

Challenges and Opportunities Facing New Space Actors

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Laura Delgado López: Thanks for joining us. My name is Laura Delgado López. I am a project manager at Secure World Foundation. If you're not familiar with our organization, we are a private operating foundation that promotes the secure and sustainable use of outer space.

One of the more relevant trends going on in space today when we think about space sustainability, is a growing number and diversity of space actors. We're talking about teams of students building CubeSats, companies with innovative business plans, and nations that are making their first forays into space.

With that, we have a lot of energy, innovation, and the promise of new solutions to complex challenges. At the same time, we have new questions that directly impact sustainability. Among these is how to disseminate and promote best practices among this diverse community.

How to build and sustain engagement to build the norms and the best practices of the future. How to work collaboratively to address the challenges that make no distinction between emerging, new, established actors such as space debris or space traffic management issues.

Motivated by questions like this, we at Secure World have undertaken a major project to develop a handbook for new space actors. This is a publication that we hope will provide new actors in space like companies, and countries, and universities, other nongovernmental entities, an overview of the fundamental principles, laws, norms, and best practices for peaceful, safe, and responsible activities in space.

It is a "Welcome to the Club" card to joining space.

Yesterday we had a daylong workshop with experts from governments, industry, and the private sector to review the draft text and provide input on its accuracy, coverage, and usability. We will work through these and other expert inputs over the next couple of weeks. We're hoping to publish the handbook later this year, ideally in time for the International Astronautical Congress in Guadalajara, Mexico.

Today's session builds on several of the themes that we addressed yesterday. I may take advantage of some of the experts that were able to join us yesterday to examine some of the opportunities and challenges that new actors face.

I will introduce each of our speakers. After we've heard their formal remarks, I hope you will join me in an active conversation about those insights and lessons learned. I know we have a lot of expertise, also, in the audience section of the room.

With that, let me first introduce Mr. Jean-Michel Eid. He's a managing director of Space Partnership International.

Mr. Jean-Michel Eid: Great. First, I want to thank Brian and Laura for inviting me to the panel, and Kagina for suggesting me on this panel. As I look to this audience, I think I am probably going to be able to ask you questions on how to improve my relationship with my customers, more than I can share the lessons learned from what I've gathered.

Just to give you a little background, Space Partnership International brings together a pool of cross-disciplinary experts...

[background conversation]

Mr. Jean-Michel: ...that are required to launch a satellite on behalf of any type of customers, whether you're a government agency, or whether you're a private company. Many of them call upon us to do due diligence. We work with the international community, the financial institutions. We look to valuations. We look to the ITU, regulatory positions that these companies have.

We are able to design a complete concept-to-operation system on behalf of our customers, through a complete turnkey solution. Many international customers call upon us for assistance in this regard, no matter where they are in the development cycle of their project.

I've been asked to say a few words about lessons learned in dealing with developing nations, which is the crux of our work, especially in Southeast Asia. As always, the relationships are fraught with rewards, frustrations, and challenges. Believe me, there's no escape from that, no matter where you are, even if you're dealing with the United States government.

The obvious challenges, of course, are linked to access to spectrum -- as we all know, that is becoming more and more difficult to do so -- and how does a new player compete in a very competitive environment today. These are the obvious ones.

The ones that are more secret to these development programs is how they can themselves implement this, within their own administration. This is what I'm going to talk to you more about, the insides of what happens.

First, let me say that, from my perspective, I've been an exchange student all my life. I love the cross-cultural challenges or the learning experiences. I take great rewards in dealing with people who are so enthusiastic about space when we meet them. They're young, they're middle-aged, some of them are old, but they're all so enthusiastic about space, access to space, and becoming the next nation that participates in the space program.

We deal with very high levels in the government, or very influential, but also they're very restricted in how they can behave and how they can make decisions, because of their administrative process. They love the idea that space brings the creation of new and innovative processes, products and services, new jobs, potentially new ways to improve the quality of life within their nation.

Of course, the greatest reward is the bond that this creates with any type of relationship that's developed. Likewise, there are challenges. The biggest one is the culture. I can't begin to stress how important that is, and I don't mean anything but the business culture. How do they respond to a challenge? How do they make decisions? How do they work with their underlings?

It's a very, very complicated process. It's very hierarchical, and also they're dealing in a nightmare of an administrative process, which is mostly legacy from our friends in England and in France. But, [laughs] having said that -- with the French and British in here -- there's very complicated navigation that is required to get a project done through that process.

Then, the procurement regulations, within the administrative nightmare, is also another one that you really have to be familiar with when you're dealing with a developing nation. It's very strict. It's very inflexible.

It doesn't allow for a creative solution to a potential workaround of a statement of work that may be issued. It's a very, very complicated process. You have to count how many pens you're going to use during the process. It's really a nightmare to respond to.

You also have to know your customer. Most of the time, the initiating RFP comes from a ministry that reports to another ministry, and that creates levels and levels of hierarchy that makes it very, very difficult to understand who's calling the decisions for this program, and who are the stakeholders, what their reporting structure is, how decisions are made. There's no limits to how many traps there are to that door.

Of course, public opinion is another one that you have to overcome, because most of the public in these developing nations don't see any value to satellites. They require a very strong public relations approach to explain to them that satellites can bring all these benefits to their way of life.

The last thing that is really key is, to make this work, you have to really embrace the international community to come and play, whether as a vendor or not. In order for them to do that, they have to be convinced that the process is fair and open, in a competitive way.

Those are the immediate challenges that we're faced with, and within that, there's additional gaps that are created just by the sheer way that the relationship is developed. From our perspective, the vendor, we actually walk into the situation not knowing what we don't know.

We put a bid together based on an assumption that is probably overstated. As a result, we face some really, really serious challenges in how to manage the program. We don't know what they know. The first kick-off meeting we went to there, there were three people that were going to manage this entire program -- the launch vehicle, the ground, the satellite procurement.

If any of you have read a satellite procurement, there's thousands of pages, and the scope of what didn't address that they were going to provide [laughs] technical aspects. We also don't know who makes the decisions or how decisions are made, and that also prolongs the entire process of the decision that has to be made for a specific issue.

Of course, we come at it with a commercial mindset, which means efficiency, which means program management, which means time sets. That doesn't exist over there, but of course, we want their business.

Likewise, on the other end, they don't know what they don't know. They've never launched a satellite. They know it's complicated, but they were told to be involved with this program, and clearly they don't know what they don't know.

They don't know how to do it. They don't even know how to manage or navigate within their own administration to get certain things done to get this satellite program off the ground. It's a very, very interesting dynamic that is created in this entire process.

