



Transcript: Day 3 - September 11, 2020

KEYNOTE FROM NOBU OKADA, FOUNDER & CEO OF ASTROSCALE

- Introduced by Ian Christensen, Director of Private Sector Programs
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IAN: I have the honor and pleasure to introduce Nobu Okada-san, who is the CEO and founder of Astroscale. Astroscale was founded in 2013 to respond to the growing need to address space debris as a business, business opportunity and business challenge. I had the pleasure to work with Nobu and his team in a variety of contexts over the last several years. And I always enjoy those interactions and their contributions very much so with that, I'm gonna turn it over to Nobu. Nobu is here to tell us about Astroscale's approach to the space sustainability ecosystem. Nobu-san, over to you.

NOBU: Thank you. I'm Nobu Okada, founder and CEO of Astroscale. So thank you for inviting me. Thank you, Secure World Foundation, to this critical dialogue on space sustainability. Over the last two days there have been variable discussions on space sustainability from a civil, commercial, and military angle, on anything from astronomy, behavior, space forces, remediation, cislunar and incentives. I am equally impressed, but not surprised, that the topic of sustainability touches so many segments of the space ecosystem.

So sustainability--it is an overused word from agriculture to transport to fashion to, even tuna. But when we apply to space, what does it really mean? For me, it's net positive. Click next, please. So it's from--it's net positive. It's not about stopping the development in space.

It's not about adding cost to operators. It's not just about considering the future generations and doing the right things. It's a net positive in market size, it's a net positive in accessibility, net positive in risk management, and it touches so many areas. So let me be clear on what net positive exactly means. Next.

Whether here on earth, in LEO, in GEO, cislunar orbit or on the moon itself, space sustainability ecosystem is a future where we have on orbit servicing, such as--next--active debris removal. Next. Life extension. Next. Refueling. Next. Orbit transfers. Next. In space situational awareness and inspection. Next. And manufacturing. Next. End of life. So it's a future servicing holistically represent a sustainable ecosystem for Earth's orbit and beyond. Next please.

We can change industry from--with culture to, uh, to space sustainability ecosystem by expanding the value chain with the advancement of RPO technologies and putting in the right set of regulations and incentives. So far, we have been in a throwaway culture, by doing just R&D, AAV, launch, and

operate. But by adding maintenance and disposal, the space industry can be on the same level as the automobile industry, shipping industry and aviation industry. The automobile industry doubled by creating the automotive aftermarket.

It could reduce the lifetime cost for the owners and reduce the traffic accident risks. And in the end, the automobile industry could expand their users and utilities. So why not do the same in space? To make it a reality, we need reliable RPO technologies for both controlled and uncontrolled objects in space and the right set of regulations. The waste culture, waste culture market size is 108 billion US dollars per year. It's not too--it's too early to say how big the space sustainability ecosystem market could become, but there is clear value in lowering lifetime costs for operators and reducing the risks. Next.

So what Astroscale does, Astroscale has over 140 employees across five countries. We were, as Ian said, we were founded seven years, 7.5--half years ago with a vision to secure the safe and sustainable development of space for the benefit of the future generations. And we are also the only company solely dedicated to on orbit servicing across all orbits. We're supporting the function of a vibrant, sustainable future in space. Technically, we are developing missions of end of life services, active debris removal, and into space situational awareness and end of life extensions.

We're soon going to launch ELSA-d and later on address J and the legs, and we will start these services within a couple of years. Um, next. So let me show the ConOps video of ELSA-d in the--demonstration. Sorry for, uh, these sounds. We will bring the service side and client together, and we'll separate the client first. We will capture you have, ah, capture testing without tumbling first.

The servicer uses a magnetic docking mechanism while the client has a fellow magnetic plate. Second demonstration will separate with tumbling. So this is more realistic capture, more dynamic. Our servicer will monitor the client satellite and then identify the rotation motion. And the servicer will synchronize the rotation rate. It's a quite unique motion. And alignment and we capture them.

The third demonstration will separate the target, separate the client and we'll lose it. We start from the searching mode. We use a very unique trajectory to safely approach the client. And, uh, after capturing we will demonstrate the de-orbit. And then we'll bring them down to the atmosphere in a burn and then complete re-entry. Sorry, it was a bit noisy music and then the video was not smooth enough.

