Satellites and Defense Solutions, the conflict in Ukraine - Webinar 3-4

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**Kellie McGann** 02:24

All right. So without further ado, this was a special last minute guest addition, we have general Roger Teague with us today. We're really excited for him to be here too. So I'm going to kind of kick us off. And we're just going to introduce this lovely panel. I'm Kelly from Republic. Thank you guys all so much for joining. I'm a marketing director here. And I am joined by Mark Bell, Cody Willard and general Roger Teague. And we're going to be talking about, you know, satellites and defense solutions and the conflict in Ukraine and investing and all of that good stuff. So I'd love to first kick it off to mark to just give a quick intro to himself.

**Marc Bell** 03:05

Yeah, thank you very much for having us today. We are thrilled to be here. And I might as Mark Bell, I'm chairman and CEO of a defense company called Terran orbital. And what we do is we solve problems from space for the DOD and the IC committee. And that has been our mission now for almost 10 years. And we're in the process of merging into a SPAC called Tailwind Two - symbols TWNT on the New York Stock Exchange. And that is happening the end of this month. So we're pretty excited. And you know, we are one of the largest providers of manufacturers of small sats here in the country. And we're the guys who invented the CubeSat was invented by a guy named Dr. Jordi puck swari and Dr. Bob twigs. Jordy had a company called Tyvek, where he did this and we acquired Tyvek in 2013. So all these new space companies you keep hearing about, really were builds off the technology that we created here at Tyvek. And with that, I'll let Roger you introduce yourself. You bet.

**General Roger Teague** 04:11

Thank you very much, Mark. Good morning, everyone. My name is Roger Teague. 35 years in the aerospace and defense business 31 years serving in our United States Air Force I retired back in 2017 as a major general and then I worked for another two and a half years as the Vice President of Space intelligence and missile defense for the Boeing Company. And then in January of 2020. I was fortunate to be able to hook up with Mark and and have been joined and working hard to bring Terran orbital and you know field a great capabilities that the paranormal is going to be able to provide here in this critical time. So again, look forward to the discussion here today. But back over to you Kelly

**Kellie McGann** 05:00

Thanks. I'd love for Cody, I'll kick it right back over to Cody to introduce himself and

**Cody Willard** 05:06

Cody Willard, full time job is hedge fund managing. I also write about all of the trades and analysis that I do, you can find that at tradingwithcody.com. I'm also the founder of a space cleaning space debris cleaning cryptocurrency. We'll probably hit on that a little bit later. And I'll talk a little bit more about that I'm sure as we delve into space, I'm my hedge fund is an investor in SpaceX relativity space. Several privately held space companies as well as Rocket Lab in a few publicly traded space companies that I have started buying. And I do think that over the next five to 10 years, the space revolution is probably the single, clearest, most obvious multi trillion dollar economy that is about to embark about to be embarked upon in our world on our end in our entire galaxy, I guess it's not just planet over anymore.

**Kellie McGann** 06:11

Thank you for that. Cody, we're going to dive into that even more in a few minutes. But just to kick us off, I think it would be remiss if we did not kind of talk about Ukraine. And you know, this webinar was actually planned a few weeks ago, before, things kind of, you know, the, the everything rapidly changed. And so we kind of pivoted to discuss this and to bring that to the forefront. And Republic's going to be doing some things next week. So keep an eye on like social and email, and we'll be sharing how we're kind of getting involved. But today, we're definitely going to take a lens and look into that, and how, you know, space and satellites and defense solutions in the conflict in Ukraine. Work together, or? Yeah, so before we dive into some of those kinds of complex topics, I'm going to ask if we can kind of start off with the basics, I'd love to hear some of your perspectives on what opportunities currently exist in space. And what both are all of you are excited about, I'd love to pass it to Cody first, cause I know you had some really interesting insights and just kick us off with kind of, you know, what you were just talking about, around this space revolution.

**Cody Willard** 07:18

So you can even sort of think of it a little bit like the smartphone revolution. Over time, over decades, the semiconductor chips got in the software got so advanced, and, and cheaper and cheaper and cheaper. And what's happening with space is the platform is getting it up getting us up there. And the cost to get to launch to get things into space cube sats or big satellites or human beings is dropping towards de minimis levels in the next over the last 1020 years, the prices are down 9590 More than 95% to get something up in space, it will continue to drop it will drop another 95% Over the next five years. And it will be not free. But compared to what we have are accustomed to it will be basically free to travel or to send things into space, say 10 years from now. And that and that gives you an entire platform then to build all these different kinds of services and applications that can then be built in space. And, you know, we can again go back to the smartphone revolution. And I wasn't smart enough to know that people would create apps that I would be able to find my dog down the street because of GPS satellite positioning combined with my smartphone. But there were people smart enough to do that. And I knew 10 years ago that yes, you unleash the entrepreneurial spirits of the people that have a platform that can reach billions of people. And you end up with trillion dollar economies Apple, Google and many apps do that now. This is the next phase over the next five or 10 years, there will be new services that I don't conceive of you haven't thought of. But just for an example, if you don't want to go if you want to go to the Kentucky Derby or the Super Bowl instead of holding your smartphone up during the greatest moments of the event, you will tell Hey Siri, use the satellite technology around me and 5g stuff everywhere to create a video feed from my perspective where I'm standing watching this, that type of stuff will happen in five or 10 years, maybe even sooner. There will be great ideas and concepts. Oh, look, Siri heard me. It's recording everything. At any rate, the sport, the space revolution will become a multi trillion dollar economy. We're probably just now in the top of the first inning. Let's not get crazy. It's going to be a long ride to get to where we're going. It will take years for these valuations to truly come to play. But you will have multi trillion dollar companies that are spaced centric 10 years from now.

