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Why on earth should business care about space?

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Two decades of technological innovation have unlocked a wealth of space-based opportunities for commercial entities to offer once-unimaginable services.

The volume of information available from space is unprecedented and can unlock massive business opportunities—if companies understand how to use it. In this episode of the *At the Edge* podcast, McKinsey experts Ryan Brukardt and Jesse Klempner join host and McKinsey partner Mina Alaghband to discuss how the space-for-earth economy has evolved and what's needed for it to scale and succeed.

An edited transcript of the discussion follows. For more conversations on cutting-edge technology, follow the series on your preferred podcast platform.

Podcast transcript

Mina Alaghband: Ground-breaking space technology exists for all sorts of industries. What does it mean for your business in the next five years and in the next fifty?

"There's a great set of technologies based on all the private capital that's flowed into the space industry to develop different innovations. But there's still a disconnect about how those innovations can help people, businesses, or

governments function."

— Ryan Brukardt

Mina Alaghband: That's McKinsey senior partner Ryan Brukardt. He joins me with McKinsey partner Jesse Klempner to discuss space applications already transforming industries and those that are just around the corner. Welcome to *At the Edge*, a production of the McKinsey Technology Council. I'm Mina Alaghband.

Ryan, Jesse, thanks so much for joining us today. We've touched a little bit on the space-for-space economy in previous episodes, and there's no shortage of hype over the commercial opportunities in space now. But today, we'd like to get grounded on the space-for-earth economy and talk to you about the opportunities, the hype, and the reality.

Ryan, what is the role of space and how has that evolved over time?

Ryan Brukardt: For more than 50 years, space has been the domain of governments, and that's largely been due to the excessive cost of actually getting into space. And it all started in the '50s and '60s with the space race between the US and, at the time, the USSR. Because it was so prohibitively expensive to reach space, there was really no reason to go there, apart from national security reasons.

And then we moved beyond superpower rivalries, and science became the chief focus. What's different now is the shift from a space-to-space environment to more of a space-for-humanity rationale.

Several technological innovations over the past two decades—from SpaceX substantially reducing launch costs to advances in onboard computing—have enabled far greater access to space. Non-government actors are becoming realistic, business cases are being made, and the private sector is getting excited. We're

really at the precipice of a monumental shift. Think about aviation in the ’20s or the internet in the early ’90s and compare it to where we are today. I think we’re at that inflection point now with space.

Mina Alaghband: Jesse, could you paint us a picture of the existing earth economies and industries and how they’re going to be affected by this monumental shift Ryan described?

Jesse Klempner: I’d frame it this way: there are people who are overly focused on the space side of the equation. And for the space-for-earth economy to succeed, grow, and scale, we need to think about what’s being delivered to industries on the ground. Ultimately, what people receive today from space are pieces of data, as satellites take pictures or act as modems in the sky, allowing us to move information more rapidly around the world. And the big unlock has been the scale at which that’s occurred in the past decade.

We can now move information much faster, and at higher bandwidths, to far more dispersed individuals, corporations, or governments around the world. And the volume of information we can extract from those space sensors has increased exponentially.

To make it a bit more tangible, agriculture has become a massive use case for most of the space industry in the past few years, because we are now able to tell farmers, “We’ve taken a picture of the same field every day for the past ten years, and there’s not enough water in the soil, or you need to change the volume of fertilizers you’re spreading.” Satellite technology allows us to target specific fields and improve crop yields much more efficiently. You can do the same thing for energy use, mining, and, of course, a whole host of security and intelligence applications.

Mina Alaghband: Jesse, the example you cited is about using satellite imagery that’s gathered in space to inform decisions in industries with a physical footprint on earth. Is the space-for-earth economy just about satellite imagery?

Jesse Klempner: Absolutely not. The types of sensors being launched into space are proliferating wildly. There's also radar imagery, radio frequency (RF) sensing, as well as heat sensing, which all unlock once-intractable use cases on the ground.

For example, we've always been able to track ships using automatic identification system (AIS) transceivers, which are required aboard every ship at sea. But some crews turn them off, which of course you're not supposed to do, causing those ships to go dark and "disappear." But we're able to use RF sensing to track shipboard cell phones or other devices to find these ships and ensure they aren't involved in illegal shipping or fishing.

On the communications side, which has historically been the largest sector of the space economy, space is far and away the most efficient means to distribute information to remote locations that are difficult to serve through other means like fiber optics. So it enables a much broader group of individuals access to the internet or other critical information they depend on for survival.

Ryan Brukardt: If I could add to that, Jesse, you mentioned radar from space, and people might say, "Well, why do I need radar from space?" Well, you need radar from space because you want the ability to capture imagery at night or when there's cloud cover, which is of particular interest to people in national security or other governmental environments who need eyes on the ground regardless of the conditions.