Just to give you an idea of their sense of urgency, we were invited to bid amongst 30 other competitors in 2011. We were finally given the award in May, 2012. By this time, most people would have launched their own satellite, but we have just gotten the award.

Meanwhile, the basis of the award was still done on a fixed, firm-price basis of a business plan that we had submitted two years ago. The impact of that delay is swept under the carpet at their end, but at our end, we see new technology.

HTS is coming into the market, the business plan has to be completely rewritten, the ITU, bringing-to-use issues come into play. There's a whole bunch of things that they absolutely not necessarily have an appreciation for. They're aware of it, but not an appreciation for what impact this creates.

Of course, there's also political issues, and political issues from both sides. Our government says something that annoys the prime minister. The entire industry is blocked from bidding or the entire industry becomes a complicated thing.

We have to, again, intervene as diplomats for the United States in that manner, because we want the best of breed. We want the best solutions to the issues. There's a whole bunch of issues surrounding that, as well.

The other complicated issue is their mindsets. Most of the time, they check the box that says, "successfully completed" at the launch of the satellites. Of course, they need to operate the satellite, and that's not part of the scope of work, initially, that was proposed.

They have to figure out how to turn a government entity into a commercial entity, so that sustainability can be created through the opening of new markets. As you know, some countries require a broader footprint than what they can actually get from within their markets.

You have to create an operational company within the mindset of a government. If you've ever tried to do that, it's kind of humorous, but it's very, very challenging because of the different factors and the different opportunities that this creates for the creation of that company, for the way it's structured.

There's many forces at play that we have to figure out and help them mitigate. Administratively wise, we cannot change government procedures. We can only work within them and respect the

hierarchy and the decision-making process. To give you an example, it's a pyramid scheme in most of the places that we work with, where the prime minister makes all the decisions.

Next in line is the minister of the ministry. Mostly the finance ministry's always involved, and then the stakeholder's ministry's involved. The chairman of that ministry is of the sponsoring ministries involved, and then the project director, and then the workforce behind it.

In order for, for instance, an invoice to be processed, a simple invoice that's already been agreed to on a contractual basis, it has to go from the project director up to the chairman, up to the minister. The minister meets 10 people from different ministries. They all ask questions about it to the project director. The project director can't answer one of them, then it's rejected.

Then it goes back down the chairman, who has a meeting with this committee that only meets once a month. If you can't meet all those questions, or respond to all those questions, it gets pushed back for another month.

Then it goes back to the project director, who is so fed up with this whole thing [laughs] he doesn't want to deal with it anymore, and is embarrassed to call us to say, "We need to correct this." Months after months, this goes back and forth, back and forth, back and forth, until it gets finally paid.

This is not only invoices. It's any decision that's made like that. Any committee that's created that has multiple facets of individuals involved in different ministries, who are all competing for the budget money and the financing, wants to put the kibosh on a space program, because space is the last thing they want.

To make this short, clearly there are many challenges, namely spectrum technology, market access. On top of that, there's the things that I've mentioned, but no challenge is really insurmountable. It requires a multi-disciplinary, very creative, very cooperative approach to problem resolution.

All interests involved must be aligned, which is very difficult to get. There's a lot of compromises through this entire process, but all in all, I can say it's a wonderful experience, and very rewarding for all parties. I hope that you all will have a chance, if you haven't already, to get involved with a satellite program with developing nations.

Voila.

Laura: Thank you.

[applause]

Mr. Jean-Michel: Thank you.

Laura: Next up, we have Dr. Rich Leshner, who's the director of government affairs at Planet Labs.

Dr. Rich Leshner: Thank you. Thanks to Secure World for inviting me, and thank you to all the attendees today for coming to listen and participate in the discussion. I don't have charts. I'm

violating one of the 10 commandments of giving a talk in DC by not having PowerPoint charts, but I hope that you will all forgive me.

Mr. Jean-Michel: Mm-hmm.

[laughter]

Dr. Leshner: Jean-Michel showed the slide of the pyramid scheme. I'm going to talk about the bottom part of that pyramid scheme. Planet Labs, for those who don't know, we are a US-based, California company.

We conduct a commercial remote-sensing mission. We launch a constellation of small satellites, CubeSats, for the purposes of commercial remote sensing mission that we call Mission One, which is to image the entire earth every day, and make information about change visible, accessible, and actionable.

What does that mean? We're commercial remote sensing. Our objective is to be market-first, and we're a US-based company, so the perspectives that I'm about to share are based on that experience, but I think they can be extrapolated out a little bit.

Before I go on, I want to make sure that I compliment Secure World on the work that went into building the handbook. It's really well done, and comprehensive, and touches on a lot of important points, and I think a lot of credit is due to the effort that went in to make that.

I've got four points that I want to share, from our perspective, lessons learned about how to make progress as an emerging commercial actor, particularly in the context of where space activities are today, where there are lots of competitors, where there's a new kind of focus on the environmental quality or environmental safety of different orbital regimes.

The first one is, any company, any private sector organization needs to know it's business plan, it needs to know it's go to market strategy, but in the context of being a space actor, what principles are at your core, with respect to what kind of actor you want to be in space.

You want to be a good actor in space. What does that mean to you? How do you define that, and how are you going to take steps to implement analogical solutions that are consistent with those principles. That's point one.

Point two, then, I think that, and I'm again going to give a shout out to the handbook. The handbook identifies, after some of the very high-level stuff, the point that every nation needs to set up a series of regulatory and/or oversight regimes for the purposes of keeping tabs on what's happening.

We are a commercial remote sensing company, so we have to go get a license for commercial remote sensing in the US. That's from the National Oceanic and Atmospheric Administration, which is NOAA. We also have to get a license from the Federal Communications Commission for the use of spectrum.

If we launch any of our satellites overseas, we may or may not need export licenses. There's a series of these processes that you have to go through. Before we flew a single satellite in space,

and before we had even submitted any applications for any of these licenses, we went and we talked to some of these regulators.

We told them about who we are, and we told them about what our plans were, and we gave them a rough sense of schedule, and we said, "We'll be back to see you, but please don't be surprised." Then, a quarter later, before we had submitted any applications, we said, "Hey, remember a quarter ago that we came to see you? We just wanted to let you know that we are making progress, and we really do think we'll hold this schedule."

Or maybe it slipped six months. We built up this aspect of the relationship to create awareness inside, at least a portion of the regulatory community, that we are going to have to deal with well before we actually submitted any paperwork for an application. I think that's a process, or a model that can be replicated by almost anybody.

It's beneficial in two parts. First, it's beneficial to the people who have to do the paperwork, that they'll know that it's coming. Second, it's beneficial to you, as the person bringing forward information, because the people on those public facing regulatory agencies will give you insight into the process.

