



**Mitch Steves:** Hey, good morning guys. This is Mitch Steves, RBC's semi-cap analyst. We've got ADI here to talk about the space business.

Before I hand it over to Mike, I'd like to say that if you're not on the Veracast system, please email me at [mitch.steves@rbccm.com](mailto:mitch.steves@rbccm.com) and we can get you the link to submit questions. Alternatively, if you are on a phone and you would like to just email me questions, that is also fine. And I will be sure to weave you in. So with that, I'll turn over to Mike to do the introductions and to his quick, forward-looking saving commentary. Take it away Mike.

**Michael Lucarelli:** Thanks so much, Mitch. Thanks everyone for joining us today as we do a deep dive on the space market. This is our fifth in the series. During the COVID times we all work from home.

We thought we'd give investors a different insight, a different aspect of our business. Today we're going to highlight Space with Bryan Goldstein. But before we get to the excitement, I got read of all the forward-looking statements they told me. Just kidding.

I'll do a quick brief forward-looking statement flash. You guys can read them as you need. And you can find this on our website. The transcript and a presentation will be under the Event section under Uncovered Series halfway down the page. So that, I'll pass it to Bryan to give himself an introduction and go through Space. Thanks so much, Bryan.

**Bryan Goldstein:** Thanks, Mike. Good morning, everybody. My name is Bryan Goldstein. I'm the Vice President of the Aerospace and Defense business for Analog Devices. I've been in the defense industry for 30 years. And I came to Analog Devices through the Hittite Microwave acquisition, where I was Vice President of the Module Subsystems and Space Business area.

Earlier in my career, I spent time at both Raytheon and Lockheed Martin. Today, ADI's aerospace and defense business, which we internally refer to as ADEF, is just over \$600 million of annual revenue. This represents about 10% of ADI's business. And our gross margins are additive to ADI's bottom line.

To help better understand ADEF, investors should think about the business in three distinct pieces. Defense, which is our largest portion, commercial avionics, which is the smallest, and then Space, where I'll be focusing my comments today, is roughly a quarter of the business. Overall, in ADEF, we're the market leader in linear precision, high speed converters, and RF microwave.

We're in a very unique position with the combination of ADI, Hittite Microwave and Linear Technologies. With the Hittite acquisition, ADI added RF technology scale, subsystems design and manufacturing, as well as increased sales reach and channels for the combined RF portfolio. With LTC, we've added power capabilities to our precision and RF solutions. And as a result, ADI is the only supplier with a complete antenna to bits portfolio for aerospace and defense applications. And this is a benefit, as our customers would like to support less suppliers and sees ADI as a one-stop shop covering many of their electronics needs.

What's also unique is how we work with our customers. We've been in this business for over five decades. And our products have very long life cycles, which is a real benefit in the ADEF industry.

We bring system level expertise from engineers who have worked in the industry. And our customers rely on us as a partner, as we not only bring the underlying semiconductor technologies but we also bring application level expertise. We're working with them closer than ever before as we now develop and manufacture complete architectures and complete integrated solutions.

Our leading position has supported our strong growth. In fact, over the last five years, this business has achieved close to a double-digit organic CAGR. We believe that this growth will continue for several reasons. First, we've been seeing record defense budgets worldwide, with a significant continued focus on advanced electronic content. Second, our breadth of technology and domain expertise allows us to drive share gains and capture additional SAM as we develop more complete and integrated solutions.

Our customers are asking us to take on more responsibility. And we're capturing increased value as we've progressed from a semiconductor components supplier to a systems solution partner. Today, I'll speak more specifically about our Space business. Moving to slide 2, Mike.

Our Space business is about a quarter of our aerospace and defense revenue and generates just north of \$150 million annually. This business also achieves above average corporate gross and operating margins. A very attractive characteristic of our business is our ability to take integrated circuits developed for various commercial end markets, qualify them for space flight, and then sell them through to our end customer base. This effectively reduces our R&D for Space and lends to very high incremental margins.

ADI's robust portfolio with leading positions in precision converters, power, and RF microwave, coupled with our domain expertise and high reliability manufacturing capabilities, makes us one of the market's premier suppliers. Our space customers include traditional satellite OEMs, defense contractors, and the emerging market disruptors.

In this market, we see opportunity across several applications. These include on-orbit satellites used for communications, navigation, and observation, ground or earth-based terminals that communicate with these satellites in orbit, and launch systems, including the rockets that propel spacecraft into orbit. Also, expanding areas include space exploration and eventually space tourism.

