



Event Transcript: Summit for Sustainability
Summit Panel: The Promise and Challenges of New Actors in Space
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Krystal Wilson: Next up, our very first panel is going to be led by Mr. Ian Christensen from Secure World Foundation. This is a panel on the promise and challenge of new actors in space. Ian, I'll turn it over to you.

Ian Christensen: Thank you, Krystal. If I could get the other three panels for this discussion to join us on stage and we can get things started.

As Krystal said, I am Ian Christensen. I am the Director of Private Sector Programs for Secure World Foundation, which means in the scope of what Secure World does, I focus primarily on our engagement with the private sector on norms of behavior, responsible operations, and evolving the policy and regulatory landscape to enable commercial space development.

Excellent, everybody is here. One of the things that we heard about throughout the Spotlight talks this morning was the rate of change that we're seeing in the space community and space sector today. We're seeing new actors, both from a commercial sense and a governmental sense, and we're seeing the innovation and applications that those new actors deliver change or change very rapidly.

The diversity and complexity of actors in the space domain is increasing. This entails new applications, new business models, and new services, as well as new investors and new regulators and new policymakers. It brings new opportunities for cooperation and for economic and societal benefit.

Yet at the same time, it poses us challenges for coordination in the use of the environment, maintaining the stability of the space domain, and in policy and regulatory efficiency and effectiveness to enable benefit and provide common frameworks.

Many more countries are developing national space programs, national law and policy, while commercial companies are leveraging cheaper and better technologies to do more with less, and to do it more rapidly.

What are the benefits of this surge in new actors, and what should we all be wary of? What steps can the world take to ensure that the new actors are contributing to space sustainability? These are the broad themes that we want to discuss throughout the course of the next hour or so.

With that, I want to introduce my panel, because they're the ones that have the really interesting things to say, not myself.

Working across the stage from my left to the right, so from the right side from your perspective, first, we have Mr. Jim Armor, who is the director of government relations for Northrop Grumman Corporation, and vice president for government services for Space Logistics, LLC. Space Logistics is developing mission extension and on-orbit servicing capabilities.

Prior to his current role, Jim served a long career in the Air Force in a variety of space leadership and staff positions. Next to Jim, we have Ms. Simonetta di Pippo, who is the director of the United Nations Office for Outer Space Affairs, UNOOSA. Prior to taking that post in 2014, Simonetta has served as director of human spaceflight at the European Space Agency, and in several senior roles at the Italian Space Agency.

Next to Simonetta is Mr. Kalpak Gude, who is general counsel and head of global regulatory for Swarm Technologies, which is developing a constellation of very small satellites to provide Internet of Things, connectivity, and applications. Previously Kalpak served as president of the Dynamic Spectrum Alliance, as a vice president in OneWeb, and as an assistant bureau chief at the FCC Federal Communications Commission.

Next to Kalpak is Raje Rajogopalan, who is a distinguished fellow and head of a nuclear and space policy initiative at the Observer Research Foundation in India. Prior to joining ORF, Raje served as an assistant director in India's National Security Council Secretariat.

At the very end of the table, Mr. Mark Mozena is senior director of government affairs at Planet, which is a satellite remote sensing company, providing daily imaging of the earth. Prior to joining Planet, Mark worked for United Launch Alliance, handling civil space portfolio, and government relations with NASA, NOAA, and the FAA.

The way this panel will work is, again, I have about an hour. I have a set of opening questions that I will ask each of the panelists to address, to give their opening perspectives on our topic, and then I have some questions for the group. We'll move into Q&A after that, for the audience, again, using Slido portfolio or platform that we did before.

With that, I'll transition on over to the first question, which is for Raje. Raje, the subject of our panel is new actors in space. What in your viewpoint or experience. makes an organization or entity a new actor? Is it simply level of experience, or is it more nuanced than that?

Rajeswari Pillai Rajogopalan: Thank you, Ian. At the outset, let me thank the organizers of the Secure World Foundation, for inviting me here and giving me this opportunity to share some thoughts on this panel on new actors in space. I think there are a lot of different prospects, and at the same time, you also have certain challenges.

I think one of the first things is, how do you define new actors in space? I think you'll put it very rightly, it's the level of expertise, the number of years they have been operating the space program, or what is it makes them a new actor in space, or it's something more nuanced?

I would say I would tend to go along with the view that it's something more nuanced than just the level of experience, and so on and so forth. If you want us talking about industry and the commercial sector, I think it's somewhat easier to define who a new actor is because it's most of the new companies that are coming up are typically called the new actors in space.

When it comes to states, I think what determines who is a new space actor, it's a little more problematic in that sense. Here, I would go back to looking at, which are those traditional state-space players? I think there are two or three major players, the US, Russia, and Europe to some extent.

Therefore I would go beyond that to look at even countries like India and China as emerging players, not because they haven't operated in the space. They have been in the space domain for five, six decades and so on and so forth.

I think when you look at the kind of programs that they're pursuing, the kind of activities that they're engaged in today, they are creating new dynamics to both space security and space sustainability dynamics.

That actually makes them somewhat a relatively new actor in creating, making them what they do in outer space has a lot more relevance today than what they had done even until a few years ago and as a [indecipherable 6:59] ago. Therefore, I think that's the way to look at.

