Chad Anderson

Hello, everyone. Welcome to Space IQ, our new quarterly webinar where we look at startup activity and investment trends in the space economy. This quarter, we're taking a look at the macro market environment, how that's affecting the space economy and new opportunities in emerging industries.

With about with half the year now behind us, the capital markets appear to be at a crossroads. On the one hand, current economic headwinds are fierce. Inflation is accelerating and the Fed is raising interest rates. Q1 GDP growth was negative, and we're still waiting on Q2 data. But a technical recession now seems more likely than before. And this is adding pressure on equity markets, which already finished their worst first half in over 50 years.

So, it's no wonder that companies are not feeling rushed to enter the public markets this is impacting private markets as well, which take cues from the public markets moving from late stage then to early stage write downs and venture capital funds are starting to occur. In Q2, we saw increased price convergence for valuations, tech companies and private and public markets, but it will take quarters or possibly years for this to be fully represented.

Chad Anderson

So, we expect to see more of this through at least the second half of 20, 22 and large crossover funds have generally vacated the late stage private market venture deal activity slowed dramatically in Q2 from a hyperactive 20, 21. On the other hand, perhaps we're on the cusp of a recovery. There's evidence for this as well. At least some of the slowdown can be attributed to VCs sitting on the sidelines taking the summer off after a hectic couple of years and waiting for valuations to stabilize before deploying their reserves.

Employment growth in the US remains strong and many startups have shifted focus back to fundamentals, revenue and cash flow and are hitting flat. While there's been a large wave of tech layoffs which started in the spring, the number of individuals laid off in June was down from May and it looks like tech stock prices may have bottomed out. The US venture funds have raised $120 billion so far this year on pace to blow past $139 billion raised last year, and many more funds have closed in the first few weeks of Q3. In fact, there's never been more cash available for startups, which may bode well for when VCs return to the office in September. But at the same time, many investors are telling founders that there's no money available.

The founders need to understand the reasoning behind this contradiction and how to operate within it, because history has illustrated the breakout companies form and grow regardless of market cycles. With all that said, while we believe the macro environment will continue to cause headwinds for some space companies, particularly those that are CapEx heavy with long timelines to revenue, we do not believe that the space economy is at existential risk. In fact, we believe that the majority of space companies are counter-cyclical and resilient to macro market conditions. That's because space technology is our next generation digital infrastructure. They're the invisible backbone that powers our global economy. Satellite technology is including GPS. Geospatial intelligence and satellite communications already play a critical role in most major industries and enterprises and governments see these space technologies as critical infrastructure.

Chad Anderson

In fact, the National Reconnaissance Office, one of the big five U.S. intelligence agencies, announced its largest ever satellite imagery purchase in Q2. And many of our portfolio companies have seen an increase in demand for their products and services. As the world becomes more dynamic and uncertain. We expect that these data businesses will continue to get funded during this market dislocation and that's where most of the investment is going.

We began publishing the space investment quarterly in 2017 with the aim of uncovering insights about investing in the space economy. We just published our latest Q2 report last week, which is available on our website and the links below. This data shows that while we've been operating in space for decades, it is only recently become a category for investment with Space X is Falcon nine first entering commercial service in 2009 and pioneering reusability in 2015 they brought the cost of accessing orbit way down, which ushered in a wave of entrepreneurship and innovation with another 6.1 billion invested in the 92 space companies in Q2. There's now been $264 billion of equity investment into over 1700 unique space companies in the space economy over the past ten years. 99% of that has gone to the launch and satellites industries with the overwhelming majority going to the applications layer of the satellites industry while launch and emerging industries get most of the media coverage, they actually only account for 9% and 1% of total investment respectively. We expect the macro environment will disproportionately affect funding for these capital intensive companies for the foreseeable future, while companies providing data and insights and critical services to enterprises and governments will be better suited to grow revenues in the near term and therefore better positioned to raise additional funding Still, we're beginning to see founders raise capital and build businesses focused on space stations, lunar logistics and industrials.