**Marc Bell** 09:54

It's funny you say that because about 10 years ago I was over at SpaceX. And we were talking about their big rockets and how my iPhone has more computing power than the space shuttle. But I had an idea I was at the Milken conference and had this idea. And I called it the ultimate selfie. And it was what I wanted to do is build a constellation of satellites, that when I'm at a football game, I can look up to press take a selfie of me, and have that image of me sitting in my seat texted to my phone. I mean, who wouldn't pay 99 cents for that, wherever they go.

**Cody Willard** 10:29

You know, this works, though you won't even pay for it will be ad supported, they'll track everything. And then you'll be able to get that selfie for free. You don't even have to pay.

**Marc Bell** 10:38

But then we realize how much of it cost to build it. And I said, Well, I got to find a way to make more money, so I can afford to make my ultimate selfie. And that's how we ended up in this business. And when people talk about you here, everyone was fascinated with launch, you know, SpaceX rocket lab, all these space rockets, startups, everybody's fascinated with it. And you know, SpaceX really, you know, revolutionize it, because they lower the cost of launch to where became affordable, affordable for anybody really to put a rocket what a satellite into space. But nobody talks about, you hear the government talks about 50,000 satellites are going to be launched over the next 10 years. That's enormous amount of satellites, compared to what's in orbit today. But nobody talks about who's going to build it. And we are the last independent manufacturer of small sets here in the United States, so that somebody is gonna be someone like us, and we are rapidly building out our capabilities. So we can go ahead and build 1000s of satellites a year to meet the demand for all these great ideas from space, and good ideas, both for commercial and civil be so like NASA, but also for the DOD and the IC community, for the military, as we're seeing with Ukraine today, how important that is from space, having ISR capabilities that unfortunately, Ukraine didn't have before this conflict,

**Cody Willard** 11:59

You're going have to tell everyone what ISR and DOD are sorry, you're assuming everyone knows what department of defense is, too, by the way, but do tell

**Marc Bell** 12:08

I'll let Roger simplify it for me.

**General Roger Teague** 12:10

Thanks. Thanks, Mark. Again, I ISR specifically stands for intelligence, surveillance and reconnaissance capabilities. But in essence, it's the ability to see and understand what's going on around you. In every medium, whether it's sea land, air or space, it's critically important to be able to surveil and, and consistently monitor exactly what's going on around you what the enemy might be doing it, what you really want to be able to do is be able to intercept and or be able to understand exactly what's going on so that you can prepare accordingly and get that information in to decision makers hands. And that they can correspondingly make decisions and take actions that might otherwise lead to you know, a different outcome and be able to you'll counter what an enemy might be planning or strategizing to do. So it's critically important that we have surveillance and reconnaissance capabilities. This is nothing new. But when you start bringing this into the space domain, and fielding large persistent constellations of satellites that can see literally the earth anywhere anytime. It becomes of tremendous value to warfighting commanders. And I think that's a critical difference and a critical enabler, frankly, a huge differentiator. That Terran orbital is specifically bringing to the aerospace and defense market.

**Cody Willard** 13:39

Can I add, if I could real quick that it, you know, we're talking about defense and stuff. But as you talk about that, one of the things I want to remind people is that this is not space revolution, and we are going to talk about Ukraine and defense and why it's so important today. But it's also about feeding the world and solving world hunger, creating better lives for all of us, whether you're the middle class or the lower class or the upper class, wherever your economic regime might be. It's about creating new things. And when you talk about, you know, real time surveillance, being able to see things like farmers will be able to manage crops better, and we again, we don't know all the different ways that people will be able to use cheap satellites that we can send up cheaply, and that you know, better lasers better heat imagery better, whatever the different technologies we keep putting on these small satellites that Terran can build and send out into space build constellations that do all of these incredible things. It's not just about tourism or defense. This is a… (Kellie’s cat appears on screen) Oh, that was a good catch shot.

**Kellie McGann** 14:53

I have no idea what you guys are talking about.