They'll tell you who all the different agencies are that participate in interagencies, or intergovernmental reviews, as the case may be. They'll talk to you about, more than just the Xs and Os of execution, they'll talk about insights from what works in the process.

What are trends that are being reviewed in the process? What are some of the pain points amongst different participants of the process? You'll gain insight into the life, or potential success or hurdles that you'll see through the process.

The next point I would make after that, after the engagement point, is be willing to go get external help. That is to say whether it's counsel, or consultants, or whatever the case may be, there are going to be people in the world that have long history and detailed expertise in dealing with these regulatory processes, dealing with these licensing processes.

It is to your benefit to engage with them, and utilize their expertise. There's often a kind of crossing point, when it becomes more useful to do that, that it may be more useful to do that later, rather than earlier, versus earlier, rather than later.

It depends on your new unique circumstances, but don't be necessarily afraid of the idea of bringing in some outside help, because the expertise that they might have will do more than augment. It would be a force multiplier opportunity, when you get to a certain level of maturity.

The last point I would make is that, at some point, as you grow in the work that you do, as you're an emerging commercial player, outside of the issues that are mirrored in many ways, if you want to do business with the government, and have them be a customer.

The structures and the names of whether it's a ministry, or a department, or an agency, whether someone's called a minister or a secretary, all of these things don't matter. The story is the same. Outside of that process, there are other things that might be happening in the governments that we fear can influence you.

There are times when you benefit by not being your own voice. That is to say, by joining a group of actors who have the same perspective as you on a handful of matters.

Whether that's an industry association, or a federation, or something similar, joining these kinds of organizations at the right time for you allows you to benefit from the collective push of an industry group that is looking to pave a road that will enable you to have more efficient processing, or more effective access to the points of pain that might come in a regulatory process.

As your effort continues to grow, it behooves you to add that to your repertoire. Taking those last three points, engaging with regulators proactively, even before you have a plan to submit an application, getting external help, and joining external organizations, they come at the right time for you.

It's not the kind of thing where if you've got a founder, and you've got four people working on the design in the garage, you don't need to say, "Let's go get ourselves a lawyer to work on that FCC application." That might be premature, but don't lose sight of those things as you grow. Those are my basic points.

Laura: Great, thank you.

[applause]

Laura: Our next speaker is Mr. Philippe Moreels, who's head of Strategy and Business Development at ASTROSCALE.

Mr. Philippe Moreels: Good afternoon, everyone. First, I would like to thank the Secure World Foundation for inviting us to be part of this panel. Today, I'm going to briefly talk about this company that you may not have heard of.

The company is called ASTROSCALE. We are based in Singapore, and it was created a few years ago with the idea of developing technologies that would help maintaining a safe and sustainable space environment.

I have a very small agenda I would like to go through with you today. Again, as I said, the mission is about developing technologies to make sure that future activities in space will still be sustainable. Our HQ is in Singapore. We opened a manufacturing facility in Tokyo, recently, based on some heritage that we acquired.

In terms of financial security, in 2015 we raised our Series A fundraising, which was \$7.7 million. Recently, we closed our Series B round of funding, totaling in the amount of \$35 million. All of this for the good cause of making space sustainable.

As you know, space is getting congested. I don't think I need to go into the details, you probably heard that from many experts. There is really a need to start thinking a bit more precisely about, what are the right options, technologically, to make this a bit less congested.

We decided to split our activities in a different parts. The first one is, make sure that we track, in the best way, and in an accurate way, actually, information about space debris that are already

orbiting the earth. We decided to look, with our first mission, at the science of debris, which we don't know much about.

We just know that there should be something like a few hundred millions of them orbiting the earth. We wanted to know a bit more, where are the most concentrated areas for this debris, and also to try to understand a little bit more about fragmentation events that may have happened in the past.

The second activity is what we call debris mitigation. Our objective is to make sure every spacecraft that will be launched in the future is easier to track, first, to approach, to eventually capture and move around and, I'd say, de-orbit, eventually, if necessary.

The third activity is very, very important for us, actually. It's basically develop the right technologies to make future spacecraft easier to de-orbit, of course, but looking at the whole and of life operations that satellite operators are going through. We develop, right now, technologies for that, to help them making EOL operations a bit more reliable, and safer.

Of course, the last objective, which is the very long-term one that the company has, is to look at ways to get rid of those very large debris in the future. Of course, we know that legal issues are among the biggest issues, especially if you look at those legacy debris.

We believe that by building technologies right now, and demonstrate our capabilities, one day, as soon as we've reached some consensus in terms of legal issues, we might be able to de-orbit the largest one.

I just wanted to give you a quick update about the first two demonstration missions that we have. The first one, as I said, will be in charge of tracking or collecting information about certain medium-sized debris, that's a 20-kilogram satellite that will be launched by the end of this year, to early next year. That's the launch window we got from the launch provider.

The idea is, in the future, to have a mini-constellation of these satellites, to make sure we can map in a more accurate way where the smallest debris are, actually. The second mission that is in the pipeline right now is called Address One. This will be a demonstration of our capability of removing a space object from a congested orbit.

The mission is planned for 2018. We will be launching a capture satellite, plus another satellite that will have a proper mission, and that we will, at some point, use as a target to make the whole demonstration process. This is a quick overview about what the mission might look like, or will definitely look like.

We want to demonstrate a few capabilities, such as a new type of ion engines that we're going to use on the chaser satellites, and then all the technologies that will be required to get closer to the object, attach to it using an in-house capturing mechanism that is actually using adhesive, and then de-orbit it, and make it burn up during re-entry.

What we felt was needed in terms of...One of the next steps for us is of course to understand that there is a problem in terms of congestion, and that there needs to be some solutions developed in the market. Of course, a lot of people are actually looking at developing these kind of solutions,

but right now they are either at study level, or didn't reach, eventually, demonstration level. We want to try to push that forward.

At the same time, we want to make sure that we improve the accuracy of the data we get about LEO environment. We know that this is a big issue. It's been discussed at SSA level among many organizations around the world, and also it's a big topic in the US.

We want to contribute to that effort of cataloging all these objects. As I told you, there are of course a lot of bias -- legal, political -- that we need to overcome. We are trying to see how we can best make change happen in this respect.

At the same time, what we want to do is also, as a new space actor that has this objective of making space sustainable, also see how private sector can basically contribute to defining some of the rules of road, making sure that space flight safety is guaranteed for future missions.