The area that is positioned to change the most over the next decade, however, is in the exponential growth of low Earth orbit communication satellites, which are commonly referred to as LEO satellites. Given our position and the changing market dynamics, I'm confident that ADI will double our space revenue over the next five years. Next slide, please.

We're embarking on an exciting time for the space industry. There are unprecedented levels of investment coming from a broad array of sources, including governments, venture capital funds, corporations, and ultra-high net worth individuals. Several factors are making this proliferation of the space economy more pragmatic, thus, ushering in all this investment.

These factors include an ever-increasing demand for data bandwidth, which is driving the need for the latest and greatest semiconductors, reduction in launch costs from approximately \$200 million each to less than \$60 million. And this is expected to drop even further. The new satellites are smaller and have lower weight, which also improve launch costs.

Shorter duration missions, closer to 5 to 7 years, as opposed to historical 10 to 20 years, allows for relaxed reliability requirements and commercial-like manufacturing scale. Satellite design and build curve has been dramatically reduced. Development timeline is now closer to three to six months as opposed to three to six years, leveraging new technologies from other markets to get products into space more quickly and efficiently.

So what's this all mean to our business? The Chamber of Commerce is suggesting that space market will more than double its share of GDP by 2040 to 5% and will reach a market size of \$1.5 trillion, while the number of LEO satellite launches in the next five years will grow exponentially. Next slide, please.

These new market dynamics are enabling the advent of commercial communications satellite networks in the form of LEO satellites. Just to be clear, LEO satellites are not new. And most satellites today reside in low Earth orbit. But this push from new disruptors, like SpaceX and Amazon, to provide global high-speed internet via satellite has real legs for the first time in history, given the staggering investments as well as the rapid advancements in technology.

To better understand what this means for ADI, I think it would be helpful to first highlight some key differences between geostationary or geosatellites and low Earth orbit, or LEO satellites. First of all, communication satellites in GEO orbit are much larger than those in LEO constellations. This is because they are greater than 22,000 miles away from the Earth and must remain functional for 10 to 20 years.

At this orbit and lifetime, they not only require the highest levels of radiation deterrence, but they require tremendous power systems to stay alive and active. On the other hand, being in large radius orbit, GEO satellites can cover much more of the populated Earth with a relatively small constellation. And they also move in tandem with the Earth orbit, appearing stationary to us on Earth, making it easy to aim an antenna at the satellite.

Satellite communications in LEO orbit fly at less than 1,200 miles above the Earth, so require much lower radiation tolerance requirements. They are also much smaller and have relatively short life spans of three to seven years. However, LEO satellites orbit the Earth in approximately 1.5 hours. So they're a bit harder to track with an antenna.

The key advantage that LEO networks have over GEO is low latency, which is the time delay from transmitting to receiving information. Accomplishing low latency allows real time communication, which is the Holy Grail not only for traditional communication networks, but this is also enabling the possibility of new industries, such as autonomous driving, and telemedicine, and others.

I want to just talk a minute more about the orbit of LEO satellites because LEO satellites change their position relative to the Earth so quickly, there needs to be a constellation of many hundreds or thousands of satellites connected to a network in order to provide reliable service with end users anywhere on the Earth. This dynamic is why the LEO launch cadence is expected to scale dramatically. Not only are the volumes interesting, but the new cost of launching satellites enable a much faster technology refresh cycle compared to today's satellites.

As a result, we expect our Space business to deliver a steadier stream of revenue growth in the years ahead with a steadier launch cadence. All told, we see the LEO satellite SAM opportunity being at least four times the size of GEO over the next five years. Next slide, please.

I want to expand on the opportunity just a little bit more. You see the content per LEO satellite is a bit lower than GEO as a function of size, shorter missions, less radiation hardening requirements. But this is more than made up in volumes. Also, the types of technology needed for satellite is expanding, with new commercial communication LEOs needing new features to deliver the performance required for low latency and an always-connected experience.

Let's take a little bit closer look at the LEO satellite to better understand where we play. We play primarily in the communications and navigation payloads. We play in the system health and telemetry systems. And we also play in the electrical power systems and stabilization hardware.

To succeed in creating this network to the fast-moving satellites, both satellites and terminals must be capable of signal beam steering. The newest networks are utilizing phased array antennas, where the physical antenna does not move but multiple simultaneous energy beams can be steered electronically. This requires an exponential increase in electronic content compared to single beam rotating antennas.

