GEORGIE FROST: Welcome to *The So What from BCG*, the podcast that explores the big ideas shaping business, the economy, and society. I'm Georgie Frost. In this episode: we don't need to travel into space, space is already here. It's the hidden system that our daily lives and the economy rely on. So what is the space strategy for your business? Well, joining me is Troy Thomas, BCG's lead for space business. Troy, what's your "so what?"

TROY THOMAS: Space equals economic opportunity and dramatically improved business performance. In short, space is no longer just about science and exploration and security, it is about economic opportunity as well as improved sustainability of our planet.

GEORGIE FROST: The global space economy is booming. It's projected to grow from around $600 billion today to more than $1 trillion by 2030, according to BCG analysis. From communication and GPS navigation to weather forecasting and environmental monitoring, space-for-Earth technology is impacting on almost every area of our lives. So where are companies already creating value, and what should leaders do now to take advantage of the opportunities?

TROY THOMAS: This is what a day would look like without space, it would certainly be disruption with hints of chaos. You might not wake up because your alarm clock wouldn't work, because your smartphone depends on the precision navigation and timing satellites that provide the timing signal. You might have trouble finding your way, because our navigation systems or even our ability to take an Uber is dependent on GPS satellites.

Financial systems that are heavily dependent on precision timing and satellite communications would slow down or lock up. And transportation systems, air travel, shipping would also freeze. And of course you wouldn't be able to predict the weather, you'd have to go outside and look yourself.

GEORGIE FROST: I live in the UK, who knows what the weather's going to be, just always take a brolly with you is the advice. How big is this industry? I just indicated at the start, 600 billion, but just spell it out for us. Where's the biggest impact being felt?

TROY THOMAS: Well, Georgie, your setup was perfect, and every year the numbers exceed our previous estimations. I think at one point we thought maybe it would be a trillion dollar economy by 2040, that's moved all the way up to 2030. And just this past year it was well over 600 million as you mentioned. Let's just put that into comparison, right?

The automotive industry is a $3.5 trillion economy each year. So space is not as big as automotive, but it is significant, and growing fast, and I think many don't appreciate the economic impact it has, and that impact is mostly space-for-Earth, that is, satellites in space that are providing value, economic value, for us here on the planet.

GEORGIE FROST: Can I ask about the change in prediction of how big this will be? Why has it changed? Because that's a huge...in a decade you brought that forward, that trillion dollar figure forward a decade. Why has that been revised and how did we get it so wrong beforehand?

TROY THOMAS: The space economy has gone through several epics or ages, and the last big boom in the space economy, nearly 30 years ago, ended up essentially being a bust. And so I think there was some open questions early in this cycle, what we now call the Fourth Space Age, as to whether or not the economic potential would be fully realized.

A lot of venture capital money flowed into new space companies in the last five years, there were big question marks around whether or not they would succeed, and whether or not the applications that space provides, which we'll talk more about, were really going to catch on commercially and not within government. And so those questions are starting to be answered, and the growth trajectory remains strong, and stronger I think than some skeptics may have initially believed. Although I'll say we've always been bullish on the potential for the space economy.

GEORGIE FROST: You talk about three pillars of space. Let's dig into each of those with a business case example, if you would. What are the three pillars of space, firstly?

TROY THOMAS: Most of the value from space is coming today from satellites that are providing

value back to earth. We call this, in short, space-for-Earth. And those satellites are essentially performing three, maybe arguably four functions. One is precision navigation and timing. We know this in the United States as a GPS, but there is also the European Galileo system, the Chinese Beidou system. There are multiple, what we call precision navigation and timing systems that provide us with that precision navigation opportunity.

There is another set of satellites that provide communication, and then finally satellites that provide observation. The way we like to think about this, is today we are able, from space, to provide persistent and pervasive and precise communication, location, and observation in a way that you couldn't do even five years ago, and arguably was only available to security establishments around the world. And so what that's allowing us to do is leverage this precision and pervasiveness of those three things, to unlock new business opportunity.

Like satellite internet is coming. We've always had large sat phones that could provide you some sort of signal in remote areas, but increasingly we're moving into an age where satellites can provide internet services that rival those provided by terrestrial ground systems, and even your airline internet services are increasing.