As we discussed, one of the reasons why we came here to DC this week was of course to join the workshop that happened yesterday, to talk about the handbook for new space actors. Some of the discussion that happened were about establishing a set of best practices for new space actors, making sure that they really contribute to the sustainability of the space environment, and also making sure that human kind also benefit from a whole new set of services or at a better cost.

That's it for me for now.

Laura: Excellent, thank you.

[applause]

Laura: Our last speaker is Dr. Raji Rajagopalan, Senior Fellow and head of the Nuclear and Space Policy Initiative at the Observer Research Foundation. Raje.

Dr. Rajeswari Pillai Rajagopalan: Yeah. Thank you Laura, and I'm very happy to be here part of this panel discussion. Must thank the Secure World Foundation for this initiative on the handbook and the panel discussion today.

Coming as the last speaker, I think there are advantages and disadvantages. But I think here a slight advantage because I think you've had three presentations, more from a practitioners than operational perspective.

I'm not technology person but I think I'm going to deal with some of the policy debates around the new space actors and the larger space security issues.

Obviously space, proliferation of space technology is something that's been happening for a while, and I think it's gathering greater momentum in the recent years.

Obviously, there is greater dependence on space. Space is no more controlled by a few handful of actors. Space is going to spread because many countries and many parts in the world are just beginning to appreciate the need for outer space assets and the utility of it in the mainly in the social and the economic domain.

I think this is going to be a larger set of countries who are going to be using outer space in a big way. But I think some countries are also beginning to look at outer space from purely national security perspective, and I think that's particularly relevant in the Asia Pacific scenario.

The basic point is that you are going to be seeing a lot many more space actors in the coming decades. This also drives you to the point that international, as well as regional cooperation becomes necessary. I think generally, when you look at it -- regional or international cooperation -- cooperation itself is a positive thing that becomes a positive kind of thing that could contribute to further positive developments in this area.

But I think, again, space in some sense, like the nuclear arena, I think the cooperation needs to be regulated at some sort of regulations have to be there. It is difficult, I understand, because the dual use nature of the space technology is such that you cannot really control the spread of technology, but at the same time, are you going to be able to look at the controlling how the space has been put to use?

What are kind of activities, the end user activities, are you able to monitor them? Again, a very difficult challenge when you talk about space and end-use monitoring aspects, in a sense. But suddenly, it is going to be...Sudden modes of regulation have to come about, because otherwise, it could spur further insecurities, both in the regional aspect as the international level. Again, I'm talking from an Asian perspective where this is an aspect that's gained a lot more traction.

Why do proliferation, why are more states entering this domain increasingly? We have more than 60 players in this domain already, including states as well as non-state actors including public sector entities as well as universities and other institutions.

But there is going to be a greater number, because I think you have to look at it again from a supply side and the demand side equation. The supply side, I think, one is the growing prosperity of states, a greater economy. A larger size of the economy would mean that states would want to put in lots more money. They want to develop more capable technologies and so on and so forth.

Second aspect is the industrial technology spread. Again, space technology therefore will spread to a lot many more countries. On the demand side, I think there are multiple and competing pressures that act. One is obviously the many countries, for instance in the Latin American region or in Africa, are looking at space more from a social and economic development perspective.

But there are countries in Asia Pacific who are looking at space more from a national security perspective. There are multiple competing pressure points that work on these countries that drive them towards developing space capabilities.

What are the broader consequences of proliferation? Obviously, threat of spectrum allocation. That is something we already talked about. That's going to happen in a big way. That's going to be a bigger problem in the coming days, but overcrowding and access problems are already there, but in some ways it's there but it's going to become much larger problem in the coming days.

Then you also have the problem of legitimate versus illegitimate activities in space. Illegitimate I mean in the name of cooperation between space actors -- in the name of civil space cooperation -- states could get civil space technology, but it could be diverted from military space programs or for developing long-range ballistic missile capabilities.

How do you restrict this, and how do you know that a state is not actually getting civil space technology but not diverting to military space programs and so on and so forth? And space, this is one area where you will not really come to know till it is actually been tested or something of that kind. It's going to be a big problem, but these are things that we need to look at.

This could also lead to a more competitive space, wherein there could be deliberate attempts to damage or destroy others' space assets through a variety of means.

These are the kind of things that you're looking at. Looking in the broader trends and growth trends in the space, obviously one of the first foremost thing is more states mean you're going to see even a more overcrowded space -- crowded, congested space. But are we also going to see more regional space agencies coming about?

I think space agencies, regional space cooperation, regional space agencies, they have had some success in certain parts of the world. Latin America, Africa, there have been relatively successful models. But then again, coming from Asia, I think looking at that background, there has not been a successful model.

The fact that there are access to regional space cooperation mechanisms, one is the APSRF, the Asia Pacific Regional Space Regional Cooperation Forum, APSRF under the Japanese leadership, and then the APSCO under the Chinese leadership, show that there are very different tones and tenor to the program.

Also, the fact that there exists no real mechanism to have a conversation between these two agencies, really talk about the kind of problems that exist in the Asia Pacific region. Private sector participation would that become a big issue.

This has been primarily a western phenomenon. The private sector participation strictly has been a western experience, but I think this is changing in Asia also and India itself. India's program for instance, -- space program -- is a state-driven program, but something to the tune of 70 percent is being outsourced to the outside private sector participants.

It's more of an outsourced job than actually private sector actually playing an independent role. I think there are trends that you're seeing, that the private sector is beginning to maybe becoming more independent actor in the coming days, coming years.

There are a whole lot of startup companies that are also becoming much more prominent players. I think there are institutional as well as legal changes that need to be made in the policy realms so that the private sector is being given a much prominent space in this realm, and the history of the space agency -- the civil space agency -- would act as more as a facilitator in the coming days.

In India, as well as in other Asian countries, I think this is a phenomenon that you're beginning to see, but is not become a big thing. It's typically a western phenomenon.

Coming to more specifically, what are the kind of challenges that you see as new space actors enter this domain? One is, again, like the point I related to earlier. How do you essentially ensure that the...How do you restrict the use of civil space technologies to peaceful use of outer space?

How do you ensure that civil space technology that has been procured is not diverted? I think that's always going to be because of the competing pressures that I talked about. There are going to be different motivations that are going to be driving these countries and their space programs.

A lot of countries may continue to have their focus on purely on social and economic issues, but at the same time, there could be a few countries that seek these technologies apparently for civil space activities but they could be diverting.

I think that's something that we need to see how. I understand what a nightmare scenario if they were to talk about monitoring these activities and so on and so forth.

Drawing red lines and setting standards for acceptable behavior. Starting from a definition aspect of how do you define acceptable behavior? How do you define responsible behavior and so on and so forth?

