



## Episode 59 – New Launch and Propulsion Technologies, Intersatellite Links and Market Consolidation to Redefine SmallSats

Guest: Leena Pivovarova, Analyst, Northern Sky Research– 18 minutes

John: Welcome to constellations the podcast from Kratos. My name is John Gilroy. I'll be your moderator. Today our guest is Leena Pivovarova. She's an analyst and consultant from NSR, and we're recording this live from the floor of the SmallSat Conference in lovely downtown Logan, Utah. All kinds of different space people here, small satellite people, military folks, people from Australia. It's a real fun conference here and maybe you'll get a chance to come down there.

During this particular episode, we'll talk about new developments and strategies in the smallsat industry with emphasis on new launch and propulsion technologies and how ground systems have to adapt to support mega constellations. Today we have Leena Pivovarova, analyst at NSR. We've mentioned that earlier. And she's been at the forefront of small set launch and new space industries since 2013.

So it's only appropriate that she's at the small set conference. We're pleased to have you with us today. The smallsat industry has been experiencing rapid growth. The expansion of this conference just being one indicator, there's thousands of people here. So Leena, do you expect to see a consolidation in the market? What do you see is going on?

Leena: Thanks for having me today, John. So when speaking about smallsats, we should probably define that, as there's various definitions within the industry. The definition that NSR uses is any satellite below 500 kilograms. So with that, we're seeing increasing competition in both launch and marketing services. That's leading to some sort of consolidation and M&As in the market. Some of that is already happening. So there's I wouldn't say that there's a trend, but there's definitely some indicators in the market already.

So talking about launch first, there are many new actors of all sizes coming to market. So we're talking heavy launch vehicles. We're talking small light launchers, smallsat launchers, dedicated ones. And so one of the examples of M&A in the market is strategic partnerships and investments like what we saw with Lockheed Ventures investing in Able Space Technologies, which is a small startup that is developing a light launcher, which is really, really cool.

And then moving on to the manufacturing segment, same kind of a trend there. There is increasing competition and we're seeing a lot of actors across the

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smallsat industry bringing their manufacturing in house, which results in increased competition overall.

And so the other thing that's really important to note here is that the business cases are not as clear cut or stable as they used to be. So they're starting to employ new methods. So we saw, I believe it was late 2018 with Boeing purchasing Millennium Engineering. So that's another good indicator of consolidation in the market. But it's also important to talk about the motivation for the consolidation that we're expecting to see in the market and already seeing.

So, for example, on one side, established actors, like in this case Lockheed or Boeing want to get involved in newer verticals of cutting edge technologies that they may not have been involved in before, by acquiring a new startup or company on the forefront of those verticals.

And so it's easier to do this not organically, but by already having a foot in the door with the kind of a scrappy startup situation.

John: I've got three kids who are in their 20s and we argue a lot about everything under the sun. And I use this phrase, "There's a difference without a distinction," or a distinction without a difference. So when it comes to terminology with smallsats, cubesat, nanosat, are these really worth differentiating between or is this just proprietary that a company makes and wants to call, no, this is a nanosat, or are there actually categories?

Leena: Well, I think in our business it really is important to differentiate because there are so many different trends that you can kind of cut the data through and see ... I mean lots of people are interested in specifically cubesats and the evolution of that. Other folks that are interested in kind of bigger satellites and other orbits and so it really depends.

John: Four days ago, I was sitting in Long Beach eating fish tacos. Great, by the way. And there's a big manufacturing presence in there with some of the large manufacturers, space manufacturers. Are there geographic locations either nationally or internationally where these satellites are starting to be made or trending to be made?

Leena: That's a very interesting question. I know I can speak specifically in the United States. I think Seattle is a pretty big hub there. It's got a lot of space presence, I think. Of course there's also Silicon Valley. LA is another really big hotspot. We see smallsats and launch vehicles being headquartered there. And also of course Florida. The Cape is rising again.

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John: There's a surprising segment in Atlanta. I mean it's spread out differently. But some areas you think would be natural, but Atlanta isn't but it seems to be there. Manufacture and launch, if I understand it, are experiencing the largest growth of all these segments. Do you see that continuing and how do you see the market playing out with respect to heavier rockets and the emergence of small launch vehicles?

Leena: That's a really, really good question. So there is going to be a large scale turnover over the next couple of years. We're actually already seeing the start of it now on the heavier vehicle side. So we're seeing traditional and kind of already established launcher actors kind of phasing out their veteran workhorse vehicles gradually over the next couple of years. And also replacing them gradually with new upgraded systems. So for example, that would be Ariane 5 is being slowly and gradually replaced by Ariane 6. We're seeing new vehicles like Northrop Grumman's Omega, another heavy launcher. ULA's Vulcan's coming into market, also. Quite a bit of them. So that's the heavier side.