I hopped on a flight just the other day that has a new Starlink system, and it's a game changer in terms of your ability to stream while flying. So satellite communications is really closing the digital divide and offering everybody, everywhere in the world, access to internet.

GEORGIE FROST: Which of those, I don't know if you can pick it, but which would be the most significant, which has the most potential for growth?

TROY THOMAS: Well, we're seeing the strongest, the largest market, if you think about the space economy and market segments, is the communication segment, that's been largely driven by the rapid deployment of Starlink satellites by the company SpaceX. But satellite communication has always been there.

There is satellite communication from satellites in other orbit, and that market is rapidly changing, and the ability to access internet anywhere on the planet, the emergence of the ability for satellites to connect directly to your phones, are really starting to change the way people have access to not just commercial activity, but also business activity over the internet.

The fastest-growing segment is actually the earth observation. It's the use of satellites to image our atmosphere and the planet in brand new ways, which we can talk about, which is providing us new opportunities in business and insurance and energy, and in other markets that weren't there even a few years ago.

GEORGIE FROST: Well, let's talk about that. What is going on in this space?

TROY THOMAS: This is really remarkable, really until a decade ago, the only satellite imagery that was commercially available was what we call electro-optical. Basically a photograph of the planet, with a resolution, with a fidelity that was a bit granular and not that great, but getting better.

Whereas in the military, not only do we have access to high fidelity electro-optical imagery, but also security establishments around the world had access to other types of what we call phenomenology or sensor types. Synthetic aperture radar, which allows you to see things through bad weather, and at night. Shortwave infrared radar, which allows you to see things in low light conditions and understand what they are.

And so now we can monitor the planet and the surface of the earth, detect activity, monitor change 24/7, all weather, with high precision. And you're seeing this increasingly on the front pages of newspapers, where people are using satellite imagery instead of photographs to illustrate the things that are happening on our planet.

GEORGIE FROST: All of this sounds very cool. Just spell it out for me, what sort of improvements can space technology bring to a company? Why should this be something that is increasingly at the forefront of the minds of leaders?

TROY THOMAS: I would say first of all, most companies are already dependent on space to some degree, and may not be aware of it. If you think about the emphasis in business on cyber

20 years ago and still to this day, there are dependencies on our networks that we need to be aware of because they're vulnerable and we need to protect for our business.

Same is true of space, companies are dependent on space today in ways they're not even realizing. But that's not the most important thing. Like yes, know your dependencies, reduce them, understand how you're leveraging space today in ways you may not even realize. But really now the chance is to think about, what if in my product development, what if in my services, I could assume that I could monitor any asset I have, anywhere on the planet? I could monitor its performance, I could monitor what's happening around it.

What if I could communicate with all of my customers no matter where they are, all the time? What if I could leverage this precision navigation and timing to operate things remotely and autonomously? And really one of the sectors that is at the forefront of leveraging this technology, is agriculture.

GEORGIE FROST: Go into that in a little bit more detail, if you would. How is it doing that?

TROY THOMAS: Well, I think you're probably familiar with the push towards smart farming, the leveraging of data to improving farm productivity. What satellite and what space is enabling farms to do is really dramatically increase farmer productivity.

An example of this would be John Deere. They're at the forefront of leveraging space. They leverage the precision navigation timing satellites, they augment that to provide highly precise seed planting and applications of fertilizers and pesticides, dramatically reducing costs, reducing runoff and increasing yield.

They use satellite communications to connect their tractors in areas where there isn't terrestrial network, and allows them to pass data real time, but ultimately to operate some of those machines remotely and even autonomously. And now they're even integrating this remote sensing data that we can get from satellites, like hyper-spectral data, and other data they allow you to measure moisture in the soil and atmospheric conditions, all together to enable the farmer to make smarter decisions, reduce costs, and drive up crop yields.

GEORGIE FROST: You mentioned cybersecurity and how 20 years ago every company had to get smart about that. Does every company now have to get smart about space? Does every company need a space strategy? And you've just given a wonderful example there of one of the oldest sectors, agriculture, relying now or benefiting hugely from one of the newest, space. So there's actually sectors that may benefit in ways that we can't foresee yet, but given what we do know, does every company need a space strategy?

