The Rational Optimist Podcast

Stephen McBride // The Rational Optimist Society
Nathan Mintz // CX2 co-founder

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Stephen McBride: Nathan, I want you to pretend for a moment that a US general from the first Gulf War, they slipped into a coma in, call it 1995, and they've just woken up. You are the first person that they get to talk to, and you have the job of telling them how drones have utterly changed warfare over the past three years. How do you actually even go about explaining that to them?

Nathan Mintz: Well, General Rip Van Winkle, I think that the automation revolution is here. And that suddenly we've gone from very expensive missiles, few in number, shooting down very expensive aircraft, to warfare reaching consumer scale. And suddenly we have thousands of small UAVs that are being piloted by what we would consider infantrymen a generation ago.

And they've sort of supplemented and replaced artillery, they've replaced ISR assets that previously were very expensive, and they've now become ubiquitous. Nobody can really move on the battlefield anymore without being seen. And the element of surprise has a different—totally different element to it. So, welcome to the future, sir.

Stephen McBride: There's news coming out of Ukraine weekly. Is there one story from the past year or so that captures the shift best?

Nathan Mintz: Well, I mean Operation Spiderweb, obviously, right? That's been the big one.

Stephen McBride: Say more.

Nathan Mintz: Yeah, Operation Spiderweb was when the Ukrainians smuggled a couple hundred, or I think it was about 120 small UAS, very cheap drones, $500 a piece with cell phone transponders, Russian SIM cards in them, and had them pop out of trucks near Russian airfields, and they did about $5 billion worth of damage. They took out a number of Russian strategic bombers. So if you look at the exchange ratio on that and the fact that they were able to achieve strategic surprise so definitively.

It really changes the face of warfare, because before, we had kind of an understanding at least from an air standpoint, you didn't have to worry about aircraft taking off from inside your own territory. Now you do, right? And so that changes the entire way that we do offensive and defensive counter air going forward.

I think the continued sort of slow drip of the Ukrainians and the Russians going back and forth with Shaheds and with some of these long-range kamikaze drones has been a big sea change. Then the other thing that has kind of come out is we're now seeing things like USVs that are launching UAVs. And we're seeing USVs launching missiles offensively. We had the first surface-to-air kill from a USV launching a you know sidewinder missile at a Russian Su-30.

So now suddenly, you know, missiles and drones are popping out of things that you wouldn't expect. And so it changes the defensive calculus quite a bit. For a while there, with air defense systems becoming so robust and so accurate, I mean, in the 90s and the 2000s and 2010s, we mastered the ability to shoot down ballistic missiles and other systems. And now we're seeing the natural counterweight to that, that now suddenly offensive systems are growing capabilities. And the assumptions about how the tactics and techniques and procedures are going to play out is swinging the other direction.

So it's very interesting to play out. That's been one manifestation. Trying to think if there's anything… Like those are—those are two very good examples right there. Oh, and like what we did see with the Iran conflict and shifting the Middle East for a little bit is in the 12-day war with Israel and Iran, culminating in the US bombing you know, Natanz and Fordow and the other nuclear sites, Isfahan, is we saw kind of the zenith of Western air dominance, right?

I think that going forward, it's going to be increasingly less likely that we're going to have such a one-sided air battle again. But the US and Israel, and then finally the US, kind of capping it off, kind of have taught a master class in how to dismember a state's air force and air defense systems and then crack open some strategic targets vis-a-vis nuclear enrichment facilities. I think those were kind of the three things that stand out in my mind from the last year.

Stephen McBride: Do you think adversaries could or have planted something similar inside the US or maybe other Western nations?

Nathan Mintz: Well, I mean, yeah, the Russians are innovating every day and so are the Chinese. I think the Chinese, I think, are particularly ahead of the curve when it comes to integrating drones and unmanned vehicles and robotics into their combined arms fighting force. You're seeing exercises pop out every day on LinkedIn, photos of robot dogs being used as ammo carriers, drones being launched from multiple drone launcher trucks out of tubes, scores of kamikaze drones, of unmanned boats, et cetera.

And what's kind of fascinating about this buildup is that it's occurring out in the open. Like people are kind of flexing out in the open whereas before a lot of these capabilities were sort of like hidden from plain sight. I think people have kind of realized that it's a lot harder to do that in this day and age so you might as well you know take credit for the flex and so there's just a lot of sort of left of you know...

We used to talk about intelligence preparation of the battlefield. This is sort of like social media preparation of the battlefield of how do you establish deterrence. It's by communicating that you have overwhelming capability more so than, “hey, I have some tricks up my sleeve you haven't thought of.” And I think there's still some tricks up both our sleeves and the Chinese sleeves and the Russian sleeves that we haven't seen or thought of, but it remains to be seen.