I think the new space domain is going to change in many big ways than one would assume. I think it's just not the presence of new space companies or the startup companies that you're going to see, but also there are a number of different countries that are beginning to pursue space for a lot of different missions, for a lot of different utilities.

A lot of the countries in the African context or the Latin American context are beginning to just appreciate how, what are the different ways and space can be utilized for a number of developmental missions and so on and so forth, so the number of countries that are going to pursue space programs in the coming days are going to increase rapidly.

You also have states in Asia, whether it is in the Middle Eastern context or in the Asia Pacific context, who are actually approaching space from a lot more national security, security-driven kind of agenda in a sense. I think this is played out so much in the Middle Eastern context and, to some extent, in the Asia Pacific, Southeast Asia countries.

Today morning, Rogel talked about the Southeast Asian programs or the ASEAN states.

There is some relevance from a climate change and whole lot of environmental perspective, but I think there's a huge dimension of the security-related dynamics that come into play also in the outer space domain.

I think the entry of new space actors is very difficult to clearly define and categorize, but I think this is going to be an important dynamics because many different countries are entering this domain with varied missions and functions that they are attributing to.

Ian: Thank you for that, Raje. I think there were some themes in there that we'll probably come back to, and I would expect maybe to see reference in a couple of the other opening comments here.

My next question is for Mark there. Mark, you at Planet operate what is currently the largest single group of satellites operating in orbit today. The CubeSat form back there, which I believe you'll be able to demonstrate for us, it offers a number of advantages in cost and pace of innovation, pace of development.

At the same time, there have been concerns about the risks that the increased use of constellations and small satellites might pose to the sustainability of the space domain. What lessons has Planet taken away from your operations experience at this nexus?

Mark Mozena: Sure. Good morning. Good morning, [indecipherable 9:28] . Yep, 20 more minutes. I brought a prop...

[laughter]

Mark: ...because why not? This is an actual model of one of our satellites. We have 150 of them in orbit. 10 percent of the current operational satellites in LEO are ours, and they orbit the entire planet. These image the whole world every day.

This is just one example of how commercial companies are venturing, more than dipping their toe and completely dived in headfirst into realms of space that were only for government actors until very recently. Imaging the entire planet at medium resolution and then follow up with high resolution can now be done and sold around the world.

As an early adopter, as we move forward and we hear from companies in this room and other companies around the world and they talk about constellations in the hundreds, in the thousands, in the tens of thousands, we get a little nervous. We design our constellation to fully deorbit itself after a few years when they decommission.

Satellites are designed to be up there for about five years operational. Then a couple years later they will all burn up in the atmosphere. They're at about 500 kilometers, so 300 miles. We use friction against them. They sail right in and then down they go. We think that's the responsible thing to do. There's a particular orbit we're interested in. It's very valuable to us.

If we start polluting that orbit and leaving space debris up there we won't be able to use it in the future. When we hear about these constellations in the tens of thousands and we don't have a current paradigm around the world in which you have to be a good actor, in which you can be an irresponsible actor, that makes us nervous.

You couple that with ASAT tests, which apparently is back in flavor. That makes us very nervous as well. We had the last ASAT test, the most recent one was by India. They told the world it was a head-on hit. It was not. It came from below. It knocked pieces way up, well past our orbits, even crossing the Space Station orbit.

We got a conjunction warning a few days later that there was a piece of that debris coming within one of our satellites to 30 meters. That's 100 feet. We're like, "Oh wow. That's close." The air bar was a kilometer. That's useless.

[laughter]

Mark: We sat and waited to see if the blip went away from the communication. It didn't. I guess we missed.

If we're going to move forward into a world where it's not just state actors but, in fact, commercial actors are setting the tone and are the dominant actors in space, at least in certain orbits, then we need to, as a community, very soon develop the regulations, develop the best practices, develop the norms, and develop a paradigm in which we're preserving the environment up there.

Space is not that big, at least the space that we are operating in. We will very quickly pollute it to the point of beyond effective use.

Ian: Thank you. I appreciate the point that we need to develop the norms and the regulations as we've heard already, a major motivation for us convening this event today. As we move through the panels over the next day and a half here, we'll be collecting ideas for norms. We'll be discussing this towards the end of the session tomorrow. Appreciate that pointer there, Mark.

The next question is for Kalpak. Swarm, your company, is implementing a business and service plan based on a combination of several novel factors. Very small satellites, constellation architectures, and non-traditional customer targets outside of the space sector.

In your conversations with both potential customers and potential regulators, what have you found to be the most challenging in explaining that approach?

Kalpak Gude: Let's see. Let me tell you a little bit about Swarm before we jump into answering those questions directly. Swarm's plan is to launch 150 very, very small quarter-U satellites. If a 1-U satellite is 10 centimeters cubed, this is 10 centimeters by 10 centimeters by 2-and-a-half centimeters, roughly. We think that that profile itself is enormously valuable.

It's enormously valuable from a commercial perspective because the costs of manufacturing and the costs of deployment drop precipitously with the reduction in the size of the spacecraft. What we have also seen is, because we have antennas that extend in both directions out from that satellite -- they're one-meter-long antennas in each direction -- the trackability of those satellites is very, very good.