**Cody Willard** 14:56

Didn't need a space video feed to see that one

**Kellie McGann** 15:04

Cody, I would love for you to continue. And I'm also curious if anyone can kind of touch on like, you know, we've talked a lot about how this technology is changing from the last like 20 years to these newer satellites that are coming out, could anyone touch a little bit on that, and kind of what the implication is

**Cody Willard** 15:18

Companies like maxar, or Telesat, iridium, some of these companies, most older satellite companies have billions of dollars sunk into their old satellites, and it cost them hundreds of millions of dollars to get those satellites up into space, you've got an entirely disruptive business model now, where Terran orbital or others can actually build satellites that are much more capable than the satellites that were sent up 10 or 20 years ago, at one, you know, one 100, or 1/10 of the cost of those older satellites, gets them up into space at 1/100 of the cost that it took to get something up into space 20 years ago. And so you've got an entire satellite revolution that is building right here right now. I'll shut up now, please take it away, Mark and or General Teague

**Marc Bell** 16:38

So so think about it a few different ways, you know, what used to cost a billion dollars to build and take 10 years to make now cost $10 million dollars to build and cut takes 2012 to 24 months to make. So the cost has gone down and the functionality has gone up. We could do more with less faster than it could be done before. So you're not so when we and we a customer comes to us with a solution with a problem. And we give them a solution from space. So currently, we build we build constellations for other people. And then we will be building one of our own. But that was also an example of a customer coming to us with a solution or solving from space. But the solution was that we build it, but we built everything. So we built 5g like phones, internet of things, you know internet from space, we build what's called electro optical imaging, which is photography from space taking pictures of the Earth, we build a technology called SAR, synthetic aperture radar, which was a technology that it was the domain of militaries and governments that has 50 years, we're finally commercializing it. And Roger why don't you tell them two seconds about SAR.

**General Roger Teague** 17:49

you bet Mark InSAR allows you to source the technology. It's radar imaging from space. But it allows you not only to see, you know, surveil large sections of the Earth at any one time, but most most importantly is its day, night and all weather. Typical electro optical, if your camera can only capture imagery when it's under sunlight conditions. And so when the earth is half the Earth is covered in darkness. It's limited already. And then the other of the half that is sunlit. At any one time, at least half of it is typically covered in clouds. And so your your business model from a business perspective, your ability to collect images get severely restricted very fast. Sar solves that problem. Sar allows you to see day night through, you know clouds through storms and whatnot ever and really surveil the Earth at any one time. And Cody I think you you really hit the nail right on the head and you know the attractiveness of the price point and being able to then at that price point and at the you know, those launch the reduced cost of launch. It allows you to feel large constellations of these types of capabilities to surveil the entire Earth with single digit minute kind of revisit rates, ie having a persistent eye on any area of the Earth as needed. And that becomes incredibly, incredibly valuable.

**Marc Bell** 19:24

And if you think of what's going on to the Ukraine today, most activity that the Russians are doing they're doing it night Are they doing when it's bad weather, because they know the majority of sellers in orbit today are the ones that take pretty pictures like you see in the Google Earth of your home. They know it needs a clear sunny day the sun's got to be shining, no cloud cover to take a picture and they know that and but we're sorry. We could see through the clouds we could see at night so they can't hide and and your knowledge is power. And that is you know, that's one of the one of the things that's very important for people to realize It's all the things that don't happen in this world, because the US government has all this knowledge from space in order to prevent things from happening before they happen.

**Cody Willard** 20:10

Out of curiosity, does SAR penetrate ocean? Can it see submarines moving around in the Black Sea or

**General Roger Teague** 20:24

The known applications...And it really depends upon you know, there are there are it there are there are certainly capabilities that star can do with regard to depending upon the the application and how you specifically refine the wavelength associated with it and how you're trying to apply it against a particular material or object.

**Cody Willard** 20:47

So, not necessarily yet. But they are to,

**General Roger Teague** 20:52

to your point, if we can detect soil moisture and soil soil content, right, so I can understand, hey, how that might then affect crop yield in a particular area at any one time from as an agricultural example. That's tremendously valuable information. And so it depends upon the client, the object that's being surveilled, and how you're ultimately applying. But

**Cody Willard** 21:18

I'm glad you brought up the food supply part again, because, again, in my mind, when I picture how does satellite How do satellites help farmers, you better yields, it's not just imagery, it is soil con moisture content, it is you're going to and again, that's where I'm not smart enough to have thought about the fact that we could send satellites that have some sort of technology that allows farmers to know that they need to water better, and that one part of the field analysis on the other part of the field, but someone was, and that's the stuff that's going to be over the next five or 10 years that we don't know how all the different incredible services and applications that SAR will itself enable.

**Marc Bell** 22:01

It's also things like helping with global warming, you know, we can monitor ice flows, monitor the monitor how it when icebergs break off, when you saw when you have the oceans arising because when you see the depths of things, you know, it's very important to how your data now like I said earlier, knowledge is power, and all different kinds of things. You can image with SAR, you get then yo use and use that data to solve problems real life real world problems today, here on Earth.

**Kellie McGann** 22:29

Mark, would you mind kind of pivoting and kind of talking about how that powerful SAR technology and some of the work that you're doing in the Ukraine right now is, is happening kind of live.