The other thing that we're seeing is we're seeing kind of a massive buildup in autonomy actually in Europe. You're seeing the emergence of companies like Helsing that are raising a billion dollars in a stretch and Quantum Systems, Techover, Stark, et cetera, others that are raising quite a bit of money and scaling quite a bit of capability.

And the Europeans have finally got serious about spending on defense after decades of sort of lethargic spending on defense. Now they seem to be meeting their NATO obligations with vengeance. And particularly players like Poland, I mean, Poland's up to 5% of GDP, I think, that they're spending on defense right now.

Stephen McBride: Before we get into what you are doing with CX2, with taking drones out of the air. Let's just talk through if you had to stack rank countries by, give each country a grade for their drone industry. Let's say you have China, Ukraine, Europe ex-Ukraine, and America. Where do they all shake out? Who's ahead right now?

Nathan Mintz: So, I mean, China obviously in terms of raw production. DJI produces 90% of consumer drones in the world. I think it’s about 8 million a year and counting. They've taken a lot of that capability and converted it into military drones as well. They have some pretty robust, cheap capabilities. Like OcuSync's a pretty good waveform that has a lot of robustness to interference and jamming and other things. And the form factor on their antennas is quite small. So that's really good. And then I think what's good for them, bad for us.

I would put the Ukrainians kind of second. Now the problem is the Ukrainians are, you know, they have hundreds of drone manufacturers, 200 plus. They're producing 2 to 4 million drones a year right now. But they're very dependent upon Chinese supply chains still, right? So despite years of trying, they still haven't completely uncoupled. There's a great report on the Snake Island Institute website about this actually, where they go into

the fact that even after two years, like 40 % of the supply chain from Ukraine is still based on Chinese parts.

The Russians are right behind them. They're probably producing 2 million drones apiece. But again, the people that are getting rich off the Ukraine-Russian war, the Chinese are selling parts to both sides. And those supply chains are very dependent.

Just behind them, I would probably put us and maybe the Europeans right behind us, right? We're starting to build up our capability. Historically, US autonomous systems has been concentrated in groups like GA, General Atomics, or like in the Gray Eagles that Boeing built out of Oregon for a while. So much larger group two, group three platforms, but we're getting smarter about group one.

You have outfits like, you know, Neros defense, you have you have Teal, Skydio, et cetera, that… You have Brinks that are starting to catch up. Turns out it's not that hard to build these things. And then the question is, like, how do we build an NDA, what's called an NDA-compliant, a non-Chinese supply chain? And that's the hard part. There's still a lot of like, you know, waivers and stuff for Chinese parts.

We're catching up on the battery side. You can now buy batteries from the U.S. pretty easily. We're catching up on the motor side. But then there's some other things like, you know, famously the rare earth magnets, for example, the Chinese still kind of have a lock on that. And it's slowly being uncoupled over time, right? So, and the whole West has that problem, right?

We've turned China into the world's workshop and we sort of outsourced all of our dirty industries and now we're paying for it. We're having to pay more to bring those back and there's a little bit of pain associated with it. But uncoupling and becoming less dependent on them is sort of an essential part of it.

It doesn't do us much good to be able to build a million drones a year if we don't have magnets to put in them, or cars, or anything else. So we have to kind of figure out how to vertically integrate Western industry and US industry, particularly for things like drones and autonomous systems, and not just focus on the part that had the highest margin, which is where all the MBAs for the past 10 or 15 years have focused.

We'll outsource the low-margin stuff. It's sort of the classic Clayton Christensen value trap, disruptive, you know, disruptive value trap. You will outsource all the stuff that's lowest margin and give that away to someone else. And it turns out, well, what if they turn it off and won't sell it to you? Okay, then you're screwed, right? So like that's, that's one of the things that we're slowly unwinding here.

Stephen McBride: We should start outsourcing the MBAs.

Nathan Mintz: Yeah, well, I mean, you know, I think we have kind of a little bit of an overproduction in the sense that we sent too many people to business school and not enough people to engineering school, whereas like, you know, China and Russia, they don't have that problem. They have a lot fewer lawyers and MBAs and a lot more doctors and engineers. And I think that's, you know… People don't look down at that kind of stuff over there. I think there needs to be a cultural shift.

Stephen McBride: Slight detour, I have three kids, I think you're one ahead of me. Do you think blue-collar jobs, or basically working with your hands, producing actual stuff in the real world? Do you hope to push your kids into that? Do you actually think that's what will become valuable now?