It's well, well in excess of a 1-U spacecraft, multiples of that. From a trackability perspective, we feel very comfortable in terms of the safety of our launching these spacecraft into orbit. From a value proposition -- to get back to your question of customers -- customers are incredibly excited about a application that will deliver low-cost IoT services.

This is one of those areas for satellite services that's incredibly important. I know this conference is talking a lot about the risk of new actors and new entities coming into the marketplace absolutely rightly. As others on the panel have said and others before have said, incredibly important to keep the environment safe for all of us to operate.

It is equally important to remember that it's great to keep the environment safe but we need to keep innovating in a manner that the space technology is delivering value to customers. I can tell you from a communications perspective. What we have seen is real challenges for satellites and satellite services to remain relevant in the area of communications.

You're seeing this in the GEO side. Incredible struggles in the economics of delivering services using GEOs. Even as they move to high-throughput satellites, the economics are very challenging. As you move to the LEOs, particularly on the broadband side, again very interesting but the economics there are challenging.

The costs of those constellations come in at \$5 to \$10 billion. The time horizon for launching and deploying into these constellations is many, many years from design to implementation. All of that create real challenges. The technology, frankly, in many of these systems is yet to be developed, particularly the antenna technology on the ground.

What we look at from a Swarm perspective is, we have satellites that are about as big as your hand. 150 of them provide near-continuous coverage around the world. Obviously, we're not trying to compare ourselves to the big LEO systems that are going to be providing broadband. It's a different application.

When you bring the cost structure down as dramatically as we believe we have, it really creates an opportunity for new verticals, new customer sets to look at satellite technology in a way that they never did. Satellite technology, frankly, I've been in the industry for many, many years.

The first thing you do is when you talk to a customer out there, first response that you get is, "Satellites, great but expensive." That is the common refrain, the common understanding that you start with whether it's regulators or customers.

Getting people to think about satellite technology differently is the game-changer from our perspective. Quickly, getting into the issue of orbital debris and space management, we think it is incredibly important. Let us be analytical in terms of our approach to solutions.

Let's not take the viewpoint that all assets in space are the same and provide the same degree of risk. Risk can vary based on the size of the object. Risk can vary based on the orbital altitude that you are launching into.

We think using the analytics to determine what that risk is and managing accordingly. Best practices we think are incredibly important. We think governments should be setting the standards in terms of what objectives you want but allowing the marketplace to drive the proper solution.

The solutions are going to continue to innovate as we go forward. What we don't want I think is an environment where we have somewhat static regulations in terms of the how-to as well as static in terms of the results that we're trying to achieve. That's the future that we should be looking towards and working to.

Ian: Thank you, Kalpak, for reminding us that the reason we want to manage and care about the risks in the space environment is so that we can all benefit from the applications that provides us. That is the two sides of a space sustainability coin if you will is both managing the stability of the environment and providing benefit from our use of it. Appreciate that.

Jim, next one is to you. One of the Northrop predecessor companies, Orbital, was sometimes described as the original new space company. How can large, established companies like Northrop leverage opportunities provided by the growing community of new space actors, both new countries and new companies? How sustainable is that growth in the new space sector?

Jim Armor: Thanks for the question, Ian. Good to be here.

I want to start by complimenting Peter Martinez for unleashing Krystal to pull this space sustainability conference together. I think it's a really valuable forum. I look forward to it proceeding in the future as well.

These are my own thoughts and not Northrop Grumman's, just for the record, Theresa, etc.

[laughter]

Jim: If I'd known we can bring form factors in here, I think the James Webb would fit in here nicely...

[laughter]

Jim: ...but probably not on the table.

Back to your question, the Pegasus commercial launch vehicle in the early '80s by David W. Thompson when he created Orbital Sciences could be looked at as that.

I will tell you in every little company, there's a spark. There's a little initiative, a new entrepreneur at the bottom of any company. After all, they do want to become big companies in the long run.

Even when I look inside Northrop Grumman, there's tons of little creative sparks that have evolved in history and grown together to do really big, exquisite things, like the TESS exoplanet explorer, like the resupply of the International Space Station with Cygnus, and like our own mission extension vehicle that we hope will scope out a new area, new market of satellite servicing.

Let me tell a little story because SpaceLogistics LLC is a wholly-owned subsidiary of Northrop Grumman. It was a little spark, a new company that actually we stood up as ViviSat. Some of you may remember this. A decade ago, I helped set up that company under ATK which was then merged with Orbital Sciences which then was bought by Northrop Grumman.

ViviSat died but it survived in the SpaceLogistics LLC because of Carissa Christensen. Where is she here? Is she still here or she departed? She did an analysis that gave us a vision of a market that was credible. I wanted to at least give her...She was the Tauri Group then. Now she's grown into the Bryce analysis group. There's another example of how these little sparks come together and grow.

Once you get the basic company, small, started, you fall into basic blocking and tackling. You've got to build your team. You've got to design and test your program. You've got to sign customers. You have got to build the financing. This is true of any company no matter what their size.

As you start to build this, you discover that policies and regulatory regimes, including those that apply to space sustainability, they make a difference in how you develop and how you raise money and which customers you talk to, etc.