But so we have a flight model there, and we're just waiting for shipment and we're going to launch from Soyuz rocket in Kazakhstan soon. And then so we're not just focus on developing--so these RPO technologies will cut across whole services, like use for other services too, like active debris removal and life extension and then in situ SSA. And then--but we're not just focused on developing the technology. In a business sense, we have attracted smart investors, and we got plenty of funding to get off the--get off the ground. We raised more than 140 million US dollars so far and we're expecting more.

And also, we are forging a new path in business concepts for in orbit servicing as well. We have, uh, ELSA-d is developed by ourselves, but now we have multiple contract and then, uh, we have some funding in the customers. And in the policy sense, this is where our global presence pays off.

We have the opportunity to be a voice in international, domestic industry, NGO, or local and public dialogue. We believe in the power of industry best practices, and we're proud members of CONFERS, ESOA, CSSMA, and Space Safety Coalition and some other groups in the world. Um, this the last-- this is the last slide. So, this is the steps toward net positive space sustainability ecosystem.

And then we have more but we try to make this kind of concise. The first, let's improve SSA. Let's share data to the extent we can, like positional data and maneuver plans and also ensure your spacecraft can be tracked and being tracked and uniquely identified. And then without monitoring, without properly measuring, we cannot have a proper track control. And avoid collision.

Let's be maneuverable and use propulsion or other techniques to avoid collisions without, with trackable objects. Let's de-orbit at the end of life. As we see the hot topic about the post mission disposal rate in the MSP or FCC we're expected to higher the PMD rate. And then everybody, every satellite should have their own de-orbit mechanism, but prepare for the unexpected and design spacecraft for--to be captured in the end when, if something occurs.

And then, if you cannot deorbit by yourself, let's please use a backup de-orbit plan, which we provide. Remove critical debris--I'm not sure how many people read the recent article, but international group identified the top 50 most critical object in space to be removed, and this is a great step. And I know Japan and Europe have initiatives for these large object debris removal. And also yesterday, NASA administrator mentioned that, you know, we should, they should incentivize remediation.

So, thanks to this conference I really hope removing critical objects will become big trend in the world soon. And finally, let's advocate for safe and sustainable space environment. And to policymakers, regulators, and legislators, and new customers, colleagues we know problem, we know problem, you know. And then the space sustainability is a net positive.

So let's switch to the net positive and extend the market and sustainability. And to do that, we need to continue advocating. That's a brief explanation of Astroscale. And then we--I'm happy to answer any questions. Thank you.

IAN: Thank you, Nobu. We do have--we do have a number of very interesting questions. I think you've done a good job of getting the audience interested and engaged and advocating that message that you delivered so I appreciate that.

And the first question, actually, is very much picking up on the last point you were making about how we advocate for space sustainability and for addressing these objects that we know we need to remove to improve the sustainability of the domain. And for those of you that are monitoring,

we just shared the link to the Top 50 Objects article that Nobu just mentioned in the chat. So you can read that at your leisure.

So the question, Nobu, is picking up on what you were just talking about. One of the big challenges that we have is convincing governments to step up and commit resources to space sustainability. So you mentioned pilot programs in the European Space Agency has done and that the Japanese government has done. Do you have any recommendations, or further recommendations, on how we can add--or really effectively communicate, as a community, advocate to those governments to step up and continue to build out on those sorts of, sorts of, programs?

NOBU: My answer is very simple: There's no silver bullet for this. There's no magic for this. So what I have done is just fly, get there, meet and talk and tell. So people--and so now regulators can understand space sustainability issue, but they do not understand how urgent it is. So we shared continuing educating them. I think that the only way, the shortest cut to, uh, incent a regression toward a more favorable to space sustainability.

IAN: Thank you. And, um so I'm gonna ask a follow on to that question: You obviously, and you mentioned in your talk, you've developed a set of investors that are interested in the work that Astroscale are doing, is doing, and see the value in this opportunity from a business standpoint. Is there any similarity in the, um, value concept that you present in investor discussions to the advocacy message that you would take to governments?