Nathan Mintz: Well, I mean my son has the knack. He's going to probably turn into an engineer. He solved the Rubik's Cube in about 55 seconds the other day. My daughter is clearly, you know, I mean, she's my oldest daughter, is clearly like a lawyer. She's very argumentative. She's into government. She's into civics, into politics, et cetera. I mean, I have the, you know, then the younger two, it's a little too soon to tell. I think my third one might be more of an artist. I'm not sure about the five-year-old yet.

So, but I think I'm fortunate to be in a position that my kids are semi-insulated from these things. I would encourage them to follow their passions. But we do need to encourage people that welding can be a very prestigious profession. It doesn't have to be, I think we created this elite overproduction and this whole class of people who thought, “well, I'm just gonna work on a laptop from a cafe and I'm good at creative things and you do need to build things in the real world.”

And like I was fortunate my father was a commercial fisherman so I spent a good portion of my childhood on the back deck, you know, catching fish or you know working deck chairs or fixing stuff or whatever. I certainly drag my son out of the house and make him do yard work and what have you. I don't protect them from getting their hands dirty.

Stephen McBride: So CX2 recently launched the Spectrum Initiative. Talk to me about the invisible battlefield. Talk to me about electronic warfare. For anyone that doesn't know what's going on right now, set the stage and tell me why this is maybe the most important thing in the drone industry right now.

Nathan Mintz: Yeah, so the Spectrum Imperative is—which you can see a copy of the prospectus for right here, and we also have a website, spectrumimperative.com. What we're trying to do there with that communications initiative is really draw attention to the capability gaps that exist in the West in terms of our systems have become incredibly

dependent upon the airwaves and the wireless spectrum for communication, command, control, and sensing.

And at the same time, we've had the luxury of operating in a permissive environment for the past 20 to 25 years where we had air superiority. We didn't really have to worry about jamming. It was somewhat of a nuisance. We were fighting sort of a long-term low-intensity conflict. And that time we became complacent. Our electronic warfare capabilities have become extremely exquisite but very few in number. And they simply are not going to hold up in a near-pure conflict.

And I think Ukraine in a lot of respects was a wake-up call in that respect you know for that, in the sense that suddenly you had all these exquisite artillery systems like HIMARs and what have you, that are basically being neutralized in terms of their effectiveness. Their main asset is that they can be extremely precise from far away by really cheap ubiquitous systems like GPS jamming.

And the Russians have kind of dialed in our number on this in the sense that they have extremely dense GPS jamming, they have extremely dense counter-UAS jamming all along the front, as do the Ukrainians for that matter. And they've got communications jamming, et cetera, and so they've basically taken the spectrum and mined it, so to speak, is probably the best way to think about it, or put up barbed wire.

And so those obstacles, any sort of Western system that we sent over there, it worked initially at first, whether it was our drones or a lot of our artillery systems, precision missiles, and then over time, it stopped working, or didn't work nearly as effectively.

Like for example, the HIMARs, and like a lot of our GPS-guided missiles at first were like 70% effective in terms of hitting their targets, and now it's less than 5% because they weren't hardened against this type of jamming, right? And so the Russians have kind of shown us that that's a problem that we need to be able to operate and have spectrum superiority. We don't have that.

Right now the spectrum over there is heavily contested. And so we believe that the way that you do that is moving away from these few exquisite systems that are very capable but few in number, things like compass call and growler, et cetera, to ubiquitous decentralized sensing and jamming systems. So you can both fingerprint, find and fix all the emitters of interest on the battlefield and then finish them either kinetically or if it makes sense with other means of electronic attack, right?

So we kind of break the Spectrum Imperative down into about 10 different tenets. You know, which, you know, or if you will, the 10 commandments of EW, which is, you know, assume the spectrum will be contested and that you should build all of your systems and tactics assuming that. And that means when you come to that conclusion, you

admit that you have a problem, that like we don't have the capabilities we need in this respect, we need to develop them, you know, that you need to build systems that are going to operate when comms are not permissive, right? When you don't have complete access to your communication channels and that you need to bring all these capabilities down to the tactical edge.

Right now they're currently held up at the core level where it's very, you know, they're not really accessible to battlefield commanders except for extenuating circumstances. And then there's also a gap in terms of our doctrine and our training. So we need to come up and make sure that we're actually training people to operate in these kinds of conditions that we have representative targets, et cetera. We don't currently have that. getting there. And then once we do this, we need to start turning signals into targets.