We, as SpaceLogistics, as Northrop, are highly involved in all of the rule-making processes with all of our favorite government agencies, FCC, Department of Commerce, NOAA, Department of State on export controls, NOAA for remote sensing licenses. It goes on and on and on. We've found that working alone is necessary, but working as a team is better.

Aerospace Industry Association, Satellite Industry Association, Commercial Spaceflight Federation, we're not a member of that but there's all of these industry associations that help effect policies and regulatory regimes and now CONFERS, which Peter mentioned at the start of program, which has developed its own set of guiding principles for safe and effective operating, including long-term space sustainability.

I'd love to talk more about our guiding principles during the Q&A period. We think that maintaining a secure, safe environment is essential to the long-term success of our company. I will stop there and look forward to the Q&A period. Thanks, Ian.

Ian: Thank you, Jim. I've got some notes that we can come back to there as well. Appreciate that.

Last silly question before we move to a more profound discussion is for Simonetta. Simonetta, your office has a number of roles and responsibilities related to international cooperation in space activities

and in promoting the utilization of space technologies and applications for socioeconomic benefit, including serving as the secretariat for COPUOS.

As the private sector becomes more significant driver in today's space community, how can that private sector become more involved in the overall UN process?

Simonetta di Pippo: Thank you very much. That's quite an important question and would require a lot of time to answer. I'll try to be brief, at least in the first round.

Indeed, the Office for Outer Space Affairs started to look at the private sector -- but I would say, in general, to new actors, to new players in the field -- in a holistic manner since few years now.

We have been helped inside the system by the fact that, first of all, in September 2015, we got the 2030 Agenda for Sustainable Development. In particular, among the 17 sustainable development goals, I would like you to focus on SDG number 17, which is partnerships for the goals.

Which means that in a way, the 193 member states of the United Nations stimulated the system to work more and more with the private sector, with NGOs, with the academia, with the variety of stakeholders. Even if we were already on this path since a couple of years before 2015, still this helped us in going in the right direction.

On top of that, even if it was not mandatory to get the General Assembly resolution on that, we managed. In 2017, we decided it was really political. We the Office, we presented the idea of having the Office working more and more and being more and more engaged with the private sector. We got the General Assembly resolution supporting us on this, in particular, on the Access to Space for All initiative.

More in general, as I said, we've been endorsed toward more with the private sector, which doesn't mean that this is the only activities we do with new players, with new actors. In the last five years, more or less since I took up duty as the director of the Office, we moved from 76 to 92 member states in COPUOS.

As it was mentioned, three more states already asked for becoming members this year, which means that by the end of this year, we would be 95 in COPUOS which is more or less 25 percent increase in just five years. This is linked to a lot of different reasons.

One of the main reasons is that we are really trying to reach out all the potential players in the field because it's the right time to stimulate responsible behavior. In order to that, we need to have a bottom-up approach. The more we have all the players, all the stakeholders at the table, the more we can really together grow towards a real global let's say correct approach.

Last point, otherwise, as I said, I could talk 24 hours.

[laughter]

Simonetta: Don't worry.

[laughter]

Simonetta: Just a word on the Access to Space for All initiative which was officially launched in November last year even if it is the combination of a certain number of projects and initiatives which started several years ago. The point is that we realized that doing capacity building in the old manner is still valid, workshop, training courses, institutional capacity building missions, etc.

What was really needed was to support in particular developing and emerging countries in mastering hardware development, in being able to launch hardware in space. That's the reason why we started with this initiative with what we call a triangular approach. The Office for Outer Space Affairs is a sort of a broker. It's, let's say, the connection. We put together developed and developing countries.

In this way, for example, we helped Kenya to become a new space country, launching a satellite, deploying a satellite from the Kibo module on the ISS, thanks to this report that we got from GACSA. It's really a way of bringing more and more countries at the table. As I said, is a holistic approach.

Also looking, if I may just one second more, to the downstream sector, it was mentioned, probably it was Carissa again who mentioned, that you can have a manned, for example, Earth observation satellite in GNSS.

Most of the applications and services are developed by people around the world who have nothing to do with this infrastructure. This is the work we also do. We try to bring all the players at the table and educate them to use all the possible let's say space infrastructures and space-based data available. Thank you.

Ian: Thank you. I appreciate the remarks from all of the panelists. I have a couple of prepared questions. With apologies to my panel, I'm going to deviate from the prepared questions...

[laughter]

[crosstalk]

Ian: ...because you've already stimulated a better question in my mind. Apologies for that.

Rajeswari: That's fine.

Ian: Several of the panelists, both on this panel and in previous sessions, have remarked on the need and the time being right to develop norms and principles for responsible commercial and new space actor action in space.

Mark, you asked about norms and regulation. Kalpak, you mentioned government should set the standard but allow the markets to evolve in how that is implemented. Simonetta, you talked about a bottom-up being necessary.

As we look towards concrete action for developing principles and norms for responsible behavior, how do we balance voluntary commitments and regulatory action in developing those elements? Anybody want to take a stab at that? Raje, start?