**Marc Bell** 22:41

So we're lucky enough that you know, we own some of our own satellites that do different do different things, you know, we've never publicize it. We aren't you know, spoken about it before. Until tonight. We watch a lot of people out there going and putting images to the New York Times and the Wall Street Journal and saying to CNN, but that's not helping the Ukrainians to realize when you send them those images, the Russians watch CNN to, you know, you're not helping them because they're just gonna move. The second they see that picture. They They're smart, they're just gonna move away. And they're not helping the Ukrainians. The goal is to give the Ukrainians data and knowledge and support and help to maintain democracy in Europe. And it's great how the world is really coming together to support them. And we want to support them by helping them by providing them data and information that can be useful to them to protect themselves.

**Kellie McGann** 23:34

Yeah. Thank you. All right. Well, let's continue to talk a little bit more about, you know, these use cases and applications. So you talked a little bit about the 50,000 satellites that are going to be put into orbit. We read that that quote was from the Space Development agency's website that said analysts predicted that for 50,000 new satellites in the next 10 years, Cody, would you mind kind of kicking us off and talking about, like, what's wrong with those satellites now and how you see the use cases for these satellites now and maybe touching a little bit? I think this was new to me when I first started talking to you guys. The difference between these low orbit, multi satellite constellations versus the older, larger satellites? Yeah, sure.

**Cody Willard** 24:21

So as Mark mentioned earlier, a CubeSat is small satellites. I mean, the way I almost try to picture it is sending a computer, the computer server up into space, instead of putting it in a server farm. You send it up into space and what you put on that computer, like a computer here on Earth, you can put all kinds of different chipsets and software sets in there and communicate with it and talk to it and even, you know, update it like you do your Tesla over the app. But that's certainly wasn't the case, you know, 10 or even 20 years ago, or even the giant satellites that NASA sends out to go observe Mars or others, satellite solar systems, you know, those things are giant buildings size and the technology. As Mark mentioned earlier, it's almost decades it was decades in the making to get these giant NASA satellites up. Whereas, you know, you could be a university right now and you've got a satellite, a space division at your university. And you guys have got these ideas of, again, I'm not smart enough to know the great applications, but someone at a university is sitting there, like, why wouldn't we from space, do this. And they contact Terran, and they're like, hey, we need to build a satellite that does this cool stuff, and uses lasers, and SAR and microwaves. And the imagery plus video feeds. And it's got algorithms that tie into some server farms that we partnered with Amazon Web Services to tie it all in together. And Starlink is going to make it all work even faster than it used to. And suddenly, you're not even, like, space just becomes another facet of our economy and of the technology revolution in the Internet revolution, the app revolution, the smartphone revolution, it smart glasses revolution, the smart eyeball revolution, the chipsets inside of your body, and five or 10 years ago, But that's another topic entirely. Fact of the matter is 50,000 satellites will be up in the air, there is going to be new technologies and new services that we haven't even thought of yet. And the technologies themselves the costs, drop, drop, drop, drop, drop and getting those satellites up there. It's cheaper, cheaper, cheaper, in the United States needs to be first. Otherwise, China and Russia will own the he also has low Earth orbit versus higher earth orbit. The low Earth orbit is where Starlink and these other satellites are focused. And if we don't build satellite constellations in low Earth orbit, China will and someone's got to get there first, we still need to get to space debris and space junk and how that is the single biggest impediment to any of this working.

**Marc Bell** 27:54

It's funny to say we've heard space debris, you know, we obviously live that nightmare every day. And it's a tremendous issue out there. And we were designing our next generation of satellites have similar to what airplanes have today, they have something called the T cast, so traffic collision avoidance system. And so we're building that into satellites will move out of the way of debris. And we're crying, we also build satellites, which do what's called space situational awareness. So we're mapping debris in space in real time. But there really needs to be a solution on how to get rid of that debris, and bring it down to earth. And it's very irresponsible, how these foreign governments are blowing things up in space to prove a point, and to flex their muscles per se. But they're creating hazards for everybody, not just for ourselves, but everybody out there they're creating hazards for and governments need to be more responsible, and how they work. It's not just low, it's Middle Earth orbit, it's a geosynchronous orbit, you've already seen each other that'd be an effect affected by all this junk in space. And, and there's a great website called stuff in dot space, where you get to see all this junk live and where it's flying around the earth. And they do a really great job of seeing it, you can click on a piece of junk it tells you when it was launched, and who's responsible for it. And people got to clean up their own mess. The great thing about what we build is all our satellites, we laugh, it's sustainability in space. And it truly is, all of our satellites are designed to deorbit on their own when in front when their lifespan is over. So they all go ahead and come into the atmosphere they burn up turn into water vapor and we leave a zero footprint behind in space.

**Cody Willard** 29:38

The only issue being...that if one of those bolts or pieces of specks of dust are flying around at 17,000 miles per hour in orbit in low Earth orbit, where to hit one of those satellites. It changes the trajectory and you hopefully right then mark it would still end up falling towards the atmosphere. But no guarantees when it hits space junk.