Anything that emits is giving away its position, we should be targeting it, right? And we don't presently do that except for air defense systems, what's called suppression of enemy air defenses, destruction of enemy air defenses. So we need to think about that for all emitters. And then that means modernizing a lot of our electronic attack capabilities, right? The only real major modernization program we've had in the past 15 years, I've been a part of it, was called Next Generation Jammer ALQ249, right?

And then I think prioritizing EW immunity in the acquisition process, making sure that we're building robust requirements in for all of our systems, not just the ones that we expect to be at the front lines attacking. Everything's susceptible to jamming, everything's susceptible to interference. And then really figuring out how we're going to roll these capabilities out with our coalition partners, because that's who we're fighting wars with across the waterfront right now.

And I think too much of our capabilities are locked up behind closed doors and SAP and Secret Squirrel and all that kind of stuff. We need to bring that out in the open, figure out how to interoperate with all of our other partners, and then lastly figure out how to do this in all of our domains. You know, we fight wars in land, air, sea, and space. The spectrum is the tapestry that connects all those systems and allows them to communicate and cooperate. We need to figure out how to do that.

So that's kind of the core tenets of the Spectrum Imperative that we've put forward. And we have a website, spectrumimperative.com. And we're also going to be rolling out a number of videos and tutorials and stuff and me giving talks like this is trying to draw attention to it and put the resources to solve the problem.

Stephen McBride: If the Department of War calls you up in the morning and says, “hey, Nathan, completely agree with you, what do we have to do now to actually implement these things?” Is it a case where you can retrofit all the existing land, air, space,

weapons and ships and all that stuff that we have? Or is it a case where you need to build everything anew?

Nathan Mintz: It's a little of both. I think on the defensive side, it's probably a lot easier for us to like add anti-jam radios to ships, figure out how to do GPS deny navigation, that sort of thing, drawing more urgency to that. I think that's, from a defensive standpoint, it's a little easier. But the offensive capabilities are lacking and sorely needed. We don't have…

We should have the ability to build an offensive electronic wall that can march across the battlefield, fingerprint, identify and geolocate, every emitter of interest and if necessary dispatch it, either kinetically or through electronic attack. We don't presently have that dynamic capability, except in limited instances like standoff jamming with the growler for suppression of enemy air defenses.

We need that for tactical radios. We need that for cell phones. We need that for counter UAS and GPS jammers. We need the ability to treat all these obstacles in the electromagnetic spectrum as something that we know how to clear in the vanguard of any sort of offensive operation. Or else we're going to find ourselves stuck in the quagmire. And we're going to have a repeat of what we have in Ukraine, where everything just comes down to attrition in the future war.

Stephen McBride: What actually works in places where signals are jammed? Is it a case that if you don't have the immunity to that, nothing works? Like what's kind of the state of the art right now? Can you overcome jamming in some ways?

Nathan Mintz: Well, there are a variety of techniques. Probably the one that's been most commonly used in Ukraine is to just keep expanding the frequency range that's available for both transmit and receive and try and outmaneuver the enemy. The problem is, is eventually he builds antennas that are wideband enough to get there. And that's why you're seeing people go with like tethered drones and things like that.

But tethered drones are a much more kind of surgical thing and they have limited utilities. So like, for example, you're not going to launch a tethered drone over water because if the tether touches the ground, it's like a fishing line, it'll just take it down. And they snag. They're not horribly reliable, it's sort of a solution of last resort.

So I think like expanding the frequency range is an obvious one. You know, all you have to do is go look in a communications textbook, alternative modes of communication. So you're seeing a lot of people go multimodal. So like if the radio command data link is broken, try and go with cell phone signals if they're available. You're seeing SIM cards go in there, SATCOM, you know, relays, mesh networks. Those are all kind of some

common things. And then there's some other tricks I won't say here, but there's lots of other stuff that you can do.

I mean a lot of this stuff has been known for a long time. Most of the investment, Electronic Protection, however, has gone into radar, not into communications, right? And so I think we're going to see a lot more investment in that since autonomous systems are much more dependent upon wireless communications. You don't have a human in the cockpit to sort of, you know, make decisions without, you know, without the commander telling them what to do.

So that's just some tactics. And then the other kind of more robust thing that you can do, I think we've become kind of spoiled. It's sort of like how software engineers have become very dependent on the cloud. You know, I think… And like, know, so they don't think about timing and sizing. In the same way, you know, communications engineers have just thought, I have this enormous bandwidth, I'm going to use most of it.