NOBU: Um, the--so the investors invest in us because they believe in there will be the market later. But so first we have to convince them there is problem. So if issue is not clear, it's very hard for them to invest. So the issue is clear. The question is, how long it takes? You know, it takes 30 years or five years, three years. And so, uh, what I did, I showed the plan. I showed the plan, there's the plan. And then what is the world trend. And then--but, for example, for those who I met two years ago, they didn't believe. They see the proliferation of the discussion of the space sustainability in the world. And then, oh I see. So now people are really taking care of the space sustainability. So now they decide to invest in us. So it takes time to convince them. But you know, the--again, in the end, it's the belief, you know, how long it takes. But there's a difference among the business acceptance level.

IAN: Thank you for that. So one of my beliefs is that, as we advocate as a community for space sustainability and to address the challenges that Astroscale and others are trying to, when convincing government it helps to have multiple stakeholder groups that are interested in the topic so that governments are not just hearing about it from operators. They're not just hearing about it from businesses like Astroscale. They're not just hearing from Secure World Foundation. But if investors become interested, if end users become interested, it helps make that--make that case in the long term, and it is a pathway that's going to take a little bit of time.

So we now have a set of questions that I'm going to try and address that ask about the government role in early phase, early stages of the business and how you transition from government role to private, more private driven markets. So, question from Peter B de Selding: Nobu, would you agree

that for active debris removal to become a business, it will require a large amount of government funding to jump start it? Or can the private sector take the lead?

NOBU: So my belief is a polluter pays money. Polluters should pay for the money. You know, the existing debris, most of them, were littered by the government, so they should pay. And then so going forward, most of the debris might come from constellations, so they have to pay.

And then the--But the question is how much they need, right? I mean, once they understand the importance of debris removal their next question, how much they have to pay? And if it takes, for example, 500 million to remove one debris, it's gonna be a, you know, the big number in the end. But if it takes 50 million or 30 million to remove one debris, and then if we have to remove only 50 or even only 200, you know, they can, they can calculate, you know? And then you know it's not unlimited.

It is--there's a certain number of the money. And then if we split among the key like-minded countries, how much they have to pay, then they digest and then they feel like, okay, it's feasible, feasible. So I think now that the stages are still early. But Europe and Japan already decided to kind of fund developing the technologies for large, large object removal, and I hope US will come soon. So I think once technologies include, like what we saw in fueling, um, you know, fueling destroyed the ozone layer and until alternative fueling comes to the world, the world couldn't do it--couldn't do anything but once alternative fueling comes they quickly change their mind and created agreement across the world. So I think that once we prove the technology, the world will, you know, move forward.

IAN: All right. Thank you. And so polluter must pay and focusing on governments since it's an initial case because it's the historic objects and I think most of the objects on that top 50 list are government legacy objects. But you also mentioned the large constellations that are coming in...and so we have a question from the audience: Have you had conversations with those large constellation operators about their interest in designing their satellites to be potentially removable at end of life?

NOBU: Yes, so we're talking with various large constellations and so there kind of understanding of a responsible manner is different. For example, OneWeb they announced to mount the docking place to be captured later. And then there is a magnetic plate there so that this is compatible with our ELSA satellite. So, uh, they're prepared for the failure. So it is just one case, but we're also talking with the other constellations too. So I think the understanding is, um, getting better and better.

IAN: Thank you for that. So we have about 10 minutes left and more questions than we're probably going to be able to get to, so thank you to the audience for submitting lots of lots of good questions.

I'm gonna try and move through some in rapid fire here. So Nobu, I want to shift to the legal and policy side of things. You mentioned that is an area of emphasis for Astroscale and your involvement in industry best practice groups and working with governments on the regulatory questions. So the question we have, is a legal obligation to remove debris, which is currently not something that we

have in place, essential for your business? Do you need international action to enable, um, legal removal of debris to make your, to make your plan close?

NOBU: Uh, legal action. So, for example, look, look at the Japanese government. They're discussing, you know, there are a certain level of the--certain number of the large object in space, and then the question whether Japanese government needs a kind of law to remove them, it's not. As long as they have an action plan. That's fine. And then, uh, if we--even if we, you know, kind of experiment with a kind of coalition to like-minded countries, I don't think that kind of a law is needed or treaty, just as long as they agree on actions. That's good enough. I hope I'm answering the question.