Rajeswari: One of the challenges, that's part of the problem, in a sense, when new actors come in, I think they're also somewhat less bound by the rules that have been established prior to their entering the domain.

When you look at the outer space domain and the regimes that have guided the outer space activities so far, you have the Outer Space Treaty and other actual agreements. I'll give you a couple of instances.

One of the issues is how states in the recent years have tended to break the norm of not doing an anti-satellite test. You have 2007 and subsequently, you have had many more tests, but then those are called missile defense tests.

Most recently, you had India conducting an ASAT test. The tendency to move away from the norm of non-testing of ASAT and creating long-lasting debris and so on, that is getting diluted. That is one.

Second, you also are adding some of the other norms that might be getting diluted are in terms of how non-interference with other satellites, other space players' assets and so on, again potentially are...

Given the now growth in the counter-space capabilities, whether it is cyber, electronic warfare, and so on, that particular norm of non-interference in others' assets, is also going to be possibly diluted in the coming years. I think this is all driven by the larger geopolitical agenda of states.

While states do not want to, in turn, go into war, it was kind of strange in the first panel when we had the Spotlight speakers. When the question was asked, other than Jana, anybody else thought that there was going to be a problem in space about the potential conflict in space, none of them thought any. One of the panelists said that she's more worried about the terrestrial conflicts than the potential conflict in space.

My worry is that the terrestrial conflicts today are beginning to play out in outer space as well. That's where we need to work towards building certain norms, building norms of responsible behavior, building greater confidence in each other so that we don't get into these kind of...

TCBMs are a good place to start the transference in confidence-building measures to build great confidence in each other so that we don't go and disrupt, damage, and create interference, do interfere in other satellite's operations, and so on and so forth.

Jim: Let me try it from an industry point of view. In our workshop yesterday, we discussed that there really are de facto norms of behavior in space today based on outer space treaties, principles, and some of the other things that we discussed in the opening panel.

In general, I think industry, whether it be new startups or existing companies, are going to not deviate too much from that, but they're also not going to be deterred if there is no norm there. [laughs] They will press on and try and expand the market that they have envisioned.

In the satellite servicing case, we recognize that rendezvous proximity operations can be a little bit scary, if you will, to observers from the outside or just across the world.

We decided to be preemptive about setting norms of behavior and drafted our own guiding principles on transparency and responsible behavior ahead of time and said, "This is what we're going to hold our industry association commitment to."

That starts a dialog with the government rule-making process. Indeed, that's sort of what's happening. It's sort of an iterative process. I wanted to make sure that I got across that industry is not going to be deterred if there are no norms. They're going to press on and start to set their own standards.

Simonetta: From my standpoint, first of all, I need to mention that I heard that there are the Outer Space Treaty and the treaties on one side, and the guidelines, and then it's a voluntary commitment and on certain topics.

One point that is extremely important to notice is the fact that the Committee on the Peaceful Uses of Outer Space is taken all decisions by consensus. Sometimes, the process can sound a little bit long, and it is. The final result, for example, the great result of the '21 guidelines and the preamble on the long-term sustainability of outer space activities is a role model in terms of space diplomacy.

It took time, but it's a very good result. All the member states will adhere to that because it's something which has been approved, as I said, in a lot of time -- a little bit of pain also. At the very end, they want to adhere to that because they committed word by word. Peter knows very well, word by word, and even comma and whatever.

The point is that we have a body, which is COPUOS. We have also the Office for the Outer Space Affairs, can be really helpful in them distributing the information and bringing new players to understand more, even, for example, how to report on their activities relevant to the long-term sustainability, and not only on the long-term sustainability. That's the first part.

The second part is that if we want to secure commercial space for the future, I don't believe that it would be proper to consider, let's say, to deviate from the treaties and the guidelines. It's in the interest of no one for doing that.

Otherwise, the space environment will not be safe and secure and not sustainable. Therefore, the commercial space activities will suffer. That's a technical evaluation of the situation.

Kalpak: I'll just add that, from our perspective, when we talk about commercial best practices, sometimes it has that connotation of this wishy-washy, aspirational, "Wouldn't it be nice, but no hard commitments." I don't think that's what we're saying here.

We think that, from the perspective, government has an important and critical role. I won't speak to government's own use of space assets. That's a very complicated, but a different realm in which governments really need to work together to figure out what their own rules of the road are going to be.

From a commercial perspective, I think government really does need to set the results that they are requiring for us to meet. Whether it's setting a number of years in orbit for our assets that are beyond useful life or something akin to that that says, "OK. Look, we want hard requirements, but we're going to let the best practices develop out there in industry of how you achieve those best practices."

We think that's critically important because all of this is innovating so rapidly. What you don't want is for specifics to be dictated of how you go about achieving those results. I think that's a way to find the right balance between the two, but let innovation continue to drive forward and improve the results.

I think that governments should look at continuing to improve those results over time, measuring that against the space environment as we see it, but also being analytical in the approach. Rather than getting caught up in the optics of how to make space safer, let's look at the real risks analytically, let's look at the numbers.

What types of satellites, what type of conjunctions, at what orbits? How do you do manage that from a numbers game is the right approach to driving the right answer, the most economic answer, but also the right answer that delivers the best results?