There are also other industries that don't even realize this technology exists, what it's used for, or how it might apply to their own sectors. So I think we're at a time where all of the space industry leadership needs to shift their model. They need to think about how they can work with companies to help them understand the unlocks space can provide for their own growth, sustainability, and other reasons.

Mina Alaghband: Ryan, what other industries do you see adopting interesting use cases by leveraging space technologies?

Ryan Brukardt: I think by and large communications is the first era of adoption. We already watch TV signals being beamed from space, and most people have satellite radios in their cars. And then there's GPS, which relies on an existing network of satellites that enable everything from military applications to Uber.

We also have SpaceX's Starlink internet constellation of satellites, which will provide people all over the world—regardless of location or economic conditions—access to any kind of information. Think about places like Sub-Saharan Africa, where it's sometimes difficult to obtain potable water or electricity. Yet they can all enjoy access to every piece of information in the world.

The second era of adoption, which Jesse mentioned, is imagery. It includes different types of imagery, which is technically called remote sensing, and I think this is the next big area of unlock. We're seeing adoption in sectors including agriculture, insurance, and even banking, where, for instance, hedge fund managers want to see how the number of cars in Walmart parking lots change over time. So we're starting to see some adoption of these remote sensing applications in many of the big industries.

But I don't think we've even begun to scratch the surface of adoption of these technologies because of the disconnect between the space community and the non-space community. There are a whole bunch of other eras yet to come that will involve things like manufacturing in space, such as taking advantage of microgravity to increase the purity of fiber optics.

Mina Alaghband: Ryan, you mentioned this disconnect between the folks thinking about space and leaders in the insurance, agriculture, and other industries, where even current applications from a communications and imaging perspective could be valuable. What's driving that disconnect? And what might allow these leaders to understand the use cases that could propel their organizations forward?

Jesse Klempner: Many individuals in the space sector take a space-forward position when they speak to potential clients, but ultimately, those insurance, automotive, or financial services companies don't care about the space side of things. These space companies should simply say, "I can tell you how many cars are in every Target parking lot every Saturday, and I can tell you how that adjusts over time," and never mention the word "space" at all.

So there's still this disconnect, where the space economy has been relatively inward-focused or focused on government customers. These companies need to stop talking about space and figure out how to engage with the rest of the economy to bring their products to bear. Space is amazing. Ryan and I love space. We're space nerds. But that's not the beauty of what space can provide to so many companies.

Ryan Brukardt: To Jesse's point, one example I like to give is cloud. Ten years ago, most people didn't know what cloud was, what it could do for them, or how it could unlock economic value and new capabilities. But today, almost every industry throughout the world, from the C-suite all the way down to those on the front lines, understand what cloud is and what it can do.

And I think space is a little like cloud back then. There's a great set of technologies based on all the private capital that's flowed into the space industry to develop different innovations. But there's still a disconnect about how those innovations can help people, businesses, or governments function.

Mina Alaghband: I think it's a great analogy. People understand the ability to access files from their phones, computers, and other places. But if you ask them to explain the underlying technology, very few people can.

And I think this goes back to the idea that the companies operating in space are so interested in the underlying technology that a lot of less technical buyers may not be able to relate to it. So if I'm the CEO of an insurance company, a fund manager, or a

mine owner, how do I think about use cases and what they can do to catalyze my business?

Ryan Brukardt: It's funny, because Jesse and I were just having a discussion with a utility CEO about some of these technologies, and he wasn't aware they even existed. What he was interested in was micro-weather forecasting around wind turbines, so he could reliably provide power to his grid and know when he needed to swap wind power with gas power.

So space companies need to think through the big problems their potential clients are trying to solve. And the CEOs of those companies need to think about their agenda and proactively engage with some of these space entities out there to problem-solve and generate some ideas.

Jesse Klempner: One thing we've seen is smart space companies beginning to hire business development individuals familiar with the sectors they're trying to cultivate as customers. They're realizing that if they want to convince a mine owner, a utility, or an insurance company of the value of the product they're offering, they need to hire individuals who can do a consultative sale with history in that market. I think that we're still in the very early innings of that shift, but we're beginning to see some traction and the model evolving.

Mina Alaghband: How do you think about the evolution of value pools in the space-for-earth economy? Where will the sizable economies and meaningful business opportunities exist?

Jesse Klempner: The technologies we're using today and launching this year and the next aren't fundamentally different than those we experienced ten years ago. More importantly, the cost curve has shifted so dramatically in the past decade that it's less about finding a huge new value pool. It's more about an expectation of a relatively high correlation between the cost coming down and the resulting unlock in demand.