**Marc Bell** 30:03

But the great and the great part of building these constellations we're building now of hundreds of satellites is that one satellite gets knocked out of orbit. There's lots of redundancy built into the constellation where it used to be, you built one satellite, put it up 43,000 miles a geosynchronous, it's been billions of dollars on it. And if that gets hit, you're in deep trouble. Now, it's like if one gets knocked out, it's okay. We keep going. And that's the beauty that look at Starling they had they had 40 satellites get caught in a solar wind. And you know what, he just keeps going? And it's okay, it's a cost of doing business. And because he's still building a constellation, that would have cost hundreds of billions of dollars years ago, that now is costing you millions of dollars. Roger, you want to add anything?

**General Roger Teague** 30:48

Yeah, no, I was just going to pick up on the point that Cody mentioned with regard specifically the specific intent of Space Development Agency, and the the need and desire frankly, intent of the US national security, space community and our government to drive resiliency into our space architectures. In general, John heighten former vice chairman of the Joint Chiefs of Staff used to to remark and talk to some of our satellite capabilities as big fat juicy targets in space. They represent a strategic vulnerability. And and frankly, that is the impetus behind this space development agency's intent to drive large constellations proliferated constellations of satellites, if you will, to disaggregate and to disperse our capabilities, provide them across many layers, and functioning missions across many layers, if you will, hundreds and even 1000s of satellites performing rather than just one or two or X number of, of bigger satellites performing those same missions. Again, that go ahead, Cody, I,

**Cody Willard** 32:01

General, I actually had a question on this very topic, what you know, as, as we're, as the tensions with Russia, escalate. And you know, space rose, Roscosmos is talking about not sending rockets to or that NASA might use things, there's already starting to be some tensions with the space programs between the United States and Russia, clearly, and I mean, you know, that sort of failure come play at this point, right? What are the risks that Russia targets, our satellite systems, and that they have the capability of doing such? And they're by How bad would like can you give, can you frame just how nightmarish are even just like trying to buy something off of Amazon, much less the defense systems in the United States being able to work if Russia were to actually actively target our satellite systems in space?

**General Roger Teague** 32:58

Well, even more to the point, it's, it's our very economy, and it's our international way of life. In fact, you know, around the world, so many systems and capabilities are fundamentally reliant on space and space capabilities. You mentioned early in the broadcast here, Cody, the critical importance critical importance of GPS, not only for precision navigation, but more important for precision timing, every banking transaction that you perform, where every time you swipe, your credit card has a precision time allocated to that specific transaction, and it has to sync up exactly correct, or it will go through. And so everything would grind to a halt very, very quickly, if it were not for the space capabilities that we have deployed and, frankly, are very, very dependent upon to your earlier question, I would just remark that both the Chinese and the Russians have demonstrated on orbit, space capabilities, anti satellite space capabilities, the Chinese blew up one of their own weather satellites back in 2007. Frankly, that got our attention and was the impetus that said you know, what, we've got to start rethinking our space architectures. And hence, that created the wave towards ultimately our nation going after and and supporting large constellations, as I've described earlier, but I think you've seen a huge shift in momentum at the whole government level through the National Security Space Council through the Department of Commerce, and even our Congress through the National Defense Authorization Act, to field and take advantage of and leverage commercial capabilities as rapidly as possible. Again, your drive driving resiliency in every mission area. So we don't we're not vulnerable to cheap shots and drive bys and nosy neighbors and all those kinds of bad behaviors that typically go on right here on Earth. Oh, by the way, it's right, those same kinds of things are going on in space. And so we're taking in the Space Development Agency The US Space Force, US Air Force, all of your major services are taking deliberate action to incorporate more and more capabilities in a more disaggregated and dispersed manner.

**Cody Willard** 35:14

Thank you. It's fascinating. I think we've got some q&a, we're eventually going to have to get to.

**Kellie McGann** 35:20

Yes, yes. I want to touch on one quick thing. It sounds like, you know, there's no doubt about the massive need for these satellites. I'd love to kind of touch on another slight issue surrounding them. What about nature? How about how they're being impacted by the global supply chain and domestic production? I know, we're seeing a lot of problems with the supply chain in recent months and years, and what it means to kind of work in government contracts with regards to building products domestically. Mark, could I pass that one to you?

**Marc Bell** 35:51

Sure, you know, we are no different as we've been hit by the shortage of chips, and the shutdown and restarted many of our suppliers. We're very lucky that we manufacture 85% of our components in house, we build over 65 modules for satellites. And we look at them as Legos, we just mix and match as we build our satellites. And but we're, but we're continuing to vertically integrate, we continue to buy supply chain guarantee us our ability. So the next three years will own 100% of our supply chain or vertically integrate with the exception of solar panels that we use with which we get from Lockheed Martin, where we have a strategic cooperation agreement with them. And so we're very, very common. You know, we were lucky in one aspect that we didn't have to close during COVID, we were COVID, we were considered a part of the national interest. And so we were we stayed open the whole time. And thankfully, everybody stayed safe. But we have, but we were impacted just like everybody else. But that that impact is is getting smaller and smaller as every day goes on. As we as we get more and more control over our supply chain.