But going back and saying, okay, well, you know, it's much easier to get 100 Kbps signal out than it is 100 Mbps signal. It's sort of saying, do I really need all that data or what's the least amount I can use? And trying to go to lower data rates, which are easier to kind of like penetrate through with jamming. It's just, it's just communications theory.

Stephen McBride: Do you think every group, every group of infantrymen, squad, whatever, is going to have a signal body armor almost? Are they gonna have an electronic warfare guy, like a medic? How is this all gonna play out? Because it seems like it's going to need to be everywhere all at once.

Nathan Mintz: Yeah, so I think everyone's gonna need more training in this. I think anyone who's a drone operator or a radio operator is gonna need to understand the basics of kind of like radio theory and jamming 101 in order to operate effectively.

Because you know the number of devices on the battlefield has proliferated right it's exploded and it's no different than it is in your home I mean if I go back to when I was a kid in the 90s you know early 90s like you know 30 years ago I we had one maybe two wireless devices in the house and they were the cordless phones right and today you know I probably have 150 transmitters in my house half of them I don't even know about my TVs wireless. I don't have a smart fridge, but a lot of people have a fridge that's on Bluetooth, even a coffee maker, right?

And so the battlefield's no different. Where we went from, you know, in Vietnam, you had one radio guy in each platoon, and now every soldier has at least one radio on them, and possibly more. They might have a jammer, might have an ESM system, they might have a situational awareness system, they may have Bluetooth devices that they're carrying.

And so everything's emitting and understanding that and how to engage in emissions control so that you're not giving yourself away is another important aspect of that, right? So I think the specialist role of the radio man or the EW, kind of what we would call the MOS or military occupational specialty, I think is gonna get more involved and more engaged and more technical.

But each individual soldier is also going to need to be educated because it's impossible for them to avoid it. It's kind like the Marines with every man a rifleman, right? Every man's going to need to be an EW, have some confidence of understanding how EW works.

Stephen McBride: Where are the big legacy primes in all of this? Do they understand how the game is changing?

Nathan Mintz: I think some of them do. I would say L3 Harris and General Dynamics are probably the most out ahead of it. But Raytheon, Northrop, Boeing, Lockheed, not to sort of disparage the big primes too much, but a lot of them are sort of very entrenched in going after large, focusing on large capital programs, right?

When I was in business development at Boeing, we specifically focused on stuff that was $10 billion or more, right? And so they kind of have this perception that most of these programs are small-dollar items, they're low ticket, they're high—they know how to do manufacturing and stuff, but they don't know how to do the consumer volumes. So they would rather kind of focus more on how do we own this exquisite layer and work there and then kind of hopefully this expendable and attributable layer where devices cost less will go away.

And we've kind of seen that with recent reprogramming. So there was an Army program called Terrestrial Layer System, TLS, that had a man pack component. It had two different drone layers, right? And what ended up happening, I think the two drone layers, one was owned by Lockheed and the other one might have been owned by Kaki or Leidos or something.

And both of those ended up getting canceled and redone. But they were really focused on holding these ones because they know how to do that well. It fits into their business model. It keeps their factory full, so to speak. They didn't focus on this one. Kaki kind of owned this lane, right? So they didn't even like think about this one.

Well, now these are canceled and now they have like no portion of this, right? So they are going to have to learn how to small, you know, small, attributable mass systems at scale. I think to some extent you're seeing some acquisitions and some dual-use stuff in

the space. I think like Motorola decided they want to get back into the military radio space with the Silvus acquisition is sort of like one example of that.

And so the primes are going to have a time for choosing pretty soon, especially if the number of exquisite systems kind of rolls off and goes away. They're going to have to figure out how they retool their business model. And there may end up being some withdrawals.

I would not be surprised if one of the primes ends up restructuring or consolidating. And then you end up with a larger waterfront of primes. In fact, when we talk to people in Washington, one of things they want to encourage is going from, you know, six, there's currently about six primes, maybe six plus two, if you include General Atomics and Huntington Ingalls Industries in there that builds all the ships. They'd like it to go to 15 or 20.

Now, some of those choices are obvious. Leidos could step up and get into that mix here in Nevada. I believe SpaceX and Palantir are both primes at this point, whether we like it or not. And then the question is for the other five to ten lanes. Well you have Anduril, obviously, I think it's pretty far out in the vanguard.

And then what do the other nine look like? Is it Saronic? Is it Shield? Is it us? I don't know. And Epirus? You know, there's lots of potential places here. I think AeroVironment's another one that's going to play there. You know, they're rolling up pretty quick.

