing photos of apocryphal license plates of cars from space and whatever it is, right?

And then you come to them and you're like, but I can give you something much cheaper that anybody can access at any time at much lower resolution. And they're like, “maybe was not what we needed here.”

So, $20 billion is spent on amazing reconnaissance satellites or something on that order. I don't know the actual number, but it's something in that range. And then like a small amount is spent on commercial companies trying to build satellite constellations and sell the data afterwards. But it's like, maybe, maybe, maybe we're discovering some of these things are easier and some of these things are harder. Hopefully that made sense.

**Stephen:** Yeah, totally. Just listening to you talk about the kind of process of government inventing things, “hey, we want this thing to exist in the world. Our partners are going to help us do it.” I often think about the decline in state capacity and the decline in kind of, you know, the bits to atom shift, I guess.

Do you think those two things are linked? Do you think it's possible to have truly frontier innovations without the government kind of being that almost first customer there, the one that picks up the R&D tab at the start?

**Andrew:** It certainly certainly it can, right. Certainly we have industries that are dominated by you know private research and development right. Semi…semiconductors kind of come to mind like massive massive R&D budgets to go build a chip that's slightly cheaper, faster, easier, more efficient you know all those things.

**Stephen:** I guess that's so true, I guess the government was the first customer, right? NASA was like the first customer of semis.

**Andrew:** No, you're absolutely right. You're absolutely right. You're absolutely right. And so that I think so maybe there is an interesting dynamic here. Maybe there's an interesting thing where, you know, seed capital to go into an industry initially to maybe get it started is useful and valuable and helpful. But we'd like it to transition to whatever extent it can into an easier place.

I will also mention something that I think is a really seismic shift that's going on in the defense industry. I would like to point to this, which is we're gonna go do that process. Hopefully this is interesting, I don't know. This may also be like some nerding out here a tiny bit.

But we're gonna go on this journey, right? And you're the service provider and I'm the government customer. And I say, “Stephen, I need a ray gun.” And then you might say, “well, I've never built a ray gun before.” And the government says, “I know, I know, it'll be great. We'll build it together.”

And so you're like, “well, I'm going to need some money to go think about building a ray gun, right?” And the government says, “well, OK, well, I'll pay your costs.” And you get the team of experts, and we'll proceed a pace in this development. And they say, “well, thank you for covering my costs. I would also like to make a little bit of profit.” And the government says, “OK, well, we'll give you a little bit more money on profit. It'll be tied to the costs, right?”

So maybe maybe 6% of all the costs you incur, you get to keep as profit. You then run off having this incentive of the more you spend, the more money you make. And then 15 minutes later, the guy was like, hang on, hang on, hang on. Why does this Hummer have spinning rims? Like this is not how this thing should go. You're incentivized to spend as much money as you possibly can on this thing called the cost-plus contract, right? Cost plus fee contract.

We're, we should not do this. We should not do this in, in, well, or at least maybe we're not going to do it this way. I'm going to make you write down before we start every single thing that you're going to spend money on and make sure that those get tracked to an overall requirement that meets the mission objective of whatever it is that we're doing.

And you're going to…you're going to have this traceability exercise where every dollar you spend should be directly tied back to the objectives that we're actually trying to pay you for. Which doesn't actually change your incentives from making it cost as much as possible. It just now changes maybe the way that you go about it and maybe there's some broader constraints around these things. It's probably better, but it's still not an ideal or an optimal situation.

And this is how defense procurement and development has gone on for the last 40 years. And you're like, “well, it feels rather inefficient.” You're like, “yeah, we know.” This is the worst process you could...

Because when you're creating something new, you often don't understand how much step A is going to cost compared to step B compared to step J. You sort of have to go along and see. But if we've already programmed all the money that you will spend X in A and you will spend X in B, well, I'll find a way to spend X in A and X in B. And so this is like not great.

There is an alternative model, of course. It's the model that we use every day in all of the commercial world and all the other things. It's called the firm fixed price model where we just agree that if you can develop and create X and you're the best, you know, low-cost solution and we have technical understanding, you can maybe get there.

Well, just give me X and whatever you, whatever you're, whatever you can manage to keep as your profit margin when you create X, well, that can be yours to keep, which is how I bought my laptop and the monitor and the camera and everything else that you see around me. Somebody had a cost and I don't know what their cost is. I just know the price and I buy it that way.