This architecture based upon a phased array antenna, is very similar to that used in 5G networks. Phased array antennas have been around for decades but were very expensive and mostly used by the military. The cost points have come down dramatically and have now enabled the commercial sector to engage.

Not only has phased array increased the business opportunity for ADI, but our customers are also asking us to provide more complete solutions in the form of modules and subsystems, where we integrate several to many hundreds of semiconductor devices in a single package. This allows us to create solutions which can optimize size, weight, power, as well as performance. An example is a family of RF up and down converter modules that we've developed for the LEO communications market.

Giving you an example of what that means. Semiconductor BOM (bill of materials) could be less than 10 to 20x the price that we're able to garner for the value of a complete integrated module, just to give you a sense of scale there. If there's one message that I want to leave you with today, it's that ADI is much more than a semiconductor provider.

We're a partner to our customers. And we have moved up the stack beyond silicon into complete integrated solutions which include, system design, manufacturing, and added value software and algorithms which increase our performance and ease of use to our customers. Next slide, please.

To close, I'd like to leave you with a few key takeaways. Overall, Space has the potential to be a meaningful growth driver and unlock value across other verticals, as well. ADI is a trusted partner with a broad and diverse customer base in the space market. The growth of the LEO satellite market is unlocking more than 4x our current market opportunity. And once fully operational, these LEO networks will provide real time, reliable high-speed connections globally.

This trend along with others give me confidence that we will more than double our revenue in the next five years. With that, I will hand it over for Q&A.

**Mitch Steves:** Perfect. Yeah, thank you very much for that overview. I'm going to open up with a few questions of mine. And again, as a reminder, if you're on the Veracast system on the website, you can just type in the questions. Or you can email me at [mitch.steves@rbc.com](mailto:mitch.steves@rbc.com).

I think one thing I wanted to double-click on-- you gave a very good overview-- is just the difference in the growth you expect from both LEO and GEO and what those ASPs difference looks like, just generally. Because you're talking about doubling the revenue line over five years. It's pretty substantial growth. So how do we think about, I guess, the unit mix, and then the ASPs difference between those two major markets within space?

**Bryan Goldstein:** Thank you. Like I said, I'm very confident that we can double our space revenue in the next five years, which equates to approximately a 15% CAGR over that time. The majority of the growth we expect will be driven by these LEO mega constellations used for communication applications, which I covered quite a bit.

We also see steady but slower growth with respect to the GEO launches. GEO launches are where we're generating a lot of our current revenue. And that is not going to go away. And that is going to continue to grow as well but not nearly as quickly as the LEO.

And as we move forward, I want you to also be aware that this growth is going to happen over the next five years. But year to year, we're going to see some lumpiness as we do in our current business because that's just the nature of this kind of business. But that doesn't change the fact that we see tremendous growth coming our way over the next few years.

**Michael Lucarelli:** Yeah, Mitch, I'll point you to, I think it was slide 4 we had. If you look at it, the content opportunity in GEO is much larger. It is tens of millions of dollars. But we only launch about 10 of those a year max.

And Bryan said, if you at the LEO mega constellations, the content is only \$100,000 plus/minus. We are launching thousands of a year or so. We put those huge numbers together, what Bryan talked about was, there's 4x SAM opportunity because of these mega constellations of LEOs.

**Mitch Steves:** Perfect. The next thing I wanted to touch on here, as you mentioned, you're not entirely a semiconductor company. You've got a lot of IP. And when we think about ADI, we think about communications, as well. So can you walk us through an example of leveraging IP to win market share in those LEO constellations, particularly in the mega constellations? And then give even the GEO side as well.

**Bryan Goldstein:** Sure. What's really interesting is the broad portfolio that ADI brings in the broad markets where we play. And our aerospace and defense business as a whole gets to take advantage of those investments and those technologies. And so our leadership in the communications market certainly plays very well as we grow into this LEO application. We're able to take those technologies and translate them and get them ready for space flight.

The IP and the innovation spawned from our Comms group and others can be taken by the space team, can be qualified for various degrees of radiation and reliability, and could be sold into this market. And some examples include, our latest high-speed converters and transceiver products, which were developed for the comms market which we are now bringing into communications networks in space. Historically, these products could not meet the rigors of the 20-plus year life expectations of GEO. But the reduced reliability and radiation requirements in LEO have enabled us to adopt some of these latest

technologies and foundry processes. And so this effectively drives very high incremental margins because we can take advantage of that R&D investment that was put forth for other businesses.