We broke out Emerging Industries for the first time in our Q2 report, which shows that $2.7 billion have been invested into the into these industries over the past decade, with nearly half of that total invested in 2021 alone. This record level of investment was driven by venture capital firms many of whom were investing in the category for the first time. In addition to the annual trends, the geographic breakdown in emerging industries is also interesting. The US continues to account for the majority of investment as another market categories, but Japan makes up a full 20% of the total versus just 2% of total infrastructure investment and less than half a percent of total space economy investment. This $500 million accounts for roughly half of all equity investment in the Japanese space companies during the last decade.

Chad Anderson

Clearly, highlighting the areas of focus for Japanese founders and hinting at where the Japanese government plans to invest its new $900 million fund for space startups. You can see here that by our accounting, in addition to satellites and launch, there are four emerging industries stations, which is made up of habitats and services, logistics made up of space, situational awareness, debris mitigation and on auto servicing, lunar made up of transportation and construction and industrials, which is manufacturing, mining and energy. Last year, venture momentum set all-time records for investment in space infrastructure. But much of that capital is chasing solutions based on a ten-year-old Falcon nine launch paradigm. In Q2, Space X received a long-awaited environmental decision on their starship program, which will allow them to conduct an orbital test of their next gen launch vehicle as early as Q3. We are now entering a new phase of infrastructure development, just as the Falcon nine did ten years ago.

Starship will further reduce the cost of orbit, enable and accelerate the growth of emerging industries and make existing infrastructure obsolete. As investors in this category, we're looking at the long term and are in search of founders who see what's coming and are building for this new reality. Now, to help us get our arms around these emerging industries and to understand what all this means for companies operating in these markets, we are now going to be joined by a couple of guests, each of whom are market leaders building successful businesses and emerging markets.

Chad Anderson

First, we're going to talk to Dan separately, co-founder and CEO of Leo Labs, the world's leading company operating in logistics. They operate a network of ground-based radars that provides a practical, cost-effective solution to space debris tracking, management and mitigation. And they're able to do this at ten times the precision and 1% cost of traditional methods. The company spun out of Stanford Research Institute back in 2016 with some significant IP. Our partners have known Dan since those early days, and we've invested in Leo. Leo lapsed several times over the years. It's incredibly exciting to see how they have become an essential service as the overall space economy grows Dan, thanks for joining us.

Daniel Ceperley

Chad, it's a pleasure. Thanks for having me.

Chad Anderson

So, to kick us off, I'm curious, can you walk us through? Who are your customers and what services are you providing to them, where they come in your lap?

Daniel Ceperley

Yeah, it's a really exciting time to be in the space industry because we're seeing the satellite population grow quite dramatically. You know, a few years ago, there were 800 satellites in low-Earth orbit. Now there's close to 4000 and pretty soon we're going to be up into the tens of thousands for the exact reason you pointed out that we'll see Starship Start taking off soon and delivering huge numbers satellites to space. So for us, we serve a few different verticals. So we serve the satellite operators directly and we we're serving over 60% of all of the active satellites in low-Earth orbit. So that's things like collision prevention and launch support for helping bring your newly launched satellite into operations quickly. We serve national governments, especially defense as well. For them, it's all about scale.

You know, it used to be there were a few satellites to keep an eye on. Now there's thousands soon to be tens of thousands of satellites. And that requires an entirely new generation of infrastructure to track and monitor that. Nobody else has been out there with a scalable architecture. And that's what we stepped into. And then we're also serving the regulatory agencies and the insurance industry as well.

Chad Anderson

Got it. And so founded in 2016, you are a first mover in this emerging industry. How has logistics changed since you started the company?