And so now the government is starting to move more and more towards this firm fixed price model. And it couldn't possibly be better for what people are doing, but you have a sort of innovator's dilemma type of situation where companies that are very, very good at justifying their costs have this very high-cost burden to operate under cost-plus models.

And then companies that don't have that same cost burden, companies that are able to move a little bit more efficiently, they don't have quite as many people to go manage all of these costs and do all their reporting… They end up doing much better on these firm fixed price models.

And so I think you're going to see over the next 20 to 30 years, the rise of companies that operate under this new, you know, maybe maybe Linux operating system of like, “we're not gonna report everything. We're not gonna trace everything up and down. We're just gonna deliver really good hardware and we're gonna do it for lower costs than anybody else.” And that's gonna be a winning solution for you, the end customer and the taxpayer ultimately.

And I'm very excited to see more of that and less of the sort of “pay as you go, pay unlimited,” you know, cost incentive sort of program. I think that's going to be a lot better for us to be more on this firm fixed price sort of model as time goes on.

**Stephen:** So that's generally bad for the primes. Two questions. If you had to pick one prime to survive and thrive over the next 20 years as we move away from cost-plus and then also away from big expensive exquisite systems towards cheap, attributable mass produced…

If you had to pick one prime to make that leap, who would it be? And then if you'd be so kind to give us the five new primes 20 years from now when we're doing part seven of this podcast.

**Andrew:** Oh man. I was thinking, right, right, right, right, right, right. You asked the first question, I was gonna have a really, really hard time with. And then you asked the second question, which is the top five primes. And then that was even harder somehow to accomplish.

Yeah, I mean, between all of the defense primes that exist right now, I think the one that will that will be in the best position and in the best place is going to be the one that continues to work with new technology and new companies and can be efficient. I don't know that it's entirely clear. I think there are some things that are moving in favor. I think some things are moving against.

Boeing has an amazing commercial business in addition to its defense business. Is that an asset or is that a liability? I don't actually know. You know, it, you know, you're tied into a production model and a production style of something that the world very much wants and the world very much needs and would be very difficult to replicate somebody else, but is that going to chain you back to the past? I, I'm… You know, I am… I don't know that I know a great answer.

But I do feel like attitudes are changing within these primes. And I think they're looking more for, you know, the same thing that Clayton Christensen recommends in Innovator's Dilemma, which is if you find yourself in an industry and you see a disruptive wave coming and you have some wherewithal to go achieve it, how do you operate?

Well, it's not by taking your cost structure and trying to change it and bend it into the new model. It's by opening up an entirely separate division that you hold at arm's length from the parent organization that has a different cost model so that it can enter the market that is emerging and that's how you can survive and that's how you can adapt and that's how you can move forward into the new era. So, I don't know we'll see there.

With regards to the five new primes, yes, all of the ones that you mentioned I think will be here 20 or 30 years from now and they will be bigger than they are today and Anduril, Palantir and SpaceX all fit that bill as companies that can do, that are running this sort of other operating systems, other sort of model, right?

The idea that like a Falcon 9 costs what it costs, it's kind of a commodity thing, right? You either buy the launch or you don't buy the launch, right? I mean, this is, and never mind what it costs me to produce a Falcon 9. If you can find a Falcon 9 mission or a ride somewhere else for lower money by all means, go find it.

But because we have this nice product and it's much lower cost than anything else, SpaceX is able to have much better margins on that system than defense primes had on kind of their older model, even though that older rocket cost much, much, much more money, the organization and the incentives were not in a sort of in line to it.

So yeah, I'm not sure. There's a part of me that wishes to put Array Labs in this category of space prime as well.

**Stephen:** Of course. I was waiting for it.

**Andrew:** But I think we need to earn it. Some distance between a 30-person organization and the thousands and thousands of people that all of these companies employ.

But I think if you are going to make the transition there, the old wisdom is still the true wisdom: You got to figure out your customer. You got to do something that they actually want that makes them very happy, that delights them. And that's how you succeed. And that's how you move the ball forward in these different domains.

And it's important to never forget that, right? We're here to serve somebody else and build something that they find useful. And changing their behavior too much or constraining them too much or trying to make them go along with your idea has always been something of a challenge in any business domain, it's nice if you can build something that somebody immediately says, “Ah, the thing I've always wanted!”