And then in the tier two ecosystem, or the tier one ecosystem of subcontractors underneath those, which aren't the people necessarily, you know, putting airplanes on the tarmac, but they're the people that are doing...you know, they're building the cards that go into boxes, they're building the generators, they're building all those types of components, the RF chips, et cetera.

Those are your Honeywells, TransDigm, et cetera. I think you're gonna see a lot of proliferation there as well, because there's been a necking down of competition, and what we've seen is a loss of quality and an increase in price as a result, which is what always happens, right?

So then, there's sort of a balancing act there for the DoD in terms of if they want to create a healthier ecosystem, if they create too many players, they potentially create some brittle points because, you know, if God forbid one of these companies goes out of business and there's something dependent upon them, they've got a bigger problem but there certainly could be a lot more players than there are today.

And you know generating you know changing the business model they've spent a lot of time…you know changing JCIDS, which is the acquisition framework. You know, changing how things are bought to try and make it easier for new entrants and allow newer technologies and faster iteration—this is all goodness and it all provides value for the taxpayer and increases our locality over time.

Stephen McBride: On that point of regulation, it seems like that was the thing holding a big part of the drone industry back for so long. What is the most important change on the regulatory bureaucratic front for drones that has happened over the past year?

Nathan Mintz: Well, I mean, you have the executive orders that Trump passed, okay, which are kind of the start of changes that Congress and the FAA have been dragging their feet on, everything from changing the way that we do drone acquisition to changing the authorities for how you can shoot down drones in the United States.

Because I think up until recently, if you were to shoot down a drone, it was considered a hijacking under Title 18 of the… or taking control the drone, was considered a hijacking under Title 18 of the U.S. Code, right? So I think people realize that's ridiculous. We're not talking about commercial airliner here. You we're talking about some hobby drone that potentially is landing in the stadium. So those are being reformed.

We're also seeing a massive investment in counter-UAS systems from law enforcement. There's still a lot of effort going on around the World Cup, for example, and the Olympics, sort of setting those things up for success around border protection, right? The massive investment in border protection and drug interdiction that came out of the One Big Beautiful Bill.

So there's a lot of money along with some bureaucratic hurdles that are either being suspended in the case of executive orders or there's legislation going through Congress bipartisan to kind of change it. So there's a recognition that things have to change and it just takes a while for the wheels to get turning. But I'm pretty confident that three to four years from now we'll have our best ecosystem solutions for life, right?

And we're going to be a part of that here at CX2. I mean, our particular play within the drone space is "shoot the archer and not the arrow." We focus on finding ground controllers rather than on finding the actual drone itself because if the drones are cheap, you shoot down one drone, the guy pulls it out of his backpack and launches another, right?

So I think, you know, from our standpoint, if you take out the ground controller, well, he's not launching another drone, right? And particularly when we talk about civilian versus military applications in a civilian environment, you're much easier to figure out and

identify who's controlling the drone and determine their intentions. And then you can intervene, then launching a bomb at them, right?

So we've been focusing more on kind shoot the archer and not the arrow as sort of our core thesis. And we think that the ecosystem is pretty well served by that because right now there's about 300 counter-UAS solutions out there on the market. It's pretty crowded, but not so much on the, you know, finding the ground controller side. There's fewer solutions.

Stephen McBride: Do you think it's a shoo-in that within five years every stadium, every political event, every sports event over a certain capacity will have both drone and counter drone capabilities? Like Trump assassination attempt last year, obviously what happened with Charlie Kirk. It seems inevitable.

Nathan Mintz: Yeah, think it's safe to say that we're going to see a lot more counter-UAS systems, but they're mostly going to be hidden from public view. You're not going to see massive machine guns looking for drones at events, because frankly, it's just not safe to fire those things off in an urban environment.

It's going to be more about finding the controller, bringing the drone down non-kinetically, that is through jamming, through some sort of spoofing to try and take control of the drone and bring it down. Those are just safer approaches and then if somebody launches a swarm, like EMP, right? But collateral damage is something you have to worry about much more in a civilian environment within the continental United States than you do like say if you're out on a battlefield environment where the chips are going to fall where they may.

Stephen McBride: What's the most overhyped and underhyped thing about drones or counter UAS right now?

Nathan Mintz: I would say the most overhyped thing is probably the tethered drones.

Stephen McBride: Say more.

Nathan Mintz: I think they have a lot of utility in certain theaters in Ukraine, but they're going to have a lot less utility in other fields. I think the most underhyped thing is probably terminal automatic target recognition, which is slowly being figured out. And also these mothership drones where you have, you know, a larger drone that's flying closer and then launching drones to attack targets.