Daniel Ceperley

Yeah, it's been a really fun time. You know, our company actually goes back about 25 years. It was 25 years of developing our IP, being supported by the National Science Foundation to do fundamental science on the ionosphere and the Northern Lights. And then about ten years of work with the U.S. Air Force and ARPA on this question of how do we expand tracking capabilities? And you know, the U.S. Air Force was the only organization in the world tracking all of tracking satellites running the space surveillance network. And they realized this new wave was coming and they needed to be able to scale up quickly. So we stepped out of that environment at the time when the inflection point was just about to occur.

So we've been watching the market and for the last few years, it's been really exciting. You know, we've seen reusable rockets take off the satellite population grow dramatically. We've seen some really good demonstrations of debris removal technology. And I'm really excited that that should become a routine part of the space industry soon. And, you know, we saw our first on orbit servicing mission with the with the heavy vehicles and it's yet another category that I think is going to take off quickly. So and for Leo Labs, it's we've moved squarely into operations. We're in the process now of scaling along with the rest of the industry.

Chad Anderson

And so this is now becoming more interesting to folks. Several competitors have gotten funded in the last couple of years. We're starting to see articles with headlines like Space Situational Awareness is becoming a hot market for startups. So a little bit different than when you started, but you have a pretty significant technical moat. Can you tell us about your competitive advantage?

Daniel Ceperley

Yeah, absolutely. It's you know, like I said, we spent decades actually doing the research and evaluating different alternatives before stepping into it. And for us, it's all about a worldwide network of ground-based systems. You know, the radar network we have covers all different orbits, all different inclinations. And operating on the ground gives you essentially unlimited access to electrical power to compute, to communications up to the cloud. So, it just it lets you scale the network in a way that's kind of never been constantly rated before and at a speed and a price point that's never been contemplated. So our founding specialty was designing and building these radars and these large, phased array radars. Nobody thought you could do this in a venture backed company. They thought it had to be a multibillion-dollar project funded by government.

But since 2016, we've built five of these radars around the world. We actually have five more under construction right now. And we're going to keep ramping up because you need to be able you need the sensor network to be able to keep up with all of the new launches and the hundreds of thousands of pieces of small debris that are threatening satellites today. And before us, nobody was tracking. So this gives us an interesting greenfield opportunity with the data science as well. This is a data set never seen before in the industry. So our data science team is hard at work.

Chad Anderson

And that's I mean, people probably said that because they just viewed it as an infrastructure play. I mean, if you were building this the way that we had always built them, then, of course, it would be prohibitively expensive. But hardware is clearly a piece of your business. But that's not the whole business. I mean, your customers are coming to you for your software solutions and the data that you provide that that the ground-based radars are just your hardware that that is supplied for you. With a unique data set. Is that right?

Daniel Ceperley

Yeah, that's exactly right. So we've turned what had been a hardware business in the past into a software business. You can almost think about it like cloud computing. There's these data centers, but very few people these days want to run, want to build their own data center, or they want very few want to have their own mass of IT department with all the hardware. Instead, they want a subscription service. They want the system to be usable on day one. And that means there's a whole bunch of additional software layers on top. It means there's operations teams on top, and that's what we've done. And by architecting the hardware correctly from the beginning and using cloud services right from the beginning, we're actually able to treat this business as a software, as a service business, both on the financial side and the operational side.

Chad Anderson

Right. So low-Earth orbit, satellite communications constellations, space access, launching a lot of satellites for us for its StarLink constellation. And your selling dated them to help them operate safely in orbit. Amazon. And one way of that, you mentioned they're building large constellations as well. China is also planning to launch a starling like system. How do we manage all of that? Multiple systems, multiple countries and geographies, different frameworks in which they're working in. Does little labs have a role to play in all that?

Daniel Ceperley

Yeah, I I'd say there's two big things. There's transparency and then there's collision avoidance. So on the transparency side, what's required is basically an independent understanding of all the different activities going on. It's kind of surprising. Space has been out of sight, out of mind for a long time. Or it just there hasn't been much information about what's going on. Where are the satellites going? When are they maneuvering, how safe are they? And that's a big part of what we provide is that transparency? We're following up with those thousands of satellites multiple times a day to be able to understand what are the actual risks and what is actually going quite smoothly. The other thing is, if you look at the collision risk, it's all about the small debris.