TROY THOMAS: I would say every company needs a space strategy eventually. And why do I say that? It's because as these new space capabilities come online, they are right now, at this moment, this year, more relevant to some sectors than others. But every sector ultimately will need to engage. Let me just give you an example. I talked about agriculture, space is highly relevant to agriculture right now, every agriculture company should be leveraging space deliberately.

That's also true of the energy sectors, logistics, you think aviation, space is super valuable for optimizing the performance of your fleets, reducing your fuel emissions, driving down your costs. Essentially all the industrials, construction, mining, energy, they're going to see 15, 20% revenue boosts, 10 to 15% cost reductions if they really engage in leveraging space. But you ask, well, what about the financial sector? The financial sector has more of a dependency on space.

But if you think about a broader perspective on finance to include insurance, the insurance industry is highly leveraging space right now, particularly remote sensing, to do damage assessment, risk assessments, and it's highly valuable. What about retail? What about pharmaceuticals or maybe even fashion? OK, fashion may not be relying on space as much today as they will in the future, but they're certainly relying on it today for distribution, and for their business operations. But in the future, when you think about space data and the access to space data and the ability to communicate with your customers everywhere in the world, leveraging space can certainly expand their markets.

GEORGIE FROST: What does a good space strategy look like? How do you implement it? What should you be thinking about first?

TROY THOMAS: I think I would start first by mapping your current dependencies. In most companies we work with don't already today understand the extent to which they're both dependent on space, and space is providing value. And then the second step I think is not to think about space for a minute, but simply ask your question, in the conduct of your business, in your business operations, in the products and services you design, what if you could assume this persistent, precise, pervasive communication observation and navigation? How would you design your products and services differently? How would you operate your business differently?

And what we're seeing is when we sit down with product developers and the people in the business, not just the chief technology officers and the chief information officers, but the product developers, and we ask them, "What if you could assume this?" And they're like, well, we've never been able to assume that. Why would we assume that?" We say, "Well now you can, because space enables you to," it leads to a completely different design of some of their products.

Processing that they used to do onboard equipment can now move to a space cloud. Insight to the performance of a vehicle real time that can provide feedback directly into the vehicle and to the operator, or other parts of the business, can all happen now real time thanks to space, and you can access customers you could never access before.

GEORGIE FROST: How do you manage the risks there? How do you become resilient? Is there a playbook to follow?

TROY THOMAS: I think resilience in terms of leveraging space goes hand in hand with your broader business resilience strategy. And what I mean by that, is most companies will have multiple suppliers for critical components or at least try to. They will have cybersecurity protocols to protect their networks. Space is the same way, space is essentially providing you access to data, data about your market, data about your company, data about the operations of your business, and that flows over networks that you need to protect. So space and cybersecurity go hand in hand. But also you increasingly have options for how to acquire space services. Just in recent years, there may have only been one or two options for the type of remote sensing imagery you needed, or the satellite internet that you needed to connect to your equipment or your business. Now there are multiple options.

Yes, there are leaders in the market like Starlink around satellite communications, but others are coming online quickly. Older companies are reconfiguring with hybrid networks. Same is true with earth observation. So you have optionality in a way that you didn't have before, and given that the cost of space is coming down so rapidly, there's even an option to own and operate your own space assets, and not just buy them as a service.

GEORGIE FROST: You have to go into more detail into that. How, why would you own your own space assets? That sounds big and expensive.

TROY THOMAS: There is a trend in some businesses, certainly in the space industry where I do a lot of work, of vertical integration, where you are basically capturing the entire value chain and dramatically reducing your cost structure. So like any make-buy decision, whether you build it, buy it and own and operate yourself, or you buy it as a service, there's an economic tradeoff there. And there may be cases where a purpose-built constellation, not even a low-Earth orbit constellation, but maybe what we call a MEO, or middle orbit constellation, can be purpose-built for your business, to provide your business with the communication or observation services that it needs.

And then you can guarantee the level of service, you can resell extra capacity and make money on it. And you wouldn't do that in the past because space is a very capital-intensive industry, but the costs of the launch are going down, the cost of satellites are going down and the performance is going up dramatically.

GEORGIE FROST: I want to ask about space and the technology in space that's helping us down here, more in terms of is there enough space in space for those sort of satellites? And also is there going to be, coming down the line, I mean, are there fights between different regions and who owns what? Is that an issue?