**Cody Willard** 36:57

I'll just mention as a hedge fund manager investment guy, not necessarily space related, but somewhat still defense related. Certainly, Intel has become my biggest position in the last few weeks or month for a lot of different reasons, but including the fact that Taiwan Semiconductor in Taiwan is at risk. I Taiwan's at risk watching Ukraine and Russia, there's parallels to China, Ukraine, China and Taiwan, and Tesla, Apple, my my phone, my car, the ships, the helicopters that the the Department of Defense uses, all use chips from Taiwan Semiconductor and even talk about supply chain issues. We there's a single besides space over the next five or 10 years. With the development of this Russian breakout into Europe crisis these tensions happening. I think we've ended the liberalized globalized economy paradigm that I've spent my lifetime investing in. And my baseline assumptions of the way the world works, I think changed, supply chains included. And there's going to be a major multi trillion dollar movement of domesticating all supply chains, from plastics to metals to rare earth minerals to develop finished goods to balance.

**Marc Bell** 38:26

You know, you're so right on so many levels about Intel, because yeah, we look at it as a defense contractor. And we cybersecurity being such an issue nowadays. We are not we are not allowed to buy chips offshore, we have to buy things that were built and made here in America, because everything now that the Chinese have put up a continent they could see into it. And so Intel is a tremendous bet. Because it has to be, you know, this whole what made America lost its ability to manufacture things. We all got used to buying everything from China. And you know, and we funded China and we have to realize we need to build everything, we need to come back to our roots. Remember the use of Made in America was the that slogan that they had for years. And we have to get back to that, you know, we need to create after COVID We need to create jobs. And the last thing we want to do was to see the DoD spending money buying things with from companies that are based offshore owned by foreign entities, they should be focused on spending money here in America today,

**Cody Willard** 39:26

Well and Mark, but even to the point, you don't know that you'll be able to get it if China invades Taiwan, it's very possible that they one day go you know what, we don't sell chips to America anymore. And then it doesn't matter the how much they cost or if it was Chinese and it's got secret code that's tracking stuff. You're not even gonna be able to put it in your satellites or in your car. And that's that that is something that you know, it's it hit real in when COVID hit and the supply chain disruptions happen in place. started creeping in the economy broadly. But the Ukraine Russia invasion and China's lack of participating in the liberalized world's reaction to this. It raised it, I was already starting to really get into Intel before this, and you know, the supply chains themselves from chips to everything have to come on shore, I think that is a major movement, space, will a actually, by the way, help all of that help supply chains manage themselves, help track where things are the Internet of Things from space, we'll know that your new chip, the your new phone is on that ship that's coming over from probably not China, maybe Mexico or something. Anyway, let's hop into q&a. Because we're running long,

**Kellie McGann** 40:51

I think. Yeah, if there's nothing else at all, I'd love to just hop into some of the questions that we got throughout the session. So we got a question about how -- about these small satellites? How long will these small satellites exist in orbit? What is the lifespan of a single satellite before it needs to be retired?

**Marc Bell** 41:14

So we there are lots of kinds of small cells, the ones a low Earth orbit lasts about five years. And that's because they're not radiation hardened. So the sun will beat up on the batteries released from the sun. So we say it's got a five year lifespan, can they last 678 years? Absolutely. But we tell people five years is that is their minimum lifespan that they're going to survive. And the good part is what used to cost. Like I said earlier, we used to cost a billion now it costs 10 million. So it's still cheaper to replace that salary every five years. So never no one ever thought of a manufacturing business before as a recurring revenue business. And that's really what we are, we're a recurring revenue business. Because once we get a customer, we got to keep replacing their satellites for the next 25 years.

**Cody Willard** 41:58

Mark, I think most business most satellite companies at this point, if they don't, look, there's a lot of low Earth orbit satellite companies out there, right, several publicly traded and some of them say that their satellites should last more than five years. And that is a major red flag. Because number one, it probably won't. And number two, the technologies and five years will be such that you'll want to replace your satellites that you sent up five years ago, I was pulling up my phone for the same reason, right? Five year recurring maybe three to five year recurring purchase price of recurring revenue, I buy my new phone.

**Marc Bell** 42:38

how many listeners on the call today? Have it? I have a phone older than five years?

**Cody Willard** 42:42

And I bet very few, very few.

**General Roger Teague** 42:47

And that's exactly consistent with the Department of Defense in the intelligence community with the United States Government intent as well as to replenish these constellations to keep them current to take advantage of Moore's Law and continue to evolve technologically and the baseline performance of these systems.

**Kellie McGann** 43:08

Great, thank you. Okay, so we have a kind of technical question here about, you know, some of the companies on the call So, someone else can you clarify this sequence of business flow? From my understanding Terran orbital was a private startup acquired by TWNT and now going IPO So can someone Mark probably clarify kind of the flow there and what's going on?

**Marc Bell** 43:29

Well, I guess I should clarify. So, last fall, Terran Orbital reached an agreement to merge with tailwind to which today today trades on the ticker TWNT, Tailwind Two into is a special purpose acquisition company otherwise known as a SPAC which you hear about, and if and when the transaction closes, the shares of TWNT will be exchanged for shares in our company Terran Orbital, which will be which will be with tailwind two. So I hope that kind of maybe clarifies how that all comes together. And we'll have a new stock symbol called LLAP post de-spac.