You know, there's 4000 active satellites in orbit today. It'll soon be tens of thousands. There are already hundreds of thousands of pieces of small debris. So if you're satellites going to be hit, if there's going to be a collision, it's most likely something small is going to hit your satellite. The analogy we like to use is if you think about halftime at a American football game, you can put a lot of musicians out there on the field and performers and they're spinning around and moving between one another and the like because they're highly coordinated. And that's what these constellations are. They're highly coordinated. They can operate at low risk in this environment. But the big risk is that drunken fan who comes off the stage and plows into the tuba player. You know, that's the piece of space debris. It's uncoordinated. And that's a big part of what we do is monitor that to make sure that all of the performers can move safely around it.

Chad Anderson

I haven't heard that analogy before, but it's a great one. Thanks. OK. Earlier I mentioned that we expect that the macro environment will disproportionately affect funding for capital intensive emerging industries like logistics for the foreseeable future. How are you thinking about the current macro market and how have you prepared your company? Yeah.

Daniel Ceperley

You know, in addition to, you know, we said the space industry is a fun time to be in it because we're going through this inflection point. But it's also been kind of a crazy few years between the COVID pandemic and between the current market disruptions. So for us, it's all about staying heads down, being deliberate and executing. We were able to execute through the COVID pandemic. We're going to continue to execute through this. There's a few things to being deliberate. One is a whole lot of our forward progress at this point is in the software development, is in the analytics We've got a great team in place that is doing that development. They got a greenfield data set to work on. They're going to keep going.

The other thing is, with the continued rate, our build outs, we've got a proven format. We've got a proven supply chain, and we're just going to we're going to keep cranking through that to keep scaling up. So it's yeah. Again, I just say it's all about being deliberate. It's all about setting plans and then having a good set of people to be able to react to the inevitable changes Okay.

Chad Anderson

Last question for you. What's on the horizon? How do you think that the logistics industry is going to continue to evolve in the future?

Daniel Ceperley

Yeah, I think as everything scales up, I think we're going to see all of this. We're going to see the whole logistics industry become just an integral, reliable part of the entire space industry. So, you know, a few years ago, the whole commercial space travel market was pretty new. The debris removal market was very new. The in orbit servicing, there's been a lot of proof points.

And now it's all about it's all about making it repeatable, reliable, and the like. And I think we're seeing we're seeing some clear winners here. The you know, a lot of benefits accrue to the people who are out there. Actually, delivering operational services, working with satellite operators on a day-to-day basis. And there's a number of companies that are doing that right now. And we're out there pioneering the new best practices. And we're also setting in place those procedures that actually work actually based on the past track record. So yeah, again, an exciting time and just exciting.

Chad Anderson

There's a lot of people talking about doing things in space. It's great to be talking to somebody who's doing a lot Dan, this was great. Thanks very much for taking the time to join us.

Daniel Ceperley

Thank you, Chad.

Chad Anderson

OK. Next up, we're going to speak with Justin Cyrus co-founder and CEO of Lunar Outpost, a leading company in the lunar industry. They are a robotics company with products surveying extreme environments on the lunar surface. As well as terrestrial industries, including mining. Lunar Outpost has two contracted rides to the moon, both the first in human history to their respective locations. And they have also sold thousands of sensor products here on Earth. We recently invested in Lunar Outpost and are excited about what they're building, their market traction and their vision for the future. Justin, thanks for joining us.

Justin Cyrus

Yeah, thanks for having me, Chad.

Chad Anderson

OK, so I would love to know you know, as a lunar transportation company, who are your customers? Are they primarily government?

Justin Cyrus

Excellent question. Yeah, actually, so we do have a mix of government and commercial customers. So similar to how space taxis rideshare, right. Where they'll have a large government payload and then they'll have commercial payloads on the side that help fill up the rocket and drive missions to profitability. We very much have a similar model. Now, the first mission is actually fully commercial.