TROY THOMAS: It certainly is Georgie. I mean, space is big, there's a lot of room up there, but it's actually an important question. There are

really sort of these macro trends with regard to the space economy. One that we've been talking about is the commercialization of space, it's leveraging space for economic value.

The other trend is congestion, as we put more and more satellites and other space infrastructure on orbit, it does get increasingly congested, and you have to really do more to monitor for debris. It's not so much that there's not room for the satellites, it's that when satellites go dormant, or in some cases satellites blow up, or other countries intentionally create space debris, it puts thousands of these little fragments of metal out in space that can disable satellites, can hit the international space...

Anyway, the congestion and the activity in space creates issues for the sustainability of the safe space environment that we definitely have to invest in and work on. But the other trend is the competition in space, the geopolitical competition, the economic competition, and the very real potential that any conflict on earth extends into space.

GEORGIE FROST: So what does your strategy planning look like for those scenarios?

TROY THOMAS: If you are a business, you have to be prepared for a wide range of scenarios, whether it's conflict or natural hazards that can disrupt your business. Businesses today are highly dependent on undersea cables, they get disrupted intentionally and unintentionally. Highly dependent on energy infrastructure that can be disrupted, by natural hazard and disasters or by attacks. Same is true of space infrastructure, if you think of it as critical infrastructure that has to be protected, as a business you're hoping that the disruption doesn't happen, but you have to build redundancy into your systems in case it does.

GEORGIE FROST: Talk to me if you would about BCG's work with NASA.

TROY THOMAS: Our partnership with NASA and USRA, which is a nonprofit research institution, really, is a good example of the potential of space data when you marry it to AI. So essentially we partnered with NASA, NASA Ames specifically, in their advanced computing power to build a foundational GenAI model that leverages 30 years worth of weather data from the GOES satellites, to improve weather forecasting. And what we're talking about here is not just weather forecasting days in advance, but what they call "nowcasting," like immediate real-time forecasting of changes in weather patterns.

And what you can do with this, is you can dramatically improve route optimization for airplanes, for ships, and ultimately that can lead to something very practical like improved arrival time estimates. But essentially it's a publicly available GenAI foundational model that we've built with NASA and USRA. It's free to the world to use, and we hope people start leveraging it to improve aviation safety, aviation business performance, and ultimately provide for safer and more efficient travel.

GEORGIE FROST: I started by asking you what a day would look like without space tech. What would it look like in 10, 15 years time? How would my life, from wake up to sleep, be different?

TROY THOMAS: Well, I think the dependencies are only going to grow. We're not that far away from satellite direct to your phone, where essentially you're leveraging satellite 24/7 for your primary means of communication and navigation, how to get from place to place. I mentioned earlier it'd be disruption with hints of chaos, it'd be some chaos for sure, and you would be having to rely on things like maps and alarm clocks, traditional alarm clocks.

But the financial system would shut down, travel would shut down, just like if the energy grid shut down or the financial system shut down, if you lacked access to space, life would grind to a halt. But also there'll be new things going on in space in a decade. You might be going there for a vacation, so you wouldn't be able to take your trip up to a space hotel.

Biomedical research, which is already happening in space, and it would be happening at scale, would likely slow down and be interrupted. We would potentially be storing vast amounts of data in space where it's naturally cooled, it's cold in space, and all of the space data that we're collecting from satellites is being processed in orbit, so you wouldn't have access to that.

And eventually, ten years on, we hope to be at the beginnings of a lunar economy, where we have a permanent presence on the moon and there's routine travel back and forth to the moon. So all of that scientific and exploration

and economic opportunity that's coming from a new space economy that extends into space, would not be realized.

GEORGIE FROST: Right. We've covered the "so what," now it's time for the "now what." What is the next step for businesses, Troy?

TROY THOMAS: Wake up to the opportunity that space presents. Look at how you could integrate it into your products and services and your business operations. Understand that the scale of your business has the potential to shape the space industry itself, we see that in agriculture with John Deere, which is really revolutionizing the way we leverage space and integrate it to improve food security.

So really see it as an opportunity, a technological opportunity to transform your business, and take the time to integrate it into any transformation or digital strategy that you're undertaking as a company.

GEORGIE FROST: Troy, thank you so much, and to you for listening. To learn more about the model that BCG built with NASA, or to download that model, check out the links in the show notes.