Bipartisan Policy Center

# Overview of the Low Earth Orbit Satellite Industry

## Introduction

00:01 – 00:44
*Tom Romanoff- Director of the Technology Project, Bipartisan Policy Center*
Hello and welcome to our second video on low Earth orbiting satellites. LEOs for short. Today we're going to go over the basics of LEO satellites for folks that are interested because the technology is exploding. There's going to be thousands of LEOs or constellations deployed in the near future, and the federal government is starting to react. The FCC has established a Space Bureau and International Affairs Office to help tackle some of these policy questions. And so today we are joined by a panel of experts, some of the leading experts that can discuss for a non-technical audience what LEOs are and why they have such a big impact coming.

## Let's Meet Our Experts

*00:57 – 01:17*
*Dr. Jon Peha- Engineering and Public Policy Professor, Carnegie Mellon University*
I'm John Peha. I'm a professor of electrical engineering and public policy at Carnegie Mellon University. I previously served at the Federal Communications Commission as the Chief Technologist, in the White House Office of Science and Technology Policy, in the House Energy and Commerce Committee, and in industry as a CTO.

*01:18 – 01:32*
*John Barentine- Executive Officer and Principal Consultant, Dark Sky Consulting, LLC*
My name is John Barentine. I am an astronomer and principal consultant at Dark Sky Consulting, LLC, and I work on issues of light pollution and satellite interference with astronomy observations.

*01:32 – 01:58*
*Robert Feierbach- President, Maritime Launch Services*
My name is Robert Feierbach. I've been in the space industry for roughly 30 years, working with all the big satellite operators worldwide. I'm president of Maritime Launch Services in Washington, DC. It's the affiliate of a Canadian spaceport that we're building in Nova Scotia right now, that we're fully licensed to start construction. And I'm also CEO of a new aerospace startup called 0-G Launch.

*01:58 – 02:21*
*Mike O'Rielly- Strategic Advisor & Advocate, MPORielly*
Well, thanks so much for having me, I'm Michael O'Rielly. I have my own consulting firm, but prior to that, I spent seven years as an FCC commissioner. And before that, I had a long career as a policymaker on Capitol Hill, as a staff in the U.S. Senate and on the U.S. House of Representatives.

## The Technology Basics

### Can you tell us how satellites impact our daily lives?

*02:24 – 02:57*
*Dr. Jon Peha— Engineering and Public Policy Professor, Carnegie Mellon University*
Satellites are a valuable communications method, particularly if you want to go, you know, across an ocean. They provide us navigation capabilities. I couldn't find my way, you know, to my neighbor now without GPS. They provide ability to monitor the Earth, to predict Earth hurricanes and weather prediction. They provide timing information that makes all sorts of infrastructure work, like our power grids.

*02:57 – 03:*
*Mike O'Rielly— Strategic Advisor & Advocate, MPORielly*
Satellites are so important for the daily lives of Americans and globally. Both the commercial side and the non-commercial side. From depicting weather and analyzing different data points that are put forward for terrain and topography and all kinds of measurements that are used on the non-commercial side. And then on the commercial side, we use them for video, we use them for broadband, we use them for voice telephony. They're so vital into the daily lives that people may not realize.

### What are LEO satellites and what differentiates them from other satellites?

03:34 – 05:02
*Robert Feierbach— President, Maritime Launch Services*
There are two main categories. Of course, there are more, but there are two main categories of satellites. The LEO is the low Earth orbit satellites that are typically around anywhere from 500 kilometers, 400-500 kilometers, to a couple thousand kilometers of altitude. The much larger and much older technology satellites are called the geostationary satellites, the GEOs, and those are at 36,000 kilometers, much, much further away. Naturally, they orbit the Earth much slower than the LEO satellites. So, LEO satellites are smaller in size. They obviously rotate the Earth much, much quicker. But they can revisit the Earth on a very, very repeated basis, roughly every 90 minutes or so. So when you build a LEO satellite to do something for you, for communications or for Internet or for even Earth observation, you have to typically launch several satellites to build out what we call a small constellation to give you the equivalent coverage that you would have from a further away satellite, a GEO satellite, that is more of a school bus satellite, school bus-sized satellite, that remains stationary vis-à-vis the rotation of the earth. So you don't have to move your antennas or you don't have to be tracking it. And so that's the main difference is size and the mass of the satellites and obviously the amount of satellites you have to put together to give that service and provide a service to the customer.

## Applications

### What are the applications of LEO satellites?

*05:13 – 05:48*
*Mike O'Rielly— Strategic Advisor & Advocate, MPORielly*
Well we're going to see them in all kinds of life, our daily life activities. You know, right now they're mostly being used or they're trying to develop the marketplace for broadband communications. But

that gets into all different other things, whether it be delivery of video, delivery of voice, all kind of go into that cornucopia of services because of their capabilities and the capacity they're able to provide new communications that weren't ever available in a lot of locations, whether it be in the United States or globally.

### How does broadband from a LEOs compare to other broadband sources?

*05:48 – 06:52*
*John Barentine— Executive Officer and Principal Consultant, Dark Sky Consulting, LLC*
The efficacy of doing satellite broadband from LEO varies a bit depending upon the details and the service provider. Our main point of reference right now, about the only extensive broadband network in LEO, is the SpaceX StarLink constellation, which now has a few thousand satellites. It is, I would say, competitive with ground-based broadband through sources like wireless 5G communications or optical fiber, but it can't quite achieve the same sort of speeds we can get on the ground. So I think the target for this kind of application nowadays is people who live generally in more rural or isolated areas where a wireless option or fiber really isn't there yet. But if you live in a city, at least right now, it's hard to imagine that the speeds that satellites in LEO can achieve would really be competitive with those more terrestrial means of serving Internet.