Mark: Just a brief little addition. I agree with a lot of what's being said. There's a definitely a strong role for government to play in setting norms through negotiation, government to government, and setting those best practices.

We are looking to grow our space community. We have a responsibility, as we grow that community among ourselves, to develop our culture such that we call out bad actions as a community when they

happen. I've got to say recently, with the ASAT tests, this community was relatively silent, which was very surprising.

Planet's founders had a response out in a number of hours. It was an awfully lonely space to have it out there. All it was was a condemnation of, "Let's try not to blow stuff up in space that then threaten everyone else." It was lonely for a long time.

This government, individuals had responses, and those individuals were called into the White House and told to pull down those responses. It's obviously a complicated situation, there's politics involved, but we are a community of commercial operators. We have a responsibility to set that tone.

We can help the best practices set by governments. We can help the treaties by actually setting a cultural tone of our community. When a bad action happens among our community, call it out.

Ian: For all that, it was a very stimulating discussion. We've got about 20 minutes here, and I do want to get to some of the questions from the room. A number of them are coming in over the Slido platform. Please continue to vote and submit there.

I'm going to attempt to combine a couple of the ones here that are up at the top. Hopefully, I get the intent in. If I don't, they're there for them, to be seen. This is primarily going to be for Kalpak and Mark. Then we'll see if there's any reaction from the other panelists.

Kalpak, your CEO has talked publicly about a certain situation you had with the FCC a while back. They received high visibility concerning a launch that occurred with some licensing issues, without a license, essentially. Did that issue traceback, essentially, to concerns about the trackability of satellites?

There's a question here. What lessons could be taken from that incident? Should operators consider, or how would operators react to discussion of a rule requiring certain trackability and identification aids. The second part of that question, maybe both Planet and Swarm might have a reaction to.

Kalpak: The first part I will say is it happened before I joined.

[laughter]

Kalpak: It may be why I joined. It was a learning experience for the company.

I will say that everything that I've done since joining, every intention by the management is to ensure that it doesn't happen again. I'm feeling very comfortable that the intention, the plans, and the systems that we're having in place will ensure that we are very responsible moving forward. I'm not going to make any excuses for what's happened in the past.

Having said that, with respect to trackability, absolutely. We think that is an important metric. It's one metric, but it's an important metric. How do we improve trackability, ensure trackability? The reality is that we think, as we've moved forward, we have been sensitive to the issue of trackability of these very small quarter-U sized spacecraft.

The spacecraft size itself is, we think, a unique and incredible advantage for us, and frankly, for our customers at the end of the day. It will help us deliver a service at a lower cost, will make accessibility to space technology available to many, many more people.

At the same time, we think given the actual design of the spacecraft, it is not just the body of the spacecraft itself that leads to trackability. The antennas provide a very large signature. We think, from a trackability perspective, in understanding trackability, you have to incorporate all of that.

Given that, what we have shown through data is that our spacecraft are very, very trackable. Getting back to your point on the broader scale, we think that is an important metric. You can't minimize risk against things you don't know are up there and can't find and see.

Again, it's important from the standpoint of also understanding what is the collision risk when a satellite is as small as ours? It's going to be inherently a different risk than for much larger spacecraft. The fact that we're operating in low-earth orbit where the active time in orbit is going to be much lower than if we were operating at significantly higher altitudes.

All of that has to be factored into the equation as you think about risk and you think about the regulatory solutions going forward.

Ian: Mark, do you have anything to add to that from a client perspective? I know you guys have an internal process for identifying your satellites upon deployment. Is there tracking aids that might be aiding that, or is a rule towards requiring tracking aids something that you'd be interested in having a conversation around?

Mark: About how we track our satellites?

Ian: Lessons from your experience tracking your satellites and whether there's requiring or suggesting a need for tracking aids is something the broader community might consider.

Mark: I mentioned briefly the conjunction warning we received from the ASAT test and how the error bar on that basically made that warning useless. Certainly, being able to track debris, being able to track other satellites to a finer degree is very important. Not just knowing when it's in the area, but knowing specifically where it is.

We have multiple types of satellites. These types actually don't have any motors on them of any kind. They have reaction wheels, so they can very slowly move, tilt, and stuff like that. For the most part, they're passive systems.

We know where they are. When there's conjunction warnings, we have to deal with that, but they cannot move out of the way very quickly. We have other satellites that are larger. They do have engines, and so they can move if need be.

Certainly, I don't think people in this room would argue with me when I say that our current ability to track and get the information out of accurate location of space debris or other people's satellites is not where it needs to be.

If we're going to really start having constellations, taking it from 1,300 objects in low-earth orbit that are operational to maybe 1,300 in one constellation in that orbit, we're talking about orders of magnitude increase in the number of satellites.

Ian: There's a couple questions in here that I'm...come back to about the data that we have and whether that's sufficient to make operational and regulatory decisions, but want to direct a question towards Simonetta and Raje primarily here and then return to that.

We have both new entrants from a commercial sense and new governments talking about creating a night-touch permissive regulatory environment. How do we balance the necessary goal of developing industry, developing capability, with a risk of regulatory fragmentation, different regulatory regimes, and forum shopping across the community?

Simonetta: You can start.

Rajeswari: OK.