Which means those markets that used to be able to afford to check only once a quarter how much oil is in a tank in Houston, for example, can now afford to do so every week or every day. And they can do it globally, instead of focusing on just one location. So I think that's a huge unlock, given the cost shifts that occurred in the past decade.

Ryan Brukardt: One thing I'd add is that, traditionally, things viewed from space needed to be analyzed, processed, and synthesized by experts on the ground. But that's rapidly changing. Think about the ability to consistently scan forest canopies looking for fires, which there was no way to do from space before. Now satellites carry sensors that can detect heat, verify fires with photos, and complement that with full-motion video. What is that early identification worth to homeowners living in a wildfire-prone area? What is that worth to the insurance companies that could possibly avoid paying out millions or hundreds of millions of dollars? What does that mean for the state government, where early intervention may help them avoid rebuilding devastated areas? So, yes, the use cases are somewhat the same, but the value pools haven't even been estimated yet.

Mina Alaghband: It sounds like the evolution of the technology and the cost curve have increased the frequency with which you can leverage these capabilities and opened a whole new set of use cases and changed the ROI. It's much more about real-time decision making, which has been enabled by this kind of stream of information and communication.

Jesse Klempner: Absolutely. And I think we're still figuring out how to use all that information in an efficient and effective way that doesn't overwhelm decision makers. The whole industry is still sorting this out, which gives me great confidence that it's only going to get quite a bit better in the next five years.

Mina Alaghband: Maybe we can spend a moment on the supply side. Who is supplying this technology? Should we just be imagining aerospace leaders? What does that landscape look like?

Jesse Klempner: I think it's a great question. The diversity and proliferation of the space industrial base, globally speaking, has expanded rapidly because the bar for doing things has come down immeasurably.

Previously, if you wanted to launch a satellite to take pictures, the satellite alone would cost many hundreds of millions of dollars. And it would have to be built in a multimillion-dollar clean room. Then that hundred-million-dollar satellite would need to go on top of an equally expensive rocket, shot into space, and be monitored by ten people to make everything work.

That's not the way the industry works anymore. People can build satellites in their garage. I'm sure everyone is tired of the proverbial garage manufacturing example, but satellites are now being built in downtown San Francisco and Chicago. That was unthinkable not long ago, so the proliferation of people who can supply this equipment has been truly mind-blowing.

Ryan Brukardt: I think the other thing is how the people involved in the space business now are totally different. It used to be just big aerospace players. It's not that way anymore. We've got small players now, and we've got a lot of private capital flowing into start-ups. Beyond that, you also have data and analytics companies processing all the different types of information being beamed down to earth. So in addition to aerospace and space players proliferating, you also have these new players, and everybody is finding ways to participate.

Mina Alaghband: I was imagining the big traditional aerospace and defense companies playing a major role in the space industry. Are they being disrupted? Will they continue to play an outsized role? Or is the space economy going to be more fragmented, with many more players sharing in those value pools?

Jesse Klempner: There will unequivocally be more players sharing in the value pools, but I think it will be less about sharing and more about expanding those value pools. That's what we're seeing quite a bit of, and I think this dichotomy between old

space and new space is a false one. There is one global space industrial base targeting these markets.

And I think the flows of value between younger companies, older companies, European companies, Asian companies, and American companies will hopefully flow in a much more dynamic manner than it did when space was largely the province of governments. So I fully expect more participants in the space industry will prosper in the future than today.

Ryan Brukardt: By the way, participating in the space economy doesn't mean that you need to launch a satellite. Look at a country like Costa Rica, which has a thriving components space business they want to grow.

So this whole idea of expansion includes not only companies but countries and institutions as well. And they're going to have to stretch to accommodate the right types of governance and standards that need to be in place to ensure the responsible and sustainable use of space.

Mina Alaghband: If you're an investor, a potential founder, or an executive in a legacy aerospace company, how do you think about the business and investment decisions you're making over the next five to ten years, given the evolving use cases you described, as well as this increasingly competitive supply-side environment?

Jesse Klempner: I think almost all companies that have been long-term participants in this market recognize how the pace of change has accelerated. It's about prioritizing which levers they want to pull and how hard to address some of these challenges.

And to be very clear, a lot of these legacy companies are on the leading edge of many of those evolutions, and we expect to see more of that. It's truly a dynamic industry, where the democratization of supply has been incredible. There's amazing expertise in every corner of the industry, and it's democratized to a degree that we see individuals participating on the supply side.

There have always been rocketry competitions, which are an old high school tradition, and we're now seeing the same type of activity in space competitions at the collegiate level. But we're talking about individuals participating in the space economy in a way that was once unimaginable.

Mina Alaghband: Ryan, any suggestions for leaders on the supply side on how they should adjust their strategies and their investments based on the trends you're seeing?