**Mitch Steves:** That's perfect. And then just one that we didn't really touch because it's obviously focused on ADI specifically. But can you walk us through the competitors in the field and then secondly, how you are gaining share against your competitors?

Is this specific design work? Why are they choosing to go with ADI? And who are the main competitors you're essentially or potentially taking share from?

**Bryan Goldstein:** Sure. So we don't talk specifically about individual competitors. But we will say, that we're very unique. And our uniqueness is in multiple forms.

We've been in this business for almost 50 years. And so there's a lot of inherent learning that needs to be developed about the space industry, domain expertise and tacit knowledge that comes along with that hands-on history and the understanding of our foundry processes. But also, our breadth of capability differentiates us. Being able to develop the underlying semiconductor technologies all the way through understanding the high reliability nature of being able to integrate and then being able to manufacture in a high reliability factory is very different.

As well as our broad portfolio, where we have competitors in each of the different functions in the block diagram. But we own the complete block diagram of antenna to bits. And like I said, our customers want to reduce the number of suppliers they have. And they really want to partner with people who could bring more value. And so ADI is just very unique in that way.

The other thing that's interesting is, because the LEO satellites are so inexpensive to make and to launch, the upgrade cycles are going to be very rapid. And ADI, because of our commercial business, is rapidly advancing our technologies across the board, as well. So that's going to feed very well into this LEO market as they advance their technologies.

**Mitch Steves:** OK, perfect. So I knew this was going to come up given all the noise around SpaceX, et cetera. So I'm going to combine a couple of questions we got from the investors here.

So when you talk about LEO constellations, can you maybe talk about some of the more use cases that we're going to see here, whether it be the importance of 5G or creating synergies in ADI segments? And then secondly, what type of other items or other activities can we do once all these major constellations are of built out using ADI products? What are the benefits of the rollout?

**Bryan Goldstein:** Sure. So first and foremost, this starts with communications, being able to bring high speed internet across the globe to places that are not currently reached. While the technologies are very similar to the work that we're doing in 5G, the applications in some cases may overlap and, in some cases, may be independent.

So we're focused on communications, specifically, in the communications networks. These new phased array antennas that I talked about really drive a huge amount of semiconductor content. And so being able to launch, one, thousands of satellites instead of tens of satellites. And then having a phased array antennas that have thousands of elements and basically 10x the electronic content of an older GEO

satellite is really driving our investments right now. So there's a lot of work going into getting these phased array antennas ready for launch in high volume, and at reasonable cost points, and at reasonable power and efficiencies so that they don't need to be cooled and they can go on small satellites.

So that's where we're starting. We are taking a lot of our commercial products and portfolio and we're upgrading them to be able to fly in space. And from there, we do see other applications. Once we get the communications off the ground, there's just this unlimited need for high speed internet. And so autonomous driving, telemedicine are just a couple that we mentioned.

So from there, once the satellites are up, and there's only so much room for satellites in space, but we see that probably taking a decade. The low cost allows us to upgrade. And they're only good for five to seven years. So there's this self-fulfilling business model, where we're constantly upgrading and replacing satellites, which is not what's happening in our current business.

**Michael Lucarelli:** Yeah, Mitch, I'll add one thing to what Bryan said. On the customer side, you're right, there's a bunch of up and comers, I guess I'll call them, or disruptors. And also, the legacy guys are also moving to LEO mega constellations.

What ADI is trying to do is supply to all of them. And that's what we are good at doing. We're basically the picks and axes in the gold rush.

We don't pick winners. So we're happy whoever wins, as long as they're launching more LEO comm satellites. It's good for our business.

**Mitch Steves:** Maybe I could just ask for clarification just so we can wrap this all up in a bow. If I think about the space revenue, how much is federal government, how much is the new up and coming disruptors? What does that look like today? And what does that look like, let's call it, in five years? Because that will give us a sense of what you guys think is going to be the growing opportunity here.

**Michael Lucarelli:** I would say, if you look at business today, the vast majority is not government really. Think of the guys out there. Telesat, Viasat, Boeing, those type of a guys. Not necessarily government, our GEO satellites aren't government related.

And if look forward, yeah, a lot of the growth will be from the emerging guys who are more commercial based, less government. But at the same time, the government is putting more and more money into space. So again, it goes back to what I said earlier. It doesn't matter who's launching the space system, whether it's the government, the disruptors, the traditional guys, it will be ADI content going up into space.

**Bryan Goldstein:** Yeah, just to add a little bit to that. It is a broad-based business. We have no single customer that's more than 10%. So we have a lot of customers.