And that has the advantage of, you know, now the data links with the mothership drone. It's not with some controller who's 50 kilometers away or 20 kilometers away. And then on top of that, it just allows much more precision targeting, right? So I think the

mothership drones and then the terminal guidance using ATR onboard to try and, you know, guide the drone through automatic target recognition to the target are probably the ones that need to be paid more attention to.

I think we've kind of over-indexed on the tethered drones. Not to say they're very powerful in certain contexts, persistent ISR, the ability to basically have an asynchronous landmine that's sitting out there that's just kind of hanging out and then some target comes by and all of a sudden a drone comes up and gets them, like that's kind of scary. And the tethered drones enable that and then working in high jamming environments.

But I think like people tend to over index them as like, oh well, you know, if jamming or these other factors are there, you don't need to worry about… A tether drone's immune to it, so just use a tether drone. And that feels like Maslow's hammer to me.

Stephen McBride: Where is AI swarm technology today? Does it work?

Nathan Mintz: Very primitive. I think people kind of look at the drone shows and go, "oh my god, look at this." But what they miss is when one of the drones loses communication and the whole drone show falls apart. And it falls on a whole bunch of people in Florida or China or whatever like that doesn't get the attention. All that is very precisely pre-programmed.

Inter-drone community coordination without a human in the loop is still a very nascent thing right I think DARPA has put a lot of effort into this. I think you know there are some companies like Shield and Auterion and you know Saronic and Overland etc. that are starting to think about it in terms of how they do command and control.

A lot of it is still centrally controlled and coordinated rather than the individual nodes talking to each other and coordinating amongst each other, right? And I think that over time it will get better. I mean, like, you know, Auterion has been doing some interesting things there as well. We've been doing some things in this respect, but I think that over time we will see increasingly more autonomy.

I would kind of break up the category into three pieces. You have sort of automation, autonomics, and then full autonomy. Right now we're heavily in automation, right? There's some autonomics in the sense that the drones may, if you give them like waveform instructions or COAs, primitive courses of action, they can execute those based on clear cut criteria.

Amongst their own ship, trying to do it amongst individual drones, you if there's no quarterback, then the running backs don't know where to go, right? They can really only call the audit from the line of scrimmage. They can't really maneuver out in the field on

their own. And then finally, full autonomy is when we're talking about each individual piece is able to coordinate with the others without and execute higher-level instructions purely off of what the…purely off of some high level, kind strategic level input from a human being.

So that's true command and conquer, like the video game. And I think we're a few years away from that at a minimum. And some of that is not necessarily a technology issue. It's a policy, it's a tactics and protocols and trust issue. We have to get more comfortable.

It's been a few years since Scharre wrote *Army of None*. But, you know, I think like that book kind of laid out, you know, it's the human in the loop, human on the loop. And like what's the policies and protocols? How comfortable do we feel with a human, with a machine actually making a decision about what target gets taken out, kinetically or not, without a human in the loop?

Like those open questions need to be kind of solved or at least made peace with. There is a bit of a prisoner's dilemma in the sense that like our adversaries have less scruples and they decide that they're just gonna throw the chips where they may and go that direction. We're gonna be pulled in that direction, but hopefully we'll maintain a technological advantage when we build the pilot.

Stephen McBride: How does what we've learned in Ukraine change in the Pacific? Because of course in the Pacific everything is forwarder, it's wetter, it's windier. Does that just completely change the battlefield again?

Nathan Mintz: Well, for one thing we're dealing with a much more sophisticated adversary. We're dealing with much longer ranges. I think that you're going to have much more integrated operations. So like the drone boat war that's occurred in Ukraine will occur at scale in the Pacific in a much larger context, you know, over much longer ranges, and you'll have less ability to kind of, you know, less automation, more kind of autonomics or autonomy, as I mentioned.

I think it's just the scale and like the concentrated mass of battle would be much larger. I think in Ukraine and Russia, it's kind of turned into a no man's land with occasional sort of small surges. You're probably looking at massive force-on-force engagements, right?

You know, you're probably looking at a lot more kind of spectrum warfare at the beginning of the conflict, sort of left of launch and sort of an escalation ladder that would play out long before any kind of missiles go in the air. And then, I mean, the other aspect of it is what happens on the island of Taiwan itself, you know, how… Does the PRC have elements that are there on Taiwan or in the other island chains that would potentially disrupt the enemy lines, how real is that?

So that's the other pieces, would we be looking at a forward order forward line of battle? Or would we be looking at more of a diffuse thing. That's been one of the key realizations from the UAS era, has been this idea that we no longer have a solid forward edge of the battle area of FIBA. We now have the ability… We now are probably dealing with enemies that are coming behind those enemy lines.