Simonetta: I can take later.

Rajeswari: I think that's a fine balancing act that every government has to do. That's also particularly important in the context of global governance. The norms and regulations that we frame at the global level also has to keep in mind that any new regime that is taking shape is not going to be seen as restraining.

Even perceived as restraining or restricting the growth potential of new states, new emerging players, is going to be problematic. For instance, I think the EU Code of Conduct, in a sense, the ICOC, ran into some bit of problem because that was seen as restrictive in nature by a lot of different states in Asia, Africa, and Latin America, of course.

That is also part of the problem, so that has to be kept in mind. One of the points that I would emphasize is that to have an inclusive process, the output that you may end up having may not be the most ideal output. At the same time, having all of the different stakeholders involved in that process, you could have an instrument that would possibly have a longer longevity.

It would be appealing to everybody because they have been part of the process, in a sense. How do you involve everybody, to take everybody's interests along? Having said that, I think the current geopolitical trends to not give me much confidence. The recent GGE on PAROS, the Prevention of Arms Race in Outer Space, is a case in point.

You had several efforts in recent years where you have not seen a huge amount of progress. Therefore, the point that kept coming up yesterday, as well as at the workshop, as well as even other conferences on space issues, has been that you may need to move towards more technical, practical, pragmatic, feasible agreements to avoid conflict in space.

Rather than looking at all-encompassing, a comprehensive instrument that is going to talk about space weapons, then you will get into a lot of problems as to how you define a space weapon and so on. Maybe what we need is to look at pragmatic, technical agreements that would avoid space conflict, that is one, that would ensure that you have continued, uninterrupted access to safe and secure outer space.

You need to look at space policy in that sense, in a very pragmatic manner. The main question that you raised is to have an inclusive process where you involve bringing together all the different stakeholders so that the final instrument that you come out with any regime or any TCBM that you come out with is fairly permissible and advice-able to all the different actors in a sense.

Simonetta: I can mention, that's again the spirit that we have at the Office for Outer Space Affairs, I mean when we dealt with transparency and confidence-building measures, and we talked about this topic, is that we, as I mentioned, we do need to have a bottom-up approach.

Clearly, we discussed with member states and with the main countries involved in this field and also on a bilateral basis quite a lot. The advantage we have is that we have the full understanding of what's going on.

That's the reason why a few months ago, we started with the idea of a new project which is called Space Law for New Space Actors, which is a project which should be fully-funded with voluntary contributions from member states.

I can tell you that we started beginning of February putting together the program, and most of the countries which have already worked a lot in a new national regulatory regime have been very, very supportive of the program.

We expect to be able to launch it by the end of the year, I hope fully-funded. Which is also quite a good signal because we've never had in the recent past a program, a new project to be funded on voluntary contributions which was able to collect this kind of support in such short time.

This is a good sign, in my opinion. It means that member states are really interested in going in the right direction and working with, as I said, in this bottom-up approach.

Jim: Can I jump in?

Ian: Please do.

Jim: On that a little bit, I want to follow up on Raje's comments a little bit. There is a balance between the state policies and regulatory regimes and the commercial interest. I would invite the states to converse and talk to the industry to come up with some of these compromises.

For debris, in particular, there is no business case today for debris removal. There's some specific cases for debris mitigation. The states and maybe at the international level, they could offer some policy updates that would, for example, allow salvage and unleash some of the creative commercial ideas in getting at space debris in innovative ways, to my opening comments like that.

Simple things like imaging of space objects, allowing it to be a public imagery space so that some of this debris can be characterized and then you can design a business around debris removal.

I just wanted to make a statement for the governments, state and international, talking with industry as to developing these rules and looking at innovative ways to encourage the debris mitigation problem, attacking that problem.

Ian: Thank you for that, Jim. Now we have about six minutes here before we're going to get to wrap up and way more questions than we're going to possibly address in that six minutes. Thank you all for submitting questions.

I'm going to try to encourage us to do a lightning round of questions here. These are short answer, quick responses here. Do we have the necessary data and information to both monitor regulatory compliance and industry commitment to voluntary best practice?

Jim: We have some but not enough.

Ian: Some but not enough.

Simonetta: I agree.

[crosstalk]

Jim: Space situational awareness, in particular. There's commercial tools available that governments aren't using, I don't think.

Ian: For everyone on the panel, to protect the usability of orbits, should we consider penalties for those who pollute with debris or don't follow proper post-mission disposal guidelines?

[laughter]

Ian: Is anyone willing to take that question on?

[laughter]

Mark: There's so much built into that question, I think it's...

[laughter]

Mark: I won't touch it

Ian: For the record, that is out there.

[laughter]

Mark: I don't know how they'd collect it if you imposed the fine.

Simonetta: They can have some way to get it.

[crosstalk]

Mark: OK.

[laughter]

Mark: Like helicopters, right?

Ian: This one's a little bit longer, so I'll allow 30 seconds to answer this one. How do we balance the need for management of certain high-value orbits -- Mark, you referenced one orbit that your company, in particular, uses -- with the need to reduce or allow various ventures or provide opportunities for new entrants to also utilize the space environment?

Balancing protected regions or high-value regions with access for new entrants?