There are a whole lot of policy debates that have to be addressed before we can actually come to the point of setting standards and drawing red lines that should not be crossed and so on and so forth. These are things that we need to think about.

Global rule making exercise. Again, something that's going to become much harder as we go further. One of the points as to why global rule making exercises are going to become harder is from perspective that many countries have looked at the rule making exercise, usually originated somewhere in the western context.

Many developing countries have looked at it as a way to...this is a perception, but the perception has been that rules are created so that there is a certain amount of restrictions being brought about in the flow of technology. Transfer of technology to other countries and so on and so forth. There is a perception management that has to be addressed, again in this particular way.

Second, developing consensus for a global rule making exercise. We have seen the way the last International Code of Conduct for all the space activities under the EU that was met with, in a sense, many countries are said to have problem building consensus among the major powers. That has always been a bigger challenge the last few years.

But getting that many more new players into the room and developing consensus among 60, 70 players or 120 players in the room, I think that's going to be one of much bigger task in the coming years.

Global rule making exercise is going to become a much bigger problem in the future. But the point that Philipe talked about, does private sector have a role? Can they actually take on a bigger role in setting the rules, in bringing about certain rules of the road, some of the certification that can be brought about.

That's something we can look at. Talking about the private sector, they could come up with the ISO2002-like certifications, standards in determining or categorizing certain access, responsible behavior and so on and so forth. That's something that can be explored in the coming days as to what can be the role of private sector in setting out these kinds of standards.

Looking at the experiences and canvassing the experiences of established space players, there is huge amount of symmetries at this point of time among the new players. In terms of the capabilities, in terms of access to technologies, indigenous development capacities, awareness levels. In terms of what are the outer space potential, what are the rules and regulations, what are the export control mechanisms, liability issues, dispute resolution.

These are many, many different issues that you talk about when it comes to the awareness levels. But there are also huge capacity differences in terms of at what levels can the indigenous development capabilities versus the acquisition possibilities and so on and so forth.

I think in that sense, sharing of the best practices is one of the good measures to go about. If I have to relate this to India, then India has come a long way in the last 40, 50 years that India has been a space player.

It's been a long journey. I think there were several international partners that were critical in making India's program thus far. I think some of the earliest partners that we...the US was one of the first partners that India partnered with in developing the space capabilities.

It's the US contribution in the area of remote sensing, as well as the communication satellites for India was very, very significant. India also partnered a great deal with France and Russia in the initial years, but later in the last 10, 15 years, India has also been partnering with countries like Israel in developing some of the more sophisticated technologies.

India is also beginning to look at cooperation with Japan and other similar countries in terms of strengthening the cooperation and partnership in this regard. I think entrenching cooperation goes a long way, but I think some of the rules and regulations that might come about could stress up.

I'm not saying that it's not the case, because even the last International Code of Conduct that came about, that was discussed and debated for about two years, three years, it had a specific focus on international cooperation and technology transfer as an important aspect of that.

But again, like I said, the perception around rules of the road is that this is a western creation, and west is trying to...even a marginal increase by other space players is seen as leading to overcrowded space, and so on and so forth. Therefore, these rules of the road might be, in a way, restricting the use of civil space by other countries. These are things that we need to address in the coming years.

Last bit of rules about the need for a policy. This again I'm talking from a national perspective. For instance, India still does not have a national space policy out in the open. I would say that I would argue, and I've been writing about this, that there is a huge merit in outlining a space policy in the open.

I think the advantages far outweighs the disadvantages of doing so. First of all, it would serve as a huge tool for messaging both your friends and foes about what your capabilities are, what your programs are in the near to the mid-term.

It could also serve as a big confidence building measure. Transparency and confidence building measure is something that we need to -- every single country, especially the established space players -- need to look at. In that sense, as new space actors enter this domain, I would argue that I think this is something that can be taken up by the new space players also.

Last but not the least, I think all the countries have to look at the long-term perspective of keeping outer space sustainable and safe and secure for the future generations to use. Which means that, I think I would go back to the point of developing a global consensus in effecting an outer space regime, for which obviously there has to be multiple levels of dialogue that we need to institute involving all the different stakeholders.

It cannot be that just the scientists sitting in a room and talking to each other, or the politicians are talking to each other about it. I think bringing all the different stakeholders into the room and having these conversations at multiple levels.

Track 1.5 and track 2 dialogues are important in developing greater confidence in each other and removing some of the political hurdles that have come in the way of effective rulemaking in the space.

I'll stop here and I'll be happy to hear questions. Thank you.

Laura: Thank you very much.

[applause]

Laura: Before we get to audience questions, I'll just take the benefit of being a moderator and build on something that Raji brought up, and ask for some quick remarks from our private sector speakers.

Jean-Michel, when you work with different governments, do these issues that we've just talked about, in terms of being a responsible space actor, do they even come up, or is it something that you as your company bringing in that expertise, you raised?

Mr. Jean-Michel: No, these are things that we raise. They think that just by launching a satellite, that's the end goal, but there's also the policies internal to the use of the satellites.

If you're a DTH operator, how are you going to get the license? Do you have a policy for that? All in the commercial side, not necessarily on the government side, but we interact with a government to get these policies in place.

Laura: Excellent. Rich, on a related note, in your community, and particularly in remote sensing, debris has been the leading issue that's come up. I think as a reaction of all of the just sheer number of satellites that some other companies want to launch.

Can you predict which next sustainability related issue will come up for your community, or do you think debris will still be the main one, where companies will want to make sure they're being responsible with that respect?

Dr. Leshner: I guess I would say that the conversation is going to evolve, to talk, not limited to issues of debris, and not specific to satellite size, but to one of, "OK, it's time to get serious about space situational awareness and space traffic management.

I think a handful of years ago -- plenty of folks in the room would know that -- it wasn't necessarily safe to use the phrase space traffic management. It might not necessarily be the perfect phrase, but I think people are now recognizing that's going to have to be a thing that somebody somewhere is going to have to figure out how to do for real.

I think that's the way that the conversation is going to evolve, and I think it will be less about size of the satellite, and I think it will be less about any one particular mission. Because I think you're looking at ideas for desegregated/distributed/proliferated, whatever your preferred term is, systems in leo, and neo, and geo -- well, not so much geo -- for remote sensing, for communications, etc.

I think awareness, knowing where things are, and knowing how to have a community engaged with itself to get stuff moving around to avoid problems is going to be the way that this conversation goes.

Laura: To build on that, Philippe, you're the one that first raised the point about awareness. How would you characterize that awareness in a region of the world where ASTROSCALE is located? How would you compare that with, say, here, where we talk about debris and space traffic management every day? [laughs]

Mr. Moreels: Let's say I wouldn't look at different or categorize regions. I would probably look at spacefaring nations who have been already having some activities in the space, as those who understand what are the main issues they have to deal with.