Ryan Brukardt: There are probably three themes here, the first being that speed matters—a lot. This is an industry that's changing very rapidly. And frankly, it doesn't matter whether you're a company that's been around for a while or whether you're a new one. The speed of innovation, particularly given the amount of private capital rushing in, is very fast.

Second, that means all companies will need to think about how to move more quickly, the implication being, "How do I get the right organization and talent to support that speed?" Obviously, we're all in a huge crunch for talent, and these firms have an advantage when it comes to attracting that talent, because, frankly, space is exciting.

I think the third thing those of us in the space industry need to think about is how to educate ourselves about the needs and agendas of our potential customers, be those organizations or nations.

Mina Alaghband: Jesse, could you comment on how the technological innovations you see on the horizon might change some of the upcoming opportunities?

Jesse Klempner: I think the biggest technological changes we'll see in the near- to midterm relate to software and the application of advanced and high-powered computing to the largest pile of data we've ever seen. I think for many years, observers, such as investors or intelligence professionals, have been focused on change detection, or how things change.

I think they recognized this was a somewhat limited aim, and what people really want to understand from afar is pattern recognition and deviations from those patterns. And I think the combination of massive data piles, advanced computing capabilities, and advanced analytics approaches will allow us to drive insights around the patterns of life we're unable to do today.

Mina Alaghband: We've talked about value pools and discussed the opportunities for insurance and hedge funds, mining, and agriculture. Ryan, you mentioned space for humanity earlier. How will this translate beyond the economic opportunities to help humanity?

Ryan Brukardt: I can give you a couple examples of how space will benefit humanity. The first one, unfortunately, is around the conflict in Ukraine. I think all of us have seen images from many of the established space players, and some new ones, depicting what's happening on the ground in Ukraine.

And those pictures are being used to hold bad actors accountable. This capability didn't previously exist commercially and could only be done by governments. But today, you or I can see pictures taken earlier in the day highlighting some of the atrocities occurring there. So when we talk about space for humanity, that's one example.

Another one involves sustainability. Again, we've always been able to monitor things from space, but we're now at the point where we can do some very exciting and innovative things. For example, we can monitor forest canopies throughout the world, not only to assess their health, but, again, to hold bad actors like illegal loggers in the rainforest accountable. Those images can be used to carry out interventions and protect those valuable resources.

The third area is one I would call the democratization and ubiquity of information, and the fact that many of the players today are making information available gets us excited.

This ubiquity of information and accessibility to information is super exciting as you think about the need to grow globally and uplift citizens throughout the world. This is a very significant development, because once you have information, there's so much you can do, like expand education and promote and provoke change.

Mina Alaghband: Ryan, Jesse, thanks for all your insights. Before I let you go, I'm going ask you a couple of quick-fire questions for the fellow space nerds in the audience. My first question for both of you is what piece of culture, art, literature, or sci-fi most sparked your interest in space?

Jesse Klempner: For me, it's Tom Wolfe's book *The Right Stuff*. And when we think about exciting innovations today, I think back to the bravery of all the individuals involved in all the programs that ultimately led to the moon landing. And I think that book, more than anything, solidified how this has been a journey of passionate individuals and some very committed countries and institutions supporting the progress we've made to date.

Ryan Brukardt: I love that book, too, Jesse, but I'm going to go with *Star Trek,* because that was the thing that excited me. I agree with your points about heroism, but I just love the idea of space exploration.

Mina Alaghband: I think we've got two sides of the story there. Second question: Do you think space travel will become ubiquitous, and do you think you'll make it to space in your lifetime?

Jesse Klempner: I don't know if I'm going to make it to space in my lifetime, but I would love to. We'll see.

Ryan Brukardt: Jesse and I both believe space travel will eventually become something many people will do. Think back to the early days of aviation in the '20s. I think that's where we are today. Where will we be 30 years from now? I'm not saying

space travel will be quite as common as commercial flights today, but I think you'll see a lot more people going into space. And more importantly, they're going to be working and living there, not just sightseeing.

Mina Alaghband: And finally, is there extraterrestrial life out there?

Ryan Brukardt: I don't think I'm qualified to answer that question. But I do think Carl Sagan was when he said, "The universe is a pretty big place. And if it's just us, it seems like an awful waste of space."

Mina Alaghband: Thank you both for joining us on the podcast. Appreciate your insights.

Jesse Klempner: Thank you for having us.

Ryan Brukardt: Thank you very much.

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ABOUT THE AUTHOR(S)

Ryan Brukardt is a senior partner in McKinsey's Miami office, **Jesse Klempner** is a partner in the Chicago office, and **Mina Alaghband** is a partner in the New York office.

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