[pause]

Ian: Again, good questions. You're stumping the expert panel here.

[laughter]

Ian: Is that a topic that global space traffic management policy discussions should consider? Let's phrase it that way.

Kalpak: Absolutely. When you're talking about large constellations, we had a discussion yesterday talking about different altitudes, perhaps, for different constellations, making sure anything over a certain number of constellations in...Let's use in.

They need to be given a different orbit altitude or something so that you can concentrate on interference of your own constellation with others. There's ideas like that. Geosynchronous orbit is more heavily managed than LEO. Perhaps the future where we break down other orbits in such ways. Below 400 kilometers I think was brought up yesterday.

Perhaps that's a different paradigm altogether. I think the comparison that Doug used was when you're a pilot in certain areas, you can fly by sight versus fly on instrument panel. Doug Loverro, all the questions for that one.

[laughter]

Kalpak: Perhaps that's the regime we need to go into where different orbits will have different rules governing them and you'll have different sections. That's largely governed by lower-altitude orbits will naturally decay so there's less of a long-term threat there from a bad polluter. Higher ones, we might be stuck with their bad actors for a very long time, so perhaps different rules as we go up.

Rajeswari: I need to secure a key point. Not exactly I'm going to stress the particular question, but also relating to the earlier point. You need effective SSA. I think SSA is, today, limited in certain limited regions and limited to certain countries.

That's a relatively non-controversial area for collaboration. Even newer actors in space, like India, China, Japan, for instance, are beginning to develop certain capabilities, [indecipherable 59:49] capabilities. The US, for instance, how they can partner with some of these new actors to create better coverage.

Today, US has the largest network, but the southern coverage is not as good as it should be. The Russian SSA capabilities feed into those. You need to have a much-integrated picture in your ability to understand what's going on, whether it is in your ability to track debris or otherwise. I think SSA has to be brought into the conversation very much.

Ian: Thank you. I've got two more, and these are back to the lightning round.

[laughter]

Ian: We're going to go down and then back. These are in the prepared questions. What is, in your view, the biggest risk posed by the trend towards new actors in space?

[pause]

Ian: If Raje's got it, Raje, you can be...

Rajeswari: Go ahead. [laughs]

Mark: I would say it's competence in operations. There's going to be unexpected events. You need experience in how to handle a lot of those, and there won't be as more and more new actors get involved in it. That would be my concern.

Rajeswari: I'm not entirely concerned by the total, increasing the number of actors. I think that perception is what is creating a certain number of dilemma in the minds of the emerging actors. When established players take the lead in shaping a new agenda, new instrument, new TCBM, and so on and so forth, the emerging players always have this dilemma.

"Is this going to be restrictive in nature? Because we are also developing our space capability. Contributing to a crowded, congested nature of outer space already." I think that fear or that dilemma is very real, and I think that's something that needs to be taken into account.

I think the other problem is in terms of developing consensus in shaping any rules of the road with regard to outer space because of the growth in the number of actors who are involved. It is not just

state actors, but we also need to bring in the commercial perspectives and commercial voice into this rule-making exercise.

How do we do that? That's the biggest challenge that I see today. The earlier years, earlier decades, this was a relatively easier thing. You had two or three major powers who had an inherent interest in controlling the spread of technology.

Today, you have the cost of access to technology becoming much easier, space collaboration driven by geopolitical agenda, and so on and so forth. The export control mechanisms have been diluted to a large extent. All of these are going to provide for growth in the number of actors.

Growth in the number of actors would also come with the challenge of finding agreement involving all the different set of actors. The last point I would say in this regard is the crisis in decision-making, particularly involving all the major space players, is the biggest hurdle in that sense.

Ian: That's interesting. All three of those answers were governance and information, not technical. Kalpak, did you...

Kalpak: I just would say space situation awareness is the biggest both threat and solution. That's where it will drive the answers of the future. If we understand the situation better, if we can make conjunction analysis and prediction much more accurate, it will drive solutions in terms of what can be done. It will drive regulation in terms of what capabilities need to be available. That's the key.

Ian: Unless Mark or someone has anything burning, I want to flip to the other side of this question, which is the biggest benefits that you see from the trend towards new actors.

Mark: I would say, with this surge of, as you were saying, lower costs of entry, lower barriers -- we should also throw in there, with the increase in our ability for AI and machine learning, which allows us to process so much more information, handle so much more information -- the result is going to be the great democratization of the access to this useful information.

Be it remote sensing, be it telecommunication, be it high-speed Internet access, the places that don't have it, technologies, or being able to see the world every day, something that only a handful of governments have ever been able to do.

Now, opening that up and creating that environment with a global truth that's available to everyone or global access to every village around the world or every mountain top, that's the real power. That will be enabled by the commercial side.

Simonetta: For us, it's quite straightforward. What we do is trying to bring the benefits of space to everyone, everywhere. We do that trying to advance international cooperation between all the stakeholders. It's clear that, for us, sustainable development is linked to an open and inclusive access to space. It's quite straightforward.

Ian: At this point, we are at the verge of standing between you all and lunch.

[laughter]

Ian: We will call that there. Thank you to the five panelists. Thank you to the audience. Go eat.

[applause]