So, we have zero government payloads whatsoever on the first mission, and that's headed to the lunar South Pole. Now, a few specific names that we're quite excited to be working with and that have been awesome partners that are headed to the moon or South Pole with us include Nokia, who's sending their LTE intro Lunar Surface Communication Technology Up to the moon. M.I.T., who's sending a resource camera and a pretty exciting payload that we're going to be announcing here shortly. And other research and industry partners that not only want to prove their technology out on the lunar surface, but that want to be an important and integral part of the system in our economy. Moving forward. So definitely a mix of that kind of commercial, you know, civil space and then also some DOD customers as well.

Chad Anderson

Very interesting. And something I think might surprise some folks. So why why the South Pole?

Justin Cyrus

So lunar South Pole is exciting for two main reasons. One, that's where Artemus astronauts are actually heading in 20, 25. So think of Mission one as a bit of a scouting mission. We're not only carrying payloads but we're also collecting data and a pretty exciting environment. And as I said, not only because NASA astronauts are going there, we need to know what that environment looks like. We need to understand how we can build the art of this lunar base, whatever the new name is. But then also we need to understand what resources are available so we can support long term sustainable operations and infrastructure on other planetary bodies. And then so resources at the Lunar South Pole are quite exciting as well. Not only, you know, your normal resources you may think of I don't know if folks normally think of resources on the moon, but some lunar scientists certainly do.

So you not only have pretty exciting resources, such as, you know, your titanium your palladium, palladium, platinum group metals, but you also just have some of the fundamentals that you need to operate long term on the lunar surface, including water, water, ice that can be used from everything from life support systems to even rocket fuel to get people and stuff back up into orbit. Or back to Earth.

Chad Anderson

OK, and then it seems like there's currently a couple of paths to the moon where the government is building S-Class and Orion. And that's a system that is built in the traditional way where NASA is the overseer of the of the of the architecture, is working with its defense contractor partners and is the benefactor of and directing the build of that system. And then they're also working with commercial partners for transportation and for on the surface, you know, where does Lunar Outpost fit into to each of those because you're working with the government and also with these commercial partners that you mentioned.

Justin Cyrus

Yeah, it's an excellent question, Chad. I think with launch providers and we're fortunate enough that we can really integrate with any of them on our first two missions. And I can talk a little bit more about the second mission here in a minute. But first, two missions we're taking SpaceX Falcon nine now. So that's very much more towards the commercial side of things. But certainly once we start looking at some of the larger payloads that can utilize ESA less or as you mentioned earlier, they can leverage the pretty drastically decreasing cost that starship is going to bring to a lunar well, not only lunar, but space transportation kind of infrastructure layer. So that's how we get into orbit. Now, there are over a dozen companies that are actually planning on providing landing services as well.

Justin Cyrus

Now, some of these include, you know, the big guys like Space X, like Blue Origin, but there are other companies that we're working with, including Intuitive Machines, who's taking our first rover to the moon or South Pole that are smaller there. Now, but they're quite capable and providing that transportation layer. However, now NASA's not only looking at launch and landing as something that they want to commercialize, they're also looking at mobility on planetary bodies.

So, if you look at what's been done historically, you know, NASA's Mars Perseverance Rover, right? $3 Billion Rover. You also have NASA's Viper Rover, which just got pushed back a year, but about a $500 million rover. And that's what they've been using to gain access to different points on these planetary bodies. Now, what Lunar Outpost is providing is those mobility services and this is just the first stage of our company. But those mobility services on these other planetary bodies for a fraction of the cost.

Chad Anderson

So as a commercial company looking to grow and not just get to the surface, but then grow from there, where do you see the most value in lunar? Is it in the transportation, in construction, once you get there or something else?