And it is a mix of government. And not only do we leverage the work that we do in the comms commercial market and bring it to space and military, but we're able to take our investments from the military side and leverage it into the commercial markets, as well. So we develop technology for some of

our military work and some of our military customers, that we are able to then leverage and commercialize.

**Mitch Steves:** OK, that's helpful. And just one last one just for me just to clarify something else. You had talked about the lumpiness of the business. Do you think that going to be more due to the emerging players or the legacy players?

**Bryan Goldstein:** I would say it currently is the legacy. Viasat launches a satellite, Boeing launches a satellite, we launch GPS satellites. They go up once every couple of years.

And so there's an order. And then there's a delay in orders and a pause. And then there's another order. So it can be very lumpy now. But as the volumes are going up in these LEO constellations, we don't see them buying all the material all in one shot. We start to see more of a linearization of the orders.

**Mitch Steves:** OK, that's helpful. Then we got another question from the audience here just trying to clarify something. So when we talk about the sales growth over the next five years, how much is it going to be pure chip sales versus IP? Meaning, is the sales growth driven by unit volume or is it more increasing content of the LEO satellites?

**Bryan Goldstein:** So let me make sure I understood the question. So first off, we don't sell IP. We sell products. We sell semiconductors, and we sell hardware that includes semiconductors. And so our revenue will all be volume based on semiconductor and then integrated modules and subsystems, which is all hardware that we design and manufacture ourselves. And so as volumes go up, our revenue will go up due to hardware content.

**Mitch Steves:** I don't want to put words in his mouth. But I think what he's driving at is, is the demand just entirely unit based or is it because when you guys do new IP blocks or improve the software or the IP associated with it, that it drives a cycle? Or is it just basically straight sales and just units of whatever people are building satellites that's the main driver?

**Michael Lucarelli:** I'll answer a bit of it. And then I'll pass it to Bryan to talk more about the technology. It's both.

If you compare GEO to LEO, the content's lower. If you compare old LEOs to new LEOs or LEO communication, there's new content within that LEO communication satellite. It's still much lower than GEO because it has to be. You wouldn't be able to launch a thousand GEOs a year, from a content perspective. I'll pass it to Bryan to talk about the new technology going into LEOs, like phased array and beam forming in RF.

**Bryan Goldstein:** In the current GEO satellites, we are leaders in RF microwave and linear precision technologies. The LEO satellites are opening up brand new SAM for us. Because of the lower reliability and radiation requirements, we're able to bring some of our advanced technologies, like 28 nanometer silicon. We're able to bring in the form of high-speed converters and transformers, as well as these a phased array antennas bringing thousands and thousands of beam former chips, as well as amplifiers. So it's enabling new technologies from our portfolio that we've never sold into space. So that opens brand new SAM, as well as brand new products that are needed in a new application, like phased array.

**Mitch Steves:** OK, that's very helpful. And then I'm going to ask a little bit of a broader question for you, Bryan, here. When we think about the defense budget, you were talking about that was very high under the Trump administration. So do you think that there's going to be any change, either positive or negative, on the overall business, both space and defense, if you can comment, in terms of any sector, that it's going to get better or worse? Or do you think it's going to be very similar to what we saw in the last four years?

**Bryan Goldstein:** I think over the last four years, we've seen a dramatic increase in the budget. I think that we are going to see-- as they're about to pass a budget now-- we're starting to see a flattening of the budget. Which for us, we're happy with that. Because even though the budget is flattening, they're continuing to increase their investments in the electronic content, the digitization of the battlefield. And so they're investing more where we're playing, even though the budgets may be flattening.

The other thing that's interesting is, we had a concern that COVID could have an impact on defense spending, with more money needing to go to back up budgets for the money being spent on supporting people due to COVID. But we haven't seen that yet. We're seeing it perhaps a bit more in Europe.

But the fact is, the world is still a very dangerous place. And so the governments have all proven that they will continue to spend money when they need to spend money to protect. And that's what we're seeing right now.

**Mitch Steves:** Perfect. Just another one from the audience here. There's a 10x content opportunity, as you were talking about LEOs versus the GEO side. So why is the SAM 1% that of the GEO side? Just trying to understand what the dynamic there is.

**Michael Lucarelli:** I'm not sure where you got the 10x number from. I guess we're not being clear. There's, let's say, 10 launches a year in GEO. There are thousands a year in LEOs. So there's a lot more going up.

But the line below that on the slide, there's a lot less dollars per LEO. Why? Bryan went through it.