And now more on the small launch vehicles, we're seeing that there is also a huge push of new actors. As you know, I think I was at a presentation earlier today that cited I think 138 new launch vehicles all over the world,.

John: Graph that. It's a hockey stick.

Leena: Oh yes. Yeah. In various stages of development that are coming to market and of course they're all competing. We also know that SpaceX announced their new ride share program yesterday, too, which is very, very exciting. So I think all of that points to the fact that, yeah, we're seeing a huge proliferation of smallsats. There's definitely demand. The question is, is there enough demand? It's all made possible because of the growth and success of smallsats and related technologies specifically on the dedicated small launcher side. If we are talking long-term, though, I think most of the new actors will not survive.

Obviously there's over a hundred. What's interesting to note, though, is that dedicated smallsat launch vehicles will not be used for the constellations. The large scale deployments of constellations for the most part. For the most part. It's hard to generalize, of course.

John: Earlier I mentioned Long Beach, let's go to the other side, go to the Atlantic. I was in Washington, DC, about three weeks ago. I was at a Space Foundation workshop on cybersecurity. And I tell you if I had a transcript, I'd have every other word would be China. It was like I was just ... I mean is there any other country out there to worry about China, China, China? And look at hardware. China has launched a rocket from a sea platform. Are there advantages for commercial or government sea launch versus traditional land based platforms?

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Leena:

I think the reason why you're hearing about China so much is that China has ramped up their launch cadence quite a bit over the last couple of years. And just to be clear, though, China is not the first to launch a rocket from a sea platform. I've seen that before with Sea Launch, which has now been sold to I think a Russian group called S7. But yes, so there are many, many advantages to launching from the sea. I mean, the biggest really drawback of launching from the traditional kind of land-based platform is just being geographically confined to an area.

And so then you're limited to a specific range of orbits that you can launch into. And so if you have a mobile platform that you can literally move to wherever you need to hit a specific orbit, I think that gives you that flexibility. Also being geographically confined can lead to some schedule delays, as well. Scarce resources and all of that. So now if we're talking about the customer side ... So for the commercial side, being not limited to specific orbit I think is really, really important.

But for governments, the biggest advantage that's the most actually attractive is more of having the ability to launch stealthily or more stealthily than before. And so currently right now, if you're launching from land, basically everybody can see what you're doing, you're rolling it out to the launchpad, you kind of can make some assumptions of what you're launching, what orbit, etc, etc, so on. And so having that mobility, I think increases the flexibility of launch. And we're seeing that as kind of a new trend perpetuated by the smallsat dedicated launch vehicle industry.

John:

You've published a lot of articles for being a young person. I mean it's really tribute to your hard work. And you've written that long-term growth will depend on government support as well as legal and regulatory requirements coming together to facilitate market expansion. Now this is true for railroads and agriculture, everything else. So explain to our listeners here what coming together means from a smallsat perspective.

Leena:

One of my favorite topics. I think it's important to note that everyone, and everyone in the industry would agree actually, that this is a really highly regulated industry. And so, sure, governments play a role of regulators, but that's not the only thing that they do. The role of governments now is regulatory. They're also participants, customers, enablers, facilitators. So really all actors are really, really intertwined in space. And so market expansion benefits all. And because of this, there really must be alignment and government support, which includes having supporting regulations that enable, instead of kind of stifle innovation. And so I'll bring back the example of China. The reason why China has been able to accelerate their development is because of they ... Rather, lowering regulatory barriers to facilitate technology transfer

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between their military and commercial sectors and so they were able to accelerate the rate a whole bunch.

John: That's interesting. Let's go from regulation to application. Earth observation has been the most notable and successful small set application. I'm beginning to hear more and more buzz about in or on orbit servicing like refueling and life extension and salvage. Do these represent some of the newer applications?

Leena: I think that's definitely a very hot topic in the industry, as well. What we're going to be seeing by end of year is Northrop Grumman's launch of their first mission. It's called MEV1. They're going to be servicing an Intelsat satellite and Geo. However, both of those are not smallsats. But there are other actors who are trying to get into the space as well. There is Effective Space who will be utilizing the smallsat form factor to serve as other satellites and they're looking at life extension and other things.

John: Leena, thousands of people from all over the world are listening to this podcast. I know. A few people come up to me at the show and tell me. If you are listening and like to get email alerts when new episodes are available, go to Google, type in Constellations Podcast and you'll come up with a site and click on Kratos and give us your email and we'll send you off announcements maybe when you're on as a guest again, so who knows.