That's also awareness about the space environment is not good enough for us to really take the right measures. I think if you look at emerging nations, their interest might be more at either developing capabilities, or getting secured access to either data or any kind of activity that's space related.

At the same time, I think they're probably among the most inclined looking at being sustainable in space somehow because they start from scratch.

They can still look at how they can best define or help the government define space policies in line with the space sustainability objectives and also make sure that they follow certain of these standards. I'd say in Asia definitely a few spacefaring nations that are pretty much aware of the problem.

We work a lot with Japan, of course, having a manufacturing facility over there. I would probably have separate this way instead of geographically.

Laura: I can keep asking questions...You have...? Great. Let's wait for the mic, and then please introduce yourself before you ask your question.

Victoria Samson: Hi, Victoria Samson, Secure World Foundation. I have two questions. One is for Philippe. You guys have a really ambitious schedule, with the launch of the satellite that's going to be doing your demonstration technology in 2018.

You mentioned one of things you guys would do is have legal and policy challenges taken care of. 2018 is two years out. I'm curious to know what gives you guys the confidence that those legal and policy challenges will be taken care of by then.

Then, Raji, I was interested to hear you talk about legitimate versus illegitimate use of space. That's a different way of looking at it, and maybe a little bit of, we'll say, judgment, though. I'm curious to know, is it just if you use space for military activities when you said you wouldn't?

Can you use military activities in space in a legitimate manner, no matter what? Will you just maybe talk more about that dichotomy you mentioned? Thank you.

Mr. Moreels: Can I start?

Laura: Yeah, please do.

Mr. Moreels: You're definitely right. Our schedule is quite ambitious. We believe that demonstrating our capabilities as soon as possible is definitely a good idea. At the same time, as I said, looking at legacy debris, we don't believe that any change or regulations will make this kind of mission favorable in the next two or three years.

We believe that all the technologies we will be demonstrating by 2018, some of them might be also already useful for operators that are planning to launch new spacecraft in the time frame 2019, 2022.

We believe that, in terms of business, actually, we can definitely start selling some sort of a service that is basically helping not to adding more debris in orbit, or to just support operators to do their missions. At the same time, what we have been looking at is not only at developing the technology.

We understand that we really need to look at different types of fronts to make sure that we are not missing anything. The policy aspect is probably among the most difficult, I believe. There are a lot of people whose awareness about the issue is not high enough.

At the same time, they probably even sometimes don't really have an understanding of what would be the right way to go. This is why we're trying to raise awareness as much as possible, and at the same time, give or share our perspective in terms of how the policy could evolve to make sure that sustainability is being maintained on the long run.

We also look at policy issues, and we try to be as much proactive as possible.

Dr. Rajeswari: Good question. I come from a little bit of a skeptical background. Asia, and particularly South Asia, we have seen how even nuclear weapons have been delivered in our neighborhood, very much in the neighborhood. Space is something that's much easier to do.

There have already been trends of that kind. When I said about the competing pressures that drive space programs and so on, and so forth, on the demand side, even proliferation of space technology also takes place for the sake of meeting geopolitical objectives. That's something that you see very much in Asia.

That's the background from where I come, and I talk about in that sense. It's a little bit too skeptic, but at the same time, the realities of...Because also the security, military, and security implications of space programs are very real in that sense, even for India.

In fact, I just finished writing a paper. I actually wrote the paper about India's space program. I was like, "OK, the military, security implications of India's space program is quite real, in terms of whether it is expertise, or whether in terms of the knowledge," and so on, and so forth.

It's very real in terms of how the single space technology can have huge applications in the military side of things. This is something that you are going to see in Asia, also. It's not going to go away, in a sense.

That's something that's going to happen. Other point, I just want to go, I later forgot about it, is as you develop even the technologies and satellites to clean up the outer space and kind of thing, you touched upon it.

The policy and the legal debates around that is going to be extremely critical, because only few countries or few entities have developed or in the process of developing these capabilities.

Unless the policy and the legal aspects around this are done in a very careful manner, it's going to lead to further suspicion about, "OK, are you going to be moving out my satellites to other orbit?"

As you develop more technologies, I think you are also falling to more vulnerabilities. You're susceptible to more vulnerabilities. Asia is driven by a lot of competition and suspicion.

Given that, I think the whole shifting balance of power politics, which has a huge impact in how Asia is looking at space as one more realm of competition. It's not a very happy situation that I see in Asia, in a sense.

Laura: Thank you.

Alejandra Solano: Hi, thank you. Good afternoon. My name is Alejandra Solano. I am Deputy Chief of Mission at the Embassy of Costa Rica. I really appreciate that you are organizing this event and inviting us. I totally relate with the challenges that Mr. Eid mentioned in his presentation.

In Costa Rica, we recently closed a fundraiser that raised \$70,000 to build a new satellite. It is going to be made by the regional association called ACAE Outer Space Regional Association. This has raised the issue that we want to have more developing capacities in Costa Rica, in the

region. This satellite is going to monitor climate change, which is something very important to us.

But I don't think those are antagonizing goals. We totally can be trying to make a balance between developing new outer space technology, and also being very supportive of the space sustainability, as our government have already stated.

Without any global cooling, of course, the handbook is going to be very useful. How do you think that we can address the dilemma, that there is no dilemma, because both interests can be living together, and we can achieve both goals at the same time?

I just want to hear your views on the developing countries developing these new technologies without contributing to the space debris and the sustainability, outer space.

Laura: I'll take a first response to that. That's been our approach at Secure World from the beginning, in the sense that whether you're established or emerging actors in your interest. We're not going to comment on the viability of specific activities, but just to say that it is in your interest to be sustainable so that you can achieve those goals.

That's really driven a lot of our efforts. Any other comments?

Dr. Rajeswari: Safe, secure, and sustainable use has been part of the objectives that every single country talks about, at least in their rhetoric. That's something that they believe in.

If you look at the competition among the major powers today, and the kind of activities that they are engaged in, I'm not too sure whether their activities, are they leading to the sustainability, or in keeping with the sustainable use of outer space model, or are they diverting away, in a sense?

Many countries talk about it. For instance, China is very active in the UN Committee on the Peaceful Uses of Outer Space, UN COPUOS, and such other places, talking about the space debris and such measures, but they have a flourishing military space program under the PLA.

China and Russia have talked about developing the draft treaty on the Prevention of the Placement of Weapons, PPWT. They do not want to talk about space debris. They do not want to talk about ASAT capabilities.