You can't put up that many GEOs, that much cost, the time to market, the design cycle. It has to be up in the air for 20 years versus three to seven years. So the dollars per satellite, whether it's a GEO versus LEO comm is much lower. There's a lot more volume.

And at the same time, if you look just specifically at the LEOs, we talked about, there is additional content going into LEOs, but still below GEOs because of what we said. It's not radiation hardened, it doesn't need you up there for 20 years, and the cadence is much longer than GEOs. That's how you get to the 4x. It's a volume and new SAM expansion within the LEO satellite.

**Bryan Goldstein:** Yeah. And just to be clear, the products that we sell into LEO are not the exact same products that we sell into GEO. They don't have the same life reliability or radiation tolerance. So there's this new category of products that we have created that are a very different price point than the GEO content. But they're also much, much higher in volume. So there's a trade off in price per unit versus the reliability and environmental requirements, which is much lower for LEO, again, made up by the huge volumes.

**Mitch Steves:** OK, understood. Very helpful. And then I'm going to switch gears here a bit and ask you something that's a little bit easier and more longer term. So if we think about the space business, you talked about the internet connectivity. But there's talk about space tourism, Virgin Galactic is an example, travel exploration. We've heard about all these other new avenues. Can you maybe talk about what you guys see in the future in terms of not just your content gain but how that market evolves?

**Bryan Goldstein:** Right. Thank you. At this point in terms of space tourism and travel, the volumes just aren't there yet. This is brand new stuff. And so we're following it, we're paying attention. But there's nothing there yet for us.

But we could see a world-- you could imagine a world where a company like Virgin Galactic, which is flying and taking tourists into space, could change the travel industry. Where instead of buying a ticket from a traditional airline you buy one from Virgin Galactic. And you can get where you're going much faster, for instance.

And we see that really providing upside to our avionics portion of the business. But again, it's really early days for that. And as far as other applications, really anything that goes up into space is in our wheelhouse. They use our components that require different levels of environmental screening. And we have the capabilities and portfolio to deliver on the toughest challenges our customers face. And so as new broad opportunities come up, we'll be there talking to our customers about how we can provide solutions.

**Mitch Steves:** Then another one I had that will give you a good feel for the people who are on the call. A lot of guys cover a lot of the defense space, as well. So could you maybe walk us through a typical deal win for you guys. What is the lead time here?

How long are these contracts? I know that it is a very sticky business. You guys probably have a lot of visibility, particularly for selling millions of dollars worth of content to a specific item. So maybe could you walk us through who you work with closely, components, any sort of shortages that you may be concerned about, or products that may be concerned about in the supply chain? Maybe walk us through a deal from day one to the time of finish.

**Bryan Goldstein:** Yeah. Thank you. It's a very interesting topic because I'm sure historically, people thought about, you wanted to buy from Analog Devices, you went to our catalog, you went to our website, you went to our distributor. But these developments are a lot like that.

These are very specialized, special components and brand-new architectures. And so they're being developed sometimes around products that aren't even released yet. So a customer approaches Analog Devices with an idea and works with us at the architectural level. And it can take several years while we co-engineer a solution for what they're trying to accomplish.

And so it could take several years from initial contact to the first volume orders. But absolutely, because we have this tight relationship and the qualification and screenings that are required, the work and the designs that we do are very, very sticky in this relationship. The products are often custom. And when they're not, the screening might be custom. And certainly, the architectures can be very custom.

We are finding the design cycles are shortening as customers are wanting to get to market faster. And the market is demanding it, including the military and government customers. And this trend is good for Analog because we're enabling them to move faster by doing more, by taking technologies from other markets, like communication, and we're able to provide a robust catalog and non-catalog solutions.

Customers are trying to rationalize their supply base. They want to work with less suppliers. And only a handful have the breadth and depth of knowledge and products that we have.

**Mitch Steves:** Perfect. And then just a follow up there, a small one here. Can you talk about the supply chain then in the US and some of the changes we're hearing about, bringing manufacturing to the US and what that global supply chain looks like? What are the bigger bottlenecks for you guys? And what kind of problems are you guys trying to solve on the supply chain side, if any?

**Bryan Goldstein:** That's a great question. So our supply chain in aerospace and defense very much mirrors what we do on the commercial side. So we have foundries that are worldwide. We have packaging sources that are worldwide.

A lot of the work we do for the military is able to use commercial products off the shelf. There are other applications that require higher levels of security, perhaps ITAR, perhaps onshore manufacturing is required. So we have to deal with that when it's required.