Justin Cyrus

Yeah, I think transportation is step one for us. Right. Proving that it's possible, providing access for folks to these other planetary bodies. Step two, which is really where we start to see the market unlock a big part of its value is putting the infrastructure in place. So we do have a contract with NASA that we're quite excited about. That's the first contract for this type of lunar infrastructure. And really it's building launch and landing pads to allow, you know, humans to safely land on the moon and take back off. But that's just the beginning. On infrastructure, you need everything from power communication, landing pad to roads, habitats, life support systems. And those are going to be some large recurring contracts, not only from your government customers, but also from your commercial customers as well.

And the our long term goal, our long-term vision is once we have that infrastructure in place that we're going to help put there, we want to leverage that infrastructure to access the infinite resources of space And that's a topic I can talk quite, quite a long time on. I know. Got 10 minutes, so I'll leave it at that.

Chad Anderson

But this is great big picture stuff I mentioned earlier that we expected we expect that starship is going to be a game changer. You know, what does Starship mean for your business?

Justin Cyrus

I mean, it's groundbreaking, right? I mean we went from $80,000 per kilogram to Leo to $5,000 per kilogram. Starship can get it down to a thousand or even less. And what that means for autonomous robotic systems or robotic systems that are going to interact with humans further on the system in our space, we can drive our own cost down by orders of magnitude, which allows us to unlock significant, significant value in our own business plans and allows the broader system in our economy to really allow business plans to close that couldn't close before due to the high cost of transporting an.

Chad Anderson

Interesting you know, one of the unique things about the lunar industry in particular is the global nature of it. So there is a lot of investment into this area from other investors in other countries. Japan being high up on that list in terms of making up a large percentage of all the capital that's gone to this area. How are you thinking about the landscape in terms of global competition or is it not even competition because the market's still so early?

Justin Cyrus

It's a very good question. A part of the excitement on being in an emerging market is you can help shape what that market looks like. And I think there will be winners and losers in this market. And certainly I do think some of the companies that are out there, we're going to see a bit of a consolidation towards the ones that have strong revenue, that have early customers like Lunar Outpost does.

But when you start looking at the global sphere, I think a lot of the folks we call them competition, if you will chat, it's not like straight competition. We're still rooting for them. Because if they succeed, then that helps us unlock a bigger part of the market for ourselves as well. But at the same time, we do think we have pretty strong competitive advantages, not only with spaceflight heritage. We've already shown we can scale commercial products and drive revenue, but also we have multiple missions to the moon to really show off some of our technical advantages as well. So we're rooting for them. I think you make a great point about some of the global competition, but we do think that we're in the driver's seat.

Chad Anderson

OK, last question for you. So earlier I talked about how we expect the macro environment to disproportionately affect funding for capital intensive companies like yours. But you've found a clever hack by focusing on revenue and profitability. How if you're spinning off some of your tech and selling at terrestrial age, how important is this terrestrial revenue stream to your long-term vision?

Justin Cyrus

I think it's crucially important. Certainly for us. We understand emerging markets it's kind of hard to time them sometimes, right. You know, where the market value is. We have a very good game plan in place. We have one of the best teams in this space, but certainly that timing can be tricky. So early on, we decided that we wanted access to strong growing markets here on Earth. And we found that there's an over 80% technology overlap with operating in extreme environments in space and extreme environments here on Earth as well. So we've deployed this technology not only into mining, as you mentioned earlier, but also oil and gas, chemical processing and a few other industries where we have taken, like I said, significantly the same technology and been able to drive revenue off of it.

Now, just to give a quick teaser on why this technology is valuable to these customers, if you have a robotic system that can operate -200 degrees Celsius to plus 200 degrees Celsius, and a GPUs denied environment that can operate with limited human interaction and limited supporting infrastructure, there are a lot of use cases that are underserved here on Earth as great.

Chad Anderson

This is really interesting stuff. We're going have to leave it there. Justin, thanks for taking the time to join us today.

Justin Cyrus

Yeah, thanks for having me.

Chad Anderson

All right, folks. That's it for this episode of Space IQ. Stay cool wherever you are in this level of heat wave. And we will see you in Q3.