And so that's where contested logistics comes in, is you can't assume that you're just gonna have these reliable supply lines and that you're only gonna face opposition at the forward edge of the battle area. And so like that means a lot more robustness from those and dynamic changing of those supply lines. That's what contested logistics is all about.

Stephen McBride: Last few questions before we close here, Nathan. What great drone business is nobody building that needs to be built?

Nathan Mintz: I think it's the automated target recognition.

Stephen McBride: Who's the right—

Nathan Mintz: And we're working on that.

Stephen McBride: And you're working on that, there you go.

Nathan Mintz: And I'm biased, but think the drones that can kind of hold the spectrum as territory and provide both sensing and seeking within that, we're laying out those products and working on those contracts right now. I think that's a big part of it. I think drone carriers is something that's getting increasingly more attention, drones that launch other drones.

And the whole tendering and logistics piece. We don't, you know… There's lots of people that are kind of starting to play in the space, but there's no Zipline for drones quite yet, right? There's no, you know, no one's building tendering boxes and stuff at scale—aside from DJI actually. Scary enough.

And so I think like the US equivalent of that where they're building drone carriers drone tenders That's a huge play if I if I sort of leave out talking my own book about electronic warfare and drones conducting electronic warfare and resilient towards electronic warfare. Obviously I wouldn't be building this company if I didn't think we needed that.

So I think, yeah, the tendering and the logistics and like how do you support them and how do you set up a diffused set of drone bases. And then the other area that's trying to get a lot more attention with companies like, know, Grid Aero and Elroy Air, is drone

logistics and like how do you use drones to kind of cover the, you know, solve the contested logistics problem in the Pacific.

And we're starting to see those companies, chips are starting to be put on the table and they're starting to get funded. That's going to be very exciting. Sikorsky at AUSA had an autonomous helicopter that opened from the front where the pilot would normally be that could, you know, do some of that. So we're starting to even see the big primes—Sikorsky's part of Lockheed—pay attention to that as well. The logistics space.

Stephen McBride: finish we'll play a little fun game of overrated underrated so I'm gonna name a dozen—I'm gonna name 12 drone related technologies products and you're gonna say overrated underrated or properly rated okay?

Nathan Mintz: Yeah.

Stephen McBride: Last-mile drone delivery.

Nathan Mintz: Properly rated.

Stephen McBride: Anti-drone turrets.

Nathan Mintz: Overrated.

Stephen McBride: Anti-drone lasers.

Nathan Mintz: Overrated.

Stephen McBride: Israel's Iron Dome.

Nathan Mintz: Properly rated.

Stephen McBride: Maritime or subsea drones.

Nathan Mintz: Underrated.

Stephen McBride: Drones for public safety.

Nathan Mintz: Underrated.

Stephen McBride: Tethered drones.

Nathan Mintz: Overrated.

Stephen McBride: Group 5 drones.

Nathan Mintz: Properly rated.

Stephen McBride: AI swarms.

Nathan Mintz: Overrated.

Stephen McBride: Fixed-wing drones.

Nathan Mintz: Properly rated.

Stephen McBride: DJI.

Nathan Mintz: Properly rated.

Stephen McBride: Last one, Ukrainian drone makers.

Nathan Mintz: Properly rated.

Stephen McBride: Very interesting. You know, one last thing. I know you're a big video game fan. What's the best video game in the last 10 years?

Nathan Mintz: I mean, I haven't played video games in probably 20 years. I've been too busy.

Stephen McBride: What's the best video game from the 90s then? Give me the 90s. That's my era.

Nathan Mintz: Yeah, Command and Conquer or World of Warcraft, those are kind of the two. And then I grew up playing Star Trek: Judgment Rites and Civilization. I think Civilization V was the last one I touched or whatever. But since starting working, I make real video games. We're actually working on, we're working with a Ukrainian drone company right now that's to build a simulator for some of our systems on FPV goggles. So that'll be a game that's worth playing.

Stephen McBride: Awesome. Nathan where can people find out more about what CX2 is doing, the spectrum imperative, all that stuff?

Nathan Mintz: Yeah, so cx2.com and then the spectrumimperative.com or you can check out, we have a Substack now that's called spectrumimperative.substack.com or my old Substack, BowofTheseus. I update stuff from time to time.

Stephen McBride: Nathan, thank you so much for your time and all the best. See you in a few weeks in El Segundo.

Nathan Mintz: Thank you. Yeah, looking forward to it.