And we're very cognizant. The government is asking more and more. They've been asking for onshore manufacturing for a very long time. I believe that they're starting to get very serious about it. And they're starting to put some money into it because that's what's required.

Commercial players like Analog Devices have to be competitive in the commercial market. And a lot of commercial players don't work very hard in the aerospace and defense because it is a boundary that's difficult to span. But we do it.

And it's very fruitful, as we've described. Being able to balance between commercial and aerospace and defense is very valuable to us. So we span that and we understand it. And so we're working with our government customers to understand what it is that they're trying to accomplish in the US. And we're on board to supporting them.

**Mitch Steves:** OK, perfect. So you've outlined a pretty bullish view of the next five years, doubling the revenue, et cetera. So maybe I can ask in a different way, just to keep the conversation balanced here. What's your biggest concern or the biggest problem you're trying to solve that would derail the story? Obviously,

You don't want that to happen. But what in your mind is the biggest bottleneck or biggest issue you guys have to solve over the next five years to hit all your watermarks?

**Bryan Goldstein:** Yeah, I understand. So first off, the demand is certainly there. We're working with a lot of the major players in this market. This growing demand for high speed data transmission is there. And space, at it's now price point, as SpaceX is starting to prove, these satellites are going up into orbit.

20, 30 years ago, when you talked about things like Teledesic, there were similar dreams. But now satellites are actually getting into space now. And so we're seeing the business opportunity there. The satellites are at least going up at this point.

On the competition side, we take our competition very seriously. But we think we're in a very unique position. So we think we're in good shape there.

We think we're in good shape in terms of our portfolio, our expertise, our manufacturing, and then the integration that we provide. But to answer your question directly, the biggest risk we think is our customers' business model that needs to be proven. Like I said, Teledesic, Globalstar, Iridium, similar business models. Some of them survived, some of them didn't. I don't think any of them really became what they dreamed that they were going to become.

And so that's the biggest risk, is whether our customers' business models prove successful. Some of them will get birds up into the air. SpaceX is first. Other are right behind them.

But will the business model be sustainable? Will we get those upgrades? Will we get those next generation satellites launched? Will we meet the volumes that we are projecting and that they're projecting? That's the biggest risk, I'd say, operator business model needs to be proven.

**Mitch Steves:** OK, perfect. And then you talked about high level customers. I don't want you to get into detail, customers or ASPs or anything like that. So instead maybe I can ask you like this.

Is your business primarily all domestic? Or are we seeing these trends about LEO and GEO satellites globally? ADI is a very large company now. I'm just curious about all the revenue is concentrated to just the United States, or if you guys are seeing this move to LEO and GEO satellites across multiple geographies?

**Bryan Goldstein:** This trend is absolutely global. We are seeing growth across all of our regions in this area. US, Europe, Asia all showing the same trend.

We're probably getting more military investment from the US side. That's driving some of our development work. But on the commercial side of this trend, absolutely worldwide.

**Mitch Steves:** OK. And then one more. Maybe you'll shut me down on this one, which is totally fine, Bryan. When I look at that five-year outlook of doubling, how much do you think is going to be new design wins versus existing ones you already see? Is there any direction you can provide on that?

**Bryan Goldstein:** Let me answer it this way. And then Mike can jump in if I've gotten too specific or not specific enough.

Our current business will continue to grow. And it's going to grow in the low to, I'd say, the mid-single digit numbers, the current stuff. Like I said, that's a lot of GEO stuff, a lot of historical stuff will continue to grow.

But the LEO stuff is a big part of what's driving the exponential growth that we're going to start to see. We have design wins already that are starting over the next year going into full production. But we have

multiple design ins, which is how we design, that we've been designed into a slot but hasn't gone to full production yet. We have some of those as well. I'll let Mike, if he wants to add anything to that.

**Michael Lucarelli:** Bryan did a good job. I would say, he was coached well on what to say and what not to say.

**Mitch Steves:** OK, perfect. That's a pretty good overview there. Then maybe you could just touch and COVID really quick. I realize I probably should have asked it earlier.

I do think we need to do another update there. You're seeing a lot of different changes, shutdowns, and all that. And you guys already been through it.

So maybe just talk us through what happened in the past. If you can just give us an idea of what changed for your business. How you guys mitigated it? Whether it helped or negatively impacted demand, all that stuff? Just what happened to your specific business over the last 12 months or so.