## Production, Operation, and Costs

### Who makes LEO satellites and how are they made?

*07:02 – 08:27*
*Robert Feierbach— President, Maritime Launch Services*
LEOs come in all shapes and sizes, in fact. They can be as small as a shoebox, let's say. That's what we call roughly a 3U satellite. And those could be built almost in your garage. A lot of those are the type of satellites that are built by universities, for example. When students in aerospace are building their very, very first units to test and launch into space. And then they can go to sizes that are more commonly around the, you know, dorm refrigerator size or a little bit bigger than that. And those will be much more capable, have larger batteries. So those are being built by several companies around the world. I would say two thirds of all satellites are being built in the United States by a couple hundred companies now that have joined the LEO space industry because there's so much innovation and it's become cheaper to launch. And then, I guess the other one third of the satellites are being built around the world, in Europe and elsewhere as well. But it really has covered the globe now. And you see companies that are not your typical governments that used to launch and build satellites. The big growth in our industry today is being propelled by the commercial space industry. And there are thousands of companies today bringing this industry to a trillion dollar industry in the next ten years.

### When are LEOs fully operational in space?

*08:31 – 09:14*
*John Barentine— Executive Officer and Principal Consultant, Dark Sky Consulting, LLC*
The time between fabrication and deployment in space has come down significantly to the point where some operators are looking at quite literally only a matter of a few weeks. So we go from parts on a bench to a functioning satellite in space in a span of perhaps 8 to 10 weeks, which is what is enabling the launch pace to increase at the rate that it has. But of course, that doesn't take into

account the run up time that involves prototyping and testing, which can be several years. Once you enter that mass production phase, the time delay between fabrication and launch is now very short.

### How are LEO satellites operated and maintained in space?

09:17 – 10:55
*Robert Feierbach— President, Maritime Launch Services*
That's an important aspect of any satellite that you launch in space. But there are differences between LEOs and GEOs as well. The LEO satellites are small, as I said. Not all of them by regulation are required to have any kind of propulsive maneuvering capability. So that means that once they're launched and they're released by the deployer of the rocket, they're basically just floating in space until slowly but surely they come in and then start degrading their orbits and come and burn up in the atmosphere, depending on the altitudes you're in, of course. But regulatorily, we're not forced to have the operators have those maneuvering capabilities which bring some issues there in terms of being able to move out of the way if there's any kind of expected collision with anything else. Most of the operators now are realizing that's not the way to build a satellite. And so they're building some sort of maneuvering capability, be it electric propulsion or be that chemical propulsion to be able to maneuver and get out of the way and at the end of the life to deorbit your system as well. But regulatorily, we're not forced to do that. In the GEO space, in the geostationary space, however, that is a requirement that you can't get a license to launch a satellite unless you have propulsive capabilities to put it into graveyard orbit at the end of its life. That's the main difference between the bigger, bigger satellites in GEO and of course, our very, very buoyant activity that's happening in LEO today. But we do need a little bit more of a rules of the road, I think, to be able to have some requirements there so that it doesn't become the Wild West out there.

## Orbits and Spectrum

### How much space do LEO satellites take up and are there concerns about collisions?

*11:04 – 11:43*
*Mike O'Rielly— Strategic Advisor & Advocate, MPORielly*
Well, there's definitely concern about what is the impact of, could a fleet - can satellites collide and what is the ramifications for that? Does it leave debris? Does it muddy the field for future launches and other, you know, other fleets going forward? So absolutely a concern for policymakers. One of the top priorities of the last administration, this administration, trying to figure out how do you balance the right debris policy to make sure that it doesn't interfere with a dynamic launch and new services, but also make sure that it maintains the capabilities in space for not just commercial satellite services, but also exploration, and NASA and services along those lines.

### What is the electromagnetic spectrum?

*11:50 – 12:36*
*Dr. Jon Peha— Engineering and Public Policy Professor, Carnegie Mellon University*
So any kind of wireless communication, television, cellular, Wi-Fi, and satellites requires use of electromagnetic spectrum. And when multiple systems use the same spectrum, there is a possibility that they will interfere with each other. And the more LEO satellites we're putting up, all of which or many of which were sharing the same spectrum bands, the greater the risk is that they will interfere with each other and that they will interfere with existing systems like geosynchronous

satellites. So this is going to be a very important issue going forward, particularly as more and more satellite constellations and more and more satellites are put into space.

## Conclusion

### How might LEO satellites change in the coming decades?

*12:37 – 14:41*
*John Barentine— Executive Officer and Principal Consultant, Dark Sky Consulting, LLC*
In the next few decades. I think we are going to see things approach a tipping point very rapidly, and that has to do with the unanswered question of how many LEO satellites can there possibly be? How dense can we pack that space with satellites and the debris that they produce without setting off a chain reaction of collisions that generates so much debris that it effectively closes that space? And that's a worry not only for the continued use of LEO but even being able to move through it. If we want to send humans to the moon, for example, or beyond, they have to transit through the LEO belt. And if the debris is so dense that they can't safely do that, it really changes what the near-term future use of space might be. So we've got to have a conversation about how to better manage this from a sort of traffic perspective. They need to become more autonomous and maneuverable for that reason. And their main competition right now is really from those ground-based broadband networks, from 5G and 6G and its future successors in wireless and faster optical fiber links on the ground. I think there is room for all of these technologies to coexist, and there's probably even a solution to the debris problem in space. But I also think that that means we're going to have to rethink the way we do a lot of things now and come up with some new approaches or else we're destined to repeat some of the history of technology in the past where we really rushed into new technologies before we understood them fully.

**Thank you for joining us. Stay tuned for our third video in our series on LEO satellites.**