In a sense, while for every major power, every major spacefaring power, this has been a stated objective, that they all want to have safe, secure, sustainable use. Their activities are not necessarily... There's a gap between what they talk about, with their rhetoric, and their action, in a sense.

Mr. Jean-Michel: First, I applaud that Costa Rica is doing something about climate change. That's really wonderful. In order for that to be sustainable, you'll have to embrace the international community. Having just one satellite over Costa Rica is not going to really give the information that you might need, since climate is such a global thing.

I'd be happy to talk to you more after the speech, so that I don't take the people's time.

Alejandra: Thank you.

Laura: Other questions?

Caleb Henry: Hi, Caleb Henry with Via Satellite. A question for Philippe and Raji. Also, too, congratulations. I had talked with ACAE about [inaudible 63:26] satellite, and I'm excited to hear that it's fully funded. They also mentioned wanting to cultivate an industry within Central America through satellites.

Alejandra: That's true.

Caleb: Very cool to see that. Congrats.

Alejandra: Thank you.

Caleb: Hearing about space debris is something that's been talked about a lot, but when it comes to active debris removal, the big question has always been, "Who's going to pay for it?" You've got these satellites that are going up.

It sounds like you've made a lot of progress, and big plans, but who do you see writing checks to you in the future?

Then Raji, India has become one of the big players in the space world. More and more people are interested in launch services from Israel. You talked about a lot of this domestic capability.

Do you anticipate that India will become a larger player, perhaps doing more commercial launch, and maybe even having some of these manufacturers that are supplying things to Israel for satellites, building satellites for other nations at some point?

Mr. Moreels: I'll start. Talking about ADR, of course, the discussion about who is going to pay is still on the table. In the industry, a few people have tried to come up with what could be the right framework to make this happen at some point.

We are aware of who are the countries, basically, who contributed to putting more debris, or creating more debris, in the last decade. At the same time, we understand that they definitely don't have any budget to clean anything up there, and right now, no interest.

One of the framework was to say, there could be one day a mutual fund where all these countries could just contribute, and then this would eventually fund ADR missions.

For us, we really see this as a very long term. We don't even know if that's going to happen one day. No one can say, actually. It's very long term. We decided to look at using a different angle, which is more at how we can make sure we don't create more debris in the end.

This is more looking at debris mitigation solutions. We know that spacecraft end of life operation is something that is quite important in order to make sure that we don't create more debris. We decided for the short-term and mid-term to really look more at these kind of issues, rather than trying to understand who will be paying in the end.

At the same time, it's good that a private space company, like ASTROSCALE, is really trying to push a bit that debate. We know it's going to take a long time for governments to agree on paying

for eventually ADR, or paying for other ways to make sure that there are not too many collisions happening.

It's not only about removing debris. It's also about knowing how the environment looks like, and how we can predict proper collision avoidance maneuvers.

Dr. Rajeswari: India has come a long way, and India has been having satellite launches on a relatively very cost effective manner, as well as reliable space launches that India has been engaged in. That's been an attractive option for a lot of different countries.

At the same time, India is also beginning to lose that edge, because India has some deficiencies which it needs to attend to on a priority basis. The deficiency comes from the fact that there is shortages on the infrastructure, the launching pad, for instance.

The debate for a second and third launch pad within India has gone on for more than five, six years. There has been no decision on that, which means that India, for instance, launches something like four to five launches per year, as against China, that does something like 20 launches per year.

There you have the numbers. Very, very stark difference. India has to strengthen its infrastructure for two different reasons. One is not to lose the commercial space out there. Second, India has to also pursue this from a national security perspective.

From both different perspective, India has to attend to some of the shortfalls that it has in terms of infrastructure and kind of things, so that it does not lose that market. Commercial space launch is an important...

Second aspect is about giving the commercial space to more private actors. That's something that India has to do, but India has to come out with a facilitating law. ISRO has to do the role of a facilitator than actually a controller.

Today, ISRO launches commercial, in terms of the commercial agreements through its commercial wing, called the Antrix Corporation. Again, Antrix, if you go back to see what's the kind of revenue that they had later, it's nothing comparable to what China and other competing space agencies have been doing.

That's because we have limited capacity at this point of time. If India has to strengthen the capacity, one is to improve the infrastructure, but also there has to be larger share has to be given to some of the tried and tested India space programs, can be given to private sector players.

This has been part of the debate in the last one or two years. The ISRO chairman, past chairman, have been talking about how, for instance, PSLV Program can be given to a set of private players, or at least one private player. One private sector company, can be given internal support.

There has been increasing number of debates around it, but it's not being done on a priority as the way I look at it. These are things that, on both the legal front, to give the private sector a larger space, as well as the infrastructure needs to be strengthened, if India has to be able to do effective launches on the commercial scale.

Male Audience Member: I've got two questions, pretty much for Raji. First, one is straightforward. My impression is that space has been pretty much militarized already, at least from the point of view of monitoring and surveillance.

In your comments, I didn't hear an explicit differentiation between militarization and weaponization. I wonder if that's part of the conversation. The second question, in more general terms, it sounds to me that things are moving very, very fast in this domain.

Whether the legacy structures at the United Nations are really well suited to accomplish the policy, and the rules of the road and everything that look like they're going to be needed on an accelerated basis.

Dr. Rajeswari: I didn't speak about these two aspects. Around the world, it's a practically acknowledged fact that militarization is something that's already happened, militarization of the space. With countries and armies, militaries around the world using space for a variety of passive applications, "passive."

There effort is to try and stop or stem the process of moving towards a full weaponization. That's, again, something that one can be reasonably clear that nobody in their right mind is going to be putting weapons of mass destruction or any sort of weapon in outer space.

There comes the bigger point about the ASAT-like missile systems that can be used for...you don't have to put a weapon in outer space, but you can use ground-based tools for targeting assets in outer space. That's something that some of the bigger players in outer space have not really wanted to talk about.

The PPWT, for instance, and that's a good example, is been something that really nobody wants to talk about. If you do not have Russia and China in the room agreeing to this, that's a big lacuna.

Anybody can talk about any number of global measures that you can come up with, but unless you have some of the critical players in there agreeing to some of these terms and conditions, you are going to have a measure that's not really meeting the goal.

For instance, the ICoC, the code of conduct, that is a reasonably good document that they came up with. The manner in which it came about initially, at least, it led to a whole lot of discontentment towards the whole effort, because they felt that the process was something...you cannot decide what's good for the rest of the world kind of thing.

Having said that, you try to do a little bit of outreach for it, but in the meantime, you have had Ukraine and thereafter the Russians have taken a very, very strong stance against any sort of initiative that comes from the West in a sense. Obviously, the EU code is more or less a dead thing as of now.