And when you talk to government customers and you say, “well, we're going to build this thing and we're going to take all the development risk and we're going to take all the technology risk and we're going to do this internally,” just like the telecommunications companies or the semis companies do when they come out with their next generation of chips or their next generation of boards or Apple, because next generation of the iPhone.

I think we haven't really done this in defense because we've had this opportunity for this crutch a little bit, this cost-plus sort of edifice. I think we're at a place where we can start moving towards more and more and more low-cost acquisition of all of these things, a little bit more efficient process, and that's going to really open up a lot of efficiency and performance and value for people who are kind of operating in this area.

**Stephen:** Before we dig into imaging and what Array Labs is working on specifically, I think about Silicon Valley, Europe…and Palo Alto, it was the most important place in the world for technology, for investors, over the past 20 years, 25, 30 years, as the software-led, internet-led bull market happened.

If we're shifting back to this world of bits and atoms towards what Array Labs is doing in space and nuclear and drones and all these amazing, you know, robot taxis, so. Silicon Valley was the most important place over the last 30 years. Where's the most important place over the next 30 years?

**Andrew:** Ooh, what an amazing question. And so narrow. You know, I think it goes back to something that other people have said, which is, you know, one of the most important things for us to do collectively as a society, and what I think you're doing here very, very well with this optimistic view of the world and sort of asking these questions is you have to sit here and you say, “okay, what is the future going to look like that's going to be different from what we have today?”

And we used to be much better at this. And I think it used to be an easier exercise for us to accomplish, you know, previously. And I think that really is the secret, right? How do you glimpse the future? What does the future look like? Is it vacations on the moon? Perhaps, right? Is it robotic, you know, a house cleaner named Rosie the robot, right? I don't know if you remember *The Jetsons*, but you know, this is this idea, right?

**Stephen:** I do.

**Andrew:** We're gonna have the old things, but they're all gonna be different and they're all gonna be new and they're all gonna be fantastic in their own way.

And so we think about, what would cheaper power truly mean? Wow, I would love, right? I would love to use more power. This is a very, very controversial thing to say, but if we can use more power and we can do that sustainably and responsibly and ecologically, then we should use as much power as we possibly can because that just helps shape and bend all the rest of the world.

It gives us more agency in our day-to-day lives, right? And that really is what the advancement is all about. It's tomorrow, I'm gonna be able to do something and I'm gonna be able to do it a little bit cheaper or a little bit easier than I was able to do it today. I'm going to be able to do a little bit more with a little bit less.

I want to see that future and I want to see that world and I want to see that vision manifest, right? So we're going to use more energy. Computers are still going to continue. Computers are going to still become faster.

I think that a lot of the work that we are doing, a lot of the knowledge work is going to continue to be accelerated by the advent of things like AI. And that's going to start shifting into the physical world and how we build and craft and create products or we create services or we create optimized functions for different things, right?

I mean, we're talking about AI laying out circuit boards. That's amazing. That's fantastic. That saves somebody so much time. You still need to be an expert to sort of manage that whole process. But now we can get to an 80% or a 90% solution that works well in a fraction of the time than we used to, right?

Software encoding is starting to do this. And those things are going to directly manifest and hit in the physical world and continue to hit in the physical world as time goes on. And I'm really excited to see all of those things, you know, happen.

And I still think it's going to be places like Silicon Valley in the Bay Area where people tend to congregate, people tend to fly and flock to from all corners of the universe to find these locations where people are in this flywheel effect where make a little bit of improvement on A, which leads to a little bit of an improvement on B, and A and B together make C, and then all of a sudden you end up with something that's wild and new and works so much better than what happened in the past.

So yeah, I'll pick that again narrowly. But there will of course be all sorts of different places where these things manifest as well. So, yeah, we'll see.

**Stephen:** You mentioned energy, so I'll go there. What's your most optimistic view or best idea for what happens when we 10X energy production or 10X energy consumption, specifically in rich countries?

Because the answer I usually get to this question is, that's great because someone in Nigeria is going to be able to live at the same standard as you guys do in America. That's great. I'm really supportive of it. But like what happens in rich countries?

One thing I've often thought about pitching the leaders of Saudi Arabia and the UAE on is, hey guys, need these big huge – everywhere in the country – you need these big giant outdoor air conditioners to have the weather of San Francisco all year round and you would…you turn the place into you know, a hundred trillion-dollar economy overnight.