IAN: I think it, I think it begins to answer it, yeah. I mean, it's--the international conversation on this topic will continue right? And it's--as national governments make action that will contribute to the larger international conversations... But now a couple of technical questions about the ELSA-d mission and video that you presented. So we have a, we have a question, a couple questions, about the third demo step, the spiral trajectory as you're hunting: What is the purpose of that and are there any concerns about, um, power availability from the solar panels during those maneuvers or connections to the TT and C links?

NOBU: So the--I guess a multiple angle. But that trajectory is to avoid any unexpected collision. So even if we, our servicer, go abnormally defunct during the searching mode, we will not--kind of passively avoid collision.

IAN: So it's a safety mitigation step, it's part of the--part of the vision and design. Okay, alright.

NOBU: And then since as you said, it was something like, have a very unique motion. It's really hard to manage power budget. It's true. And also communication budget too. So but we found, we found a way, how to solve this.

IAN: You are aware of these issues and the mission designing, and you're looking at that and have a plan to mitigate it. So, appreciate that. Um, okay, five minutes or so left....so we've been talking about the active debris removal part of the business. But recently Astroscale made an acquisition of Effective Space in the UK and moved into the satellite life extension market. So, how does that relate to the ADR work that you're doing and is the service plan, the business plan for the life extension, is it similar to what Space Logistics is doing with the mission extension vehicle?

NOBU: So first of all, the Space Logistics demo was great. I think it opened the door for its services, so I really appreciate that. And then, uh, the--so it was--acquiring Effective Space Solutions technology IP was not new stuff for us. We discussed for a long time. And then, actually there--it is, again, RPO technology, rendezvous and proximity operations technology, which we can have a synergy together. And then--so over the next 15 years, 475 satellites will be retired and not just some of them, many of them need life extension. So, uh, there will be the market. And there is a clear economic reasons for that.

IAN: Okay. Thank you. Short one, is Astroscale looking into recycling orbital debris in the future?

NOBU: So good question, because when we talk about environmental technologies it always start with reduce reuse, recycle, right? Three R's. I believe we can--that we're doing the reduce, reduce the debris and then reduce the launch by life extension. And then we want to move to reuse by having the refueling capability in space and in a midterm.

But at the question of recycling, we're not yet started the feasibility study yet, but we definitely want to double check whether recycling can be done in space.

IAN: All right. Thank you for that. All right, so we are coming to the end here. I'm just looking, looking through the questions one more time. So now I think the last question, that I wanted to ask you is one that that's looking towards the future. So you've outlined the business case. You've outlined the vision, and you've shown us the demonstration mission that is hopefully launching very soon, right. You mentioned you're looking at that life extension and the importance that Space Logistics had that first demonstration mission--commercial demonstration mission as successful. What is the biggest milestone that you're looking for in terms of showing that active debris removal is a viable business case, a viable commercial opportunity going forward?

NOBU: I have--yeah, thank you. I have a clear milestone, by 2030 I want to make on-orbit servicing as just routine work. Not--as kind of a very normal generic service in space. So it happens every day. Like--if you throw the garbage on the road, the garbage truck will pick up, right? The same thing. It's a kind of AAA on the highway. If there's a defunct car, AAA will tow it. So same, same in space. And to do that, we have only 10 years. It is very, very short. So if we kind of try, you know, come up with action to do to achieve there, there's so many things that we're planning to develop larger entity, large facility to be able to manufacture multiple satellites. So there are lots of things, and so we're quite busy right now.

IAN: 2030 as a milestone for routine on orbit servicing--I think we would all love to have routine on orbit servicing available and a robust ecosystem of actors providing and utilizing those services. So I will, I will hold you to that deadline Nobu-san, and we will--we will work through that as a community to help you and your industry colleagues get there. So with that we're coming to the end of our keynote slot here. I, want to convey my thanks to Nobu for his time at a very late hour in, uh, Japan--

NOBU: Still barely Friday, one minute to go.

IAN: We'll let Nobu get to his Saturday on time. Thank you Nobu, for your presentation and for your vision. And we do appreciate Astroscale's support of this summit and support of our community overall.

NOBU: Thank you very much for the great three days. Thank you very much. Appreciate it. Bye.