**Cody Willard** 44:02

I would think most people watching this have probably been around a SPAC in the last year. It was hard to not be involved at some point in the last year there was you you can stand on walls on the corner of Wall Street and not get in the head with a spac.

**Marc Bell** 44:20

Spacs have gotten a bad rap. The reality is, you know, you could even do an IPO, you can do a direct listing, or you can do a SPAC and a SPAC gives you the highest likelihood and likely chance to close if we try to do an IPO two weeks ago, it would have been a market out the Dow was having a horrible day, the book would have evaporated before the market opened and we never would have gone public with a SPAC you're going to go public. But the problem is you have a lot of companies merging into SPACs today that never should be public. And and that's and that's true with some of you have gone to space and a lot of other industries. They're too small. You know, we're a real company with real revenues real backlog, we just added 170 million dollars of contracts and awards. We announced I think a week and a half ago to our backlog. I mean, we're not we're we have an amazing management team of people like Roger on board, and a lot of his compatriots we have you know, we're very purpose built company. But a lot of these a lot of these startups emerge in stacks and has given Spats kind of a bad name. So we try to avoid we do spec as a four letter word and avoid it. And we just save as we're going public. And we what we are, we are capital intensive. If you look at what we're building in Florida, we're building will be the world's largest salad assembly facility. 660,000 square feet of space, almost a kilometer long, from end to end, you can go to turn orbital.com and see pictures of it and renderings of it. And it's being paid for by the state of Florida, they Space Florida $300 million, they're putting up for it. And I will be able to produce 1000 satellites a year from that facility alone. And we're not stopping there. We just added another facility in Irvine, California, we were building another 60,000 square feet, we're going to continue to add more space and continue to grow. And as demand continues to pick up.

**Kellie McGann** 47:23

thank you for that. We have a few other questions even just more about the satellites. Is there anything else we wanted to cover on? Terran and Tailwind?

**Marc Bell** 47:32

No, lets get to people's questions, let's see what we can get. It's all about it's all about them today.

**Kellie McGann** 47:37

Yeah. So we have an interesting question here about, like the use cases for the sats. And if they the police department could even use them to track movements and different things like that, or if that kind of data is too small to effectively capture

**Cody Willard** 47:54

Not necessarily today, but in five years. I mean, yes, surveillance state, it will get worse with as space capabilities increase.

**Marc Bell** 48:05

There are a lot of laws here in the US to protect people's privacy from space. It's interesting. So we could do we, we can watch everybody in the streets of Moscow, we can't do it here in the US. It's a lot of a lot of protections to protect people's privacy here in the United States. So, but the right this is all to protect people in the United States from outsiders think of it that way. Did I get the right, Roger.

**General Roger Teague** 48:28

Yep, Mark. That's exactly right.

**Cody Willard** 48:30

I'm a little more cynical about it, then the other two guys on the board. But yes, I think there certainly are protections but you know, the capabilities will be there. And a lot of people will break rules, including

**General Roger Teague** 48:44

Cody, I would give a nod though, to the regulatory environment, specifically being enabled by the Department of Commerce towards commercial space companies. It's erased quite a bit. And it's made our lives much easier to be able to do business and pursue these these kinds of opportunities that we see. We're very, very grateful for that. We monitor it closely and have great working relationships with them, you know, to make sure that we're doing exactly what you're insinuating. You're making sure we're in compliance in accordance with our licensing, right, and the overall operation. Great.

**Kellie McGann** 49:22

Great, thank you for that. Alright, here's another question. Do you see the satellite manufacturing sector becoming similar to the automotive sector in terms of the number of suppliers or will it be vertically integrated by few actors?

**Marc Bell** 49:35

It will be there'll be a lot of consolidation. We've already seen a lot of consolidation. So we used to have a lot of competitors. Raytheon bought one of our competitor competitors blue Canyon, Boeing bought another one of our competitors millennium and like the Borg, they got assimilated and disappeared. And so there there are there's a lot of consolidation going on. But we are building industry 4.0 manufacturing facilities, footwear build we're working towards full robotic additive manufacturing augmented reality, we have kids wearing headsets now where they can actually look and put together a satellite. If you know how to use an Xbox, I can put you on an assembly line in 30 minutes and have you start building a satellite. It's pretty amazing technology. And we're continuing to try and do and we continue to evolve our products. And we're always innovating. And unlike the car industries, the car is still a car, you know, 100 years later, it's got four wheels do the same thing. We're trying to do much different things every day. And we try to come up with new ideas and new what we call payloads is that it was with the with the or the satellite does from space, new things that you do with space and new problems on the earth we can solve from space.