**Andrew:** I have never thought about giant air conditioning, but I think it is a good idea. I will join you in this.

**Stephen:** If you could build it, that would be great.

**Andrew:** The world, and you're like, well, yeah, no, I like that idea. But in terms of rich countries and other things, again, like all of your life, the clothes that you wear, the food that you buy, the transportation that you enjoy as you move from point A to point B, all of the things in life that give you agency and give the electronics we have, it all fundamentally has to come from energy.

Energy gives us all of these things. It's energy that runs the factories. It's energy that runs the buildings or the air conditioner or whatever it is that is being done. And that energy is kind of the most base currency for our physical reality. Yeah, I mean, you just

get to shape it a little bit more and a little bit more easily to whatever it is that you're trying to accomplish. And so, yeah, I don't know.

This is an area where, again, I think finding better ways to have that crisp idea. And maybe outdoor air conditioning is like a really, really good one, you know, because we need, as you mentioned before, we need stories, not statistics, right? We need to have that *Jetsons* view of, “well, imagine when it will be possible for us to just do X or Y or Z, right? Imagine when we'll be flying around in space or imagine when we'll be flying around in our flying car or imagine when, right?”

And so it's like, how do I get places? How do I have things? How do I share things with other people? How do we have a richer experience? And like, is that just screens? Hopefully not, right?

There should be something easier where we go… I mean, one of the easiest things for me to contemplate and imagine is what if reasonably efficient and low-cost and much faster transport was available for people in California, right? We have Northern California, we have Southern California. There's some quite distance between the two. We should be able to get from one to the other, much more cost-effectively and much more conveniently than other ways, right?

And so is this like Hyperloop? There's nothing technically wrong with Hyperloop. It's a great idea. It's a much more efficient way of moving things from place to place than you might otherwise imagine. Will that catch on? I have no idea, but I don't know.

There are things like this that could be possible in a *Jetsons* future and we should spend a lot of time, more time than we do, conceiving and moving the collective conscious towards a view of abundance and a view of a little bit better than today and find out what it is that we want to have, right? While still being in touch with the other things that are truly important like our families and our friends and the human connection and human touch around all of these aspects as well. I don't know. All great questions. Not simple ones, for sure.

**Stephen:** Listen, let's get into what Array Labs is building. Give me an overview of the imaging market today, specifically what is the state of the art today? And I know you're building something that is 10X better. So just describe exactly what you're building and how it's going to impact the average person or just explain it to the layperson, I guess.

**Andrew:** Yeah, this is definitely something that I can speak to with a little bit more precision than…than what will the world look like 50 years from now when we have energy abundance.

Okay, so in terms of the Earth imagery market and Array Labs and sort of the saying… We've sort of talked a little bit about how existing systems and existing programs are maybe a little bit more traditional and a little bit slower in how they're conceived and how they're developed and how we'd like to move to something a little bit faster and more cost-effective leveraging commercial technology.

And one of the easiest ways and most obvious things that you can do as you conceive of how do we build better radar systems starts with kind of the input into that funnel, which is who are the people, who are the engineers that we're using to actually create some of these new technologies and new things.

And this is again an area where defense primes have a little bit suffered thanks to the way that that business is incented, which is, you're a very promising RF engineer or electronics designer and you have an opportunity to work for Apple or Qualcomm or NXP or one of these other amazing technology companies and you also have an offer to work for a defense prime and make a third of the money and have a much different life and outlook, you're like, “well, this is not exactly a hard decision.”

To do these different things, you know, we're going to do something that is that is a little bit you know, it's quite straightforward, right? We're gonna do something, you know a little bit easier.

I just noticed that I have another meeting.

**Stephen:** Listen, Andrew, you've been super valuable or super good with your time. So if you have to go, have to go. What I'll do is we could have a follow-up in a couple of weeks and we could publish it as a continuation.

**Andrew:** I would love to. We sort of have just sort of talked about whatever this was. Man, I can't tell you how fun this conversation has been. I really appreciate all your questions and the care as we kind of go through each of these different industries and imagine a world that's a little bit different than the one that we're living in today.

And yeah, I love what you're doing and thank you so much for the time and the opportunity to provide more of those stories in the world and how things are gonna be better tomorrow than they are right now.