**Bryan Goldstein:** I understand. Thank you. So first off, ADI is considered part of critical infrastructure in the US. And because we're critical infrastructure, we never closed down. We never shut down completely during the COVID situation. But we had regions that had travel problems and couldn't go into the offices, and things.

So we had to do some special things to get people back to work as quickly as possible. For instance, in the Far East, we had people that were living in hotels and living in the factory because they couldn't travel around the country as much. So we did some interesting, unique things to keep our business going.

So in all, the underlying trend absolutely did not change. We did see some delays from our customers as they were shutting down in different regions of the world. But like I said, underlying trends have not changed.

And perhaps some of them have even accelerated given the boom in mobile data demand, which is brought on by people having to work from home. So perhaps some delays. But in general, we're talking months at the most of what we've seen in changing our business.

**Mitch Steves:** Understood. I said that's a good overview. Then I wanted to ask you a technical one because you've got a good handle on all of this. So when we think about the space industry-- and it relates specifically to your business, to Analog-- what's the main technical hurdle you guys are trying to overcome? And what is the main technical hurdle you have overcome that's allowing you to see market share gains?

I realized a lot of people get focused on the numbers too much sometimes. So I'm just curious about both those items. Both what issue you guys are trying to solve now and what you guys have solved it in the past that allows you to enter this market?

**Bryan Goldstein:** Yeah, thank you. So first off, the space environment is a very, very challenging environment. Not only is it very hot. But it also gets very, very cold. And so we have to deal with both sides of that.

There's also cosmic radiation that can not only degrade performance but could also actually damage the electronics. And so we understand all of these environmental challenges. And we understand them all the way down to the molecular level. So we're able to start at the semiconductor level to solve these challenges.

Another challenge is making our products more efficient and lower power. Because these batteries that are required to power them in space or solar arrays, can only be such a size in such a weight. So we need to make products smaller, lower weight, as well as more power efficient.

We understand the effects of radiation on all of our foundry processes. And we're able to develop products and solutions that can withstand the harshest environments. So while this is a very difficult challenge on the semiconductor side, we have the ability to overcome these challenges for our customers, given our understanding as well as our ability to environmentally screen and guarantee our products when we ship them.

Historically, costs have been the gating factor as well to the adoption of high-volume space products because of all the reliability screening that would be required quality-wise would make the products very expensive. But the reduced environmental requirements have allowed us to create a new family of products that are able to balance cost and quality and reliability screening required for this next generation of products. So those are some of the challenges. So again, environmental performance, thermal, as well as cost are all challenges that we believe that we've done a good job of tackling for our customers.

**Mitch Steves:** OK, perfect. I think I'll ask one last one and then leave it to you to make some closing comments about the space opportunity. But we've you've a lot about just all the LEO and GEO satellites. Are there any connectivity points in the ground related to space that you guys are going to have content in in the future, i.e., is there some ground opportunity that we should be aware of? Or is it all primarily going to be LEO and GEO satellites?

**Bryan Goldstein:** No, absolutely. Ground systems are absolutely part of our strategy in connecting to these satellites. Within Analog Devices, the ground terminals lie within our Communications division.

And so while we have similar customers, not all the customers are the same. But absolutely, they are also taking advantage of our knowledge on the space side and our relationships. And they're also absolutely taking 5G communication technologies and bringing them into the earth-based terminals.

I didn't touch on much of that. But absolutely, that's going to grow in parallel to the space side.

**Mitch Steves:** OK, perfect. Thanks for that overview. Give any closing remarks that either you or Mike want to make just in terms of space.

**Bryan Goldstein:** I'll go and then I'll let Mike go. I just want to thank you for the opportunity to talk about this business. I hope you can tell that it is very exciting to me and it is a passion of mine. And I am very deeply engaged in the technology as well as the business aspect. So thank you for the time to get to talk about this.

But when I say that we're confident-- and Mike will tell you-- our confidence is high. I'm known for doing what we say we're going to do. And so we're going to double this business and our confidence is high. And so I'll end there and I'll let Mike comment, as well.

**Michael Lucarelli:** Thanks, Bryan. Thanks, Mitch. Bryan's right. Bryan is an honest guy. He's a straight shooter. He likes to under promise and over deliver. So I'm excited about the Space opportunity.

And overall, Bryan's business, aerospace and defense, is a great market for ADI. We have a really good strong position that's growing nicely in good times and in bad times.

I'll stop there. I'll say, thanks, everyone, for joining the webcast. You know how to reach me if you any questions. And happy holidays to everyone.

[End]