**Cody Willard** 50:44

I would just say by the way, the cars are about to start driving themselves, like my my Tesla will at least come to the front of the store if I call for it. And I don't think that of cars did that 10 or 20 years ago, I am teasing you a little bit there mark. By the way, look, I think marks totally right there is there will be a lot of consolidation. But they're also going to be 1000s of startups related to space that are coming into the market over the next five or 10 years, hundreds of those will come public in the next five or 10 years. And dozens of those will be worth hundreds of billions of dollars. And a handful of those will be worth trillions of dollars.

**Marc Bell** 51:25

It's great that you've talked about cars driving themselves. So we actually have been doing. We've been doing AI in space for quite a long time. And so we have satellites now as soon as we have drones in space autonomous vehicles in space. And we have a program now that we're working on, where two satellites will go find each other space autonomously, and they're going to dock with each other, or they're gonna undock do some maneuvers, and they're gonna find each other again. Now imagine, imagine a needle in a haystack, except the haystack is bigger than planet Earth. And if that is two objects that are this big, have to find each other and meet up and get hooked up to connect to each other autonomously. With no help from humans on the ground.

**Cody Willard** 52:06

It almost sounds like like two crows or Ravens. And will those two satellites then forever have a bond? And what were their children look like?

**Marc Bell** 52:17

Lots of little satellites, what's a little satellites?

**Cody Willard** 52:21

You talking about? CubeSat. We're getting a little baby cube sets. And why wouldn't that happen? By the way? I can. I'm just picturing that I've never really thought about the fact that why wouldn't I my daughter likes Pringles so I happen to have one on my desk here. So why wouldn't in five or 10 years, some satellites, you could have a constantly you could send up 3000 of these in one Falcon nine ship and have an entire constellation of Pringles satellites.

**Marc Bell** 52:50

You laugh people actually are thinking about this. This is real. This is real world stuff you're talking about. You're ahead of the curve here. You were way ahead of the curve. Could you just say,

**General Roger Teague** 52:59

General J. Raymond makes reference to a Russian satellite that basically that basically follows the exact concept that you're describing here, Cody, and it's a nesting doll, kind of satellite. So suddenly, they thought there was one launch and then lo and behold, there became 234 satellites coming out of that single, single vehicle. And so those kinds of concepts and ideas are already actually in work.

**Cody Willard** 53:25

See, that's what I mean. I'm not smart enough to thought of them yet. I just came up, because I started getting a box on my desk right now.

**General Roger Teague** 53:31

Yeah, he got me thinking about Pringles right now.

**Marc Bell** 53:35

Fingers happy. We need to build a Pringles NFT in space DAO. So Pringles is watching this, think about it a Pringles NFT in space.

**Kellie McGann** 54:15

I'm alright, let's wrap up with one more question. We're talking about smaller and smaller and smaller satellites. So we had a question saying what about beyond low Earth orbit? Are there opportunities for those small satellites beyond low Earth orbit? And what are some examples?

**Marc Bell** 54:31

So we do everything from very low Earth orbit to we have we have two satellites going to the moon shortly. We're going to be mapping the moon with the infrared. And we're going to be helping to build a comm system for the first lunar base. And those two will be launching this year. And so we get we get when we're working with Nat we're working on ideas for deep space missions missions to Mars. We have a lot of things on the books. It's very exciting. All the things,

**Cody Willard** 54:57

those satellites that you're that you're picturing. Sending the Mars over the next several years. CubeSat size? No. What are we talking about?

**Marc Bell** 55:06

Now we build satellites are satellites. Now the size of a small fridge to the main frigerator in your kitchen is predominately what we build. We haven't built a CubeSat in quite a few years now.

**Cody Willard** 55:16

And in five years, though, what is the trend?

**Marc Bell** 55:19

They've been getting bigger. And but that's not because you need more electricity and more power. cube sats demonstrated that it was doable. But to make it really practical, you need to be in that 150 to 500 kilogram weight. To really make it you have enough electricity and have batteries on board to do something.

**Kellie McGann** 55:42

Thank you. Okay. All right, General Teague, please.

**General Roger Teague** 55:46

I was just gonna say that today. Hopefully, we will continue to see advancements in technology. And we can drive in smaller and smaller, but he's exactly right. That's where we are today. And obviously, we're gonna keep pushing the envelope.

**Kellie McGann** 55:59

Cool. Yeah, it sounds like you guys are primed to do that. While we're almost out of time, I want to just thank you guys so much for your willingness to hop on and this discussion. Is there any last things you want to add? Mark or anyone else?

**Marc Bell** 56:13

I just want to say thank you for having us.

**Marc Bell** 57:23

Great. Thank you very much. Really appreciate everyone's time. And we I want to thank everybody for joining us today on this podcast. Really great to have everybody on board. Thank you.

**Kellie McGann** 57:32

Yep. And we have some final questions about how they people can get involved invest, we'll send out a follow up email as well with all of the relevant information. So thank you everyone for joining.

**Marc Bell** 57:46

Really appreciate it.

**Kellie McGann** 57:47

Thank you, Mark. Thank you, General Teague. Thank you, Cody.

**Cody Willard** 57:51

Thanks, General. And thank you, Kellie. Yep, thanks, everyone.