So I want you to put on your technology hat now. Take off the government hat and your application hat and put on technology hat. One of the problems that I see with smallsats is without internal propulsion capability, they can't move. And that means new propulsion systems have to come online. Is that true? And what's new and is available in the propulsion area?

Leena: That's true for the most part. And I think developing propulsive capability is really another one of those enabling technologies that are going to unlock a lot of new capabilities for smallsats. So we're seeing a trend of smallsats kind of moving to Geo whereas they used to be more confined to the lower orbits. There also are restraints on smallsats specifically that are propulsion.

So there will be easier kind of maneuverability, faster reaction times, and that will enable a lot of different interesting, cool things. And so also having to put less propellant on the bus itself. You're not as constrained by volume anymore, you're able to utilize more payload space. And so add more capabilities for that as well.

John: In DC, there's an acronym and it's called SME, subject matter expert. And I know you're not a subject matter expert on ground systems but I want to get your perspective because you're pretty well rounded and you're kind of up with

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what's going on with this. When you look at mega constellations like OneWeb and SpaceX, what impact do you think they'll have on ground systems operations?

Leena: Sure, so that's a really good question. And the ground segment is very, very important, as you noted, to support the operations in space. It also makes up a really big part of the CapEx for all constellations. And so OneWeb and SpaceX, I believe they're first generation stats are not going to have intersatellite links. So they're very, very important to build out the ground infrastructure all over the world. So this means at least higher costs and higher cutbacks at least initially. Later on, of course, it will probably as technology develops, the prices will go down, but still it's a big deal and it's something that's needed as well.

John: Now this is the Constellations podcast. We've probably interviewed 50 or 60 people, and we've done a couple of interviews on phased array antennas and different types of antenna technology. And we see a lot of innovation even in that. Do you think they'll have an impact on smallsats?

Leena: Yes, absolutely.

John: Leena, let's assume at least one of the proposed major constellations is successful. What impact will they have on large satellite operators?

Leena: That's a very good question. Although it's very difficult to answer. It's hard to generalize, again, about all constellations. Each situation is unique, just like basically everywhere in the industry. But I think for the most part they will complement larger satellite operators for the most part. I actually don't believe that Geos are going to go away for sure, but cannibalization of certain revenue streams will occur eventually, somewhat.

An interesting trend that we're seeing is operators beginning to trend towards using kind of hybrid architectures, which are bigger birds in Geo using others. So having satellites in different orbits and working together. So complementary. An example of this is JSAT and Hispasat and strategic partnerships with LeoSat and things like that. So use of hybrid architectures allows them to kind of hedge their bet, somewhat. And that's a good thing, too.

John: I have a friend named Claude whose son may not be able to go to Mars because of space debris blocking any kind of satellites from going on. And so we got debris out there, we got the risks of collision today. All of a sudden we're increasing the number of satellites because of smallsats. These are increasing a lot of standard industry concerns, isn't it?

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Leena: Yes, there is concern. This is another hot topic right now. I believe you heard Greg Wyler in his opening keynote talk about being a good space operator and talking about sustainability as well. And so there are companies that are within the space situational awareness space, SSA company, but they do need some support of the government. There are a lot of actors across the industry that believe that this is more of a later problem, not a now problem.

And there's not very much right now that's motivating them to update what they're using now for space situational awareness. And this is another one of those examples where we talk about the industry needs to come together and really support each other, where other stakeholders may need to incentivize satellite operators to rely on these other new methods. And there's definitely a need for that.

John: Leena, you've been here a couple days. I think you've gone to a lot of booths. You've heard the keynote, you've heard a lot of presentations here, and maybe you're able to take a look at and get a handle on where this is going to project out in the next four or five years. Maybe where are the opportunities and where are the pitfalls? I mean we could have an event where there's been a lot of trouble coming up in the future. So looking down the road, challenges and opportunities and pitfalls, what do you see?

Leena: I think I'm very, very biased. My love is launch, so I'll constantly be keeping my eyes on the development of the new dedicated smallsat launchers, lighter launchers, just rockets in general. But there are other emerging applications that I find very, very exciting and very thrilling. And I think they are opportunities. One we mentioned is in-orbit servicing, and specifically sophisticated robotic manipulation. The capability of that is not currently mature enough. But it's still a little bit farther out, but I think that one is something to look out for.

Another really good application is, or rather software defined capabilities. I think that's very, very exciting and has a lot of potential. Intersatellite links and more efficient use of spectrum capabilities. A sign of optical communications and things like that. And so those are just some, but there are many exciting things coming in the industry.

John: Well, Leena, unfortunately, we are running out of time. I'd like to thank our guest, Leena Pivovarova, analyst and consultant at NSR.