Other measures in place, you have some of the Outer Space Treaty as well as other supplementary agreements. I think they come from a good set of measures but I think they have become far too expansive.

How do you define peaceful use of outer space? How do you define difference of use? What is a space weapon? There are a whole range of things that we need to...Keeping up with contemporary relevance, how do you define an astronaut?

Tomorrow, you have space tourism, speaking of it in a big way, in a galactic sense, a tourist. Should he be considered an astronaut? What is it? A whole lot of issue have come forward for the review, but, again, the lack of consensus today among the major powers has come in the way of making any effective mechanism, be it political commitments or even a legally binding mechanism.

These have become extremely difficult and to reach even some sort of [indecipherable 73:09] is proving to be extremely challenging. As we have more and more number of actors coming into play, it's going to become even further harder in terms of developing an agreement.

First, to start with, what are the challenges? Then to bring on an agreement in terms of how do you deal with those challenges? I'm not very optimistic when it comes to a lot of future measures to keep the outer space safe and secure, in a sense. [inaudible 73:42] .

Female Audience Member: Hi, [inaudible 73:51] , PhD student at Grant. This is for Mr. Moreels. At the IAC this year, there was a presentation, I believe it was by a space generation working group, that was looking at different elements that enable space startups to be created in different countries. It's an interesting concept.

They were looking at US and Japan, which, to me, was maybe not the most logical comparison but a lot of the things they claimed prevented space startups happening in Japan, to me, were similar to aspects of Singapore.

I know that you're based on Singapore, I believe you have a Japanese founder. What technological, political and financial elements were important to you in selecting Singapore, and what you think countries should do to enable the creation of space startups?

Mr. Moreels: First, the reason why the company was created in Singapore was...There were definitely many reasons. The first one, I'd say, would be very personal to the founder, who is sitting at the back of this room.

[laughter]

Mr. Moreels: He was already in Singapore and had one or two companies around there. He knew the ecosystem and how to build a startup around that. At the same time, when creating the company, the focus was mostly on ADR and how ADR could be feasible in the future.

For these purposes, it's better to be in a country that is seen as neutral and then has good relationships with, let's say, the three countries that may have produced the most debris.

[laughter]

Mr. Moreels: I think it's better. Having an HQ in Japan and maybe talking with China would not be the best way to eventually have some commercial discussions about removing debris in the future. I think that's the geopolitical aspects of having the company set up in Singapore.

At the same time, if you look at governments -- and we know a bit about Asia -- governments who are willing to establish this network of startups, space startups...There's a lot of proper space activity at the national level.

I think Singapore is doing an amazing job right now. The government is really committed to make Singapore as a hub within Asia. Emerging hub, of course. But at the same time, we've noticed that Japan is also trying to have new startups starting in Japan.

Trying to give incentives, helping them setting up the company. Also, growing at the very initial part before they can eventually have a proper value proposition that allows them to make sustainable money. We see that Japan is trying to get up to speed with developing new startups. I forgot about the last question you had.

Female Audience Member: If there are any other specific elements [inaudible 76:43] for space startups.

Mr. Moreels: For space startups. I think in Asia right now, Japan is definitely moving forward and Singapore a lot. Apart from that...

Laura: Australia.

Mr. Moreels: Yeah, Australia, true. I think they have plans to have a space port, where exactly? In the northern part, I think. We know that some local governments within Australia are also trying to make that push happen.

They have entrepreneurs who are willing to change the world, in a way, in the southern hemisphere. They are trying to make this happen, giving land to have these activities happening, space ports definitely. Also, companies eventually looking at satellite manufacturing, also at some point.

Mark Mulholland: Hi, I'm Mark Mulholland from New York. I was thinking that, in terms of the issues affecting sustainability and growth of your industries, I'm thinking that sooner or later, the forcing function becomes the number of rockets and that sooner or later you run out of rockets that are going where you want to go.

Pretty soon, you run out of range slots. In a wildly successful world, you potentially start putting out a business, the big sale, like people that are buying the rockets to begin with. I'm wondering if there's any interest in the industry or any thoughts that sooner or later you get to a breaking point.

Is there anybody out there, other than maybe the Australians, that are considering getting into the launch business and have the financial and technical resources to be able to do that?

Mr. Moreels: You could start.

Dr. Leshner: I'll just say, from our perspective, we see a lot of promise in the smaller class, call it venture-class launch community. NASA has a program that's supporting three players and that's Space Virgin, Rocket Lab and Firefly. Did I get that right?

Mr. Moreels: Mm-hmm.

Dr. Leshner: I think are supported by them. There was news about some of the folks from SpaceX starting a new, smaller launch company. There's rumblings...I think that there's real potential for the small launch community and the small satellite community to build a sustainable relationship between each other.

We're also having, what we're seeing in the larger launch arena with the cost profile changing and the evolution of the secondary payload market. I think that the conditions are all ripe. Foundation is well laid for this community to interact in such a ways that the market can sustain all the different portions of it.

I would say that right now the smartest thing for any...I would say, a good position for the US government to put itself in -- I'll just speak from that perspective -- is to recognize that emerging trend and find ways to support it and enable it and not compete with it.

Mr. Moreels: Access to space is already and will become one of the most important things that satellite operators or satellite manufacturers will have to look at. As Rich said, I definitely have to agree with that, you see more and more initiatives happening around the world.

You mentioned Australia, definitely, the government is investing a lot in this very specific initiative. I think we're going to see a lot of new operators as soon as they reach the right maturity level, hopefully in the coming years. Providing opportunities for companies like us to launch micro satellites because our [inaudible 80:59] satellite is basically a micro satellite in its current fashion. Cost is going down, opportunities to fly will veritably go up.

We have a feeling that this should not be too much of a problem in the future. The only question is, when will these launch providers be ready and have the rocket in place and what will be the final price that they will be charging companies like us?

We see that the opportunities are going in the right way for now but time will say.

Laura: One more question before we close. Jean-Michel, I was curious that one of the challenges you didn't list, I think, in working with developing nations is the ability of those institutions to learn, to build a cycle of having learned from the experience of working with you in, say, building your first satellite.

Do you see that institution is able to apply lessons learned from past experiences, just on the theme of best practices and how do you survive within a country?

Mr. Jean-Michel: One of the key challenges with any government program is the turnover within the administration itself and the way that the budgets are structured. It's very difficult to have continuity unless you create an operational company for that project and let that drive on its own with the support of the government. That's a very good question.

Laura: Yes.

[laughter]

Laura: Thank you all very much. If there are no other questions, I thank you for the conversation and please join me in thanking our experts.

[applause]

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