New Actors in the Space Domain

Michael Simpson: We can get you to the rest of the fascinating program that the Space Foundation has put on with this year's symposium. I guess you probably have the same sense I do that with 12,000 or so people here.

We're not counting directly because I don't want the fire department to quote me, but there's a lot of people here. People we want to meet and we want you to be able to have a great session here and also, with the rest of the day with the Space Foundation's Space Symposium Program.

I'm Michael Simpson. I'm the executive director of the Secure World Foundation. We're sponsoring this form for a couple of reasons.

One of the very biggest reasons is we had become more and more aware of the extraordinary issues, contribution, and opportunities that are being presented by the development of new ideas for the use of space by participants who worked at it in the space sector, even in some cases, five years ago or 10 years ago.

We were so interested in this field in fact, that we produced a handbook this year. It took a good year and a half of hard work and editing to bring it your way. In February this year, we announced the production of this handbook for new actors in space.

We have copies for all of you at your places. This book is really aimed initially at new companies or entrepreneurs who might be entering the space sector and new countries that were beginning to consider a space policy that encourage a commercial activity in space.

What we have been hearing increasingly is that we have served those two markets, but that there's really a third market. That's where the folks had been involved in space since Methuselah was a minnow and who nonetheless are doing something different. As they do something different, they look in here and says, "Wow." There are some questions here that I need to answer and some head start to where we can answer that.

First of all, we want you to know about this book. We want you to use it. We also want you to be utterly free to send us your critiques. Things we might have missed. Things we might have gotten wrong or at least you feel that we got wrong.

Things where you feel maybe we ignored. A cultural issue that submerging either in our own entrepreneurial culture or in a national culture because this will not be the last edition of this book.

I see a certain amount of critique on the face of staff who know that this book will be a permanently recreated exercise. We also know it will keep us fresh. It will keep us where what's going on. If in fact it is as useful as some people are telling us it is, we are very pleased to make this available.

We run a thousand copies. Initially, we're nearly out. We've got a second order in for another thousand. We have this available as a PDF for free on our website. If you need to distribute it to somebody for information, it is available that way.

It will be available as a Kindle edition. It will probably even make it available through Amazon for people who so want a hard copy immediately and they're not willing to wait for our next printing. They can go and order themselves a copy.

Secure World Foundation has been around now for a dozen years. What we do is we pursue cooperative solutions for space sustainability. We look to make sure that our grandkids have as much access to not only what we are currently doing in Space, but to the creative opportunities of Space as we have had.

I think often that my grandfather died in 1962, but for years prior to that, he'd pay taxes that contributed to the development of space technologies that I benefit from every single day of my life.

We as a foundation work very hard to make sure that issues like space debris, and space situational awareness, and access to space, and the use of space as a source of applications they favorably gives back human life is facilitated advanced and discussed around the world.

In that context, we have pulled together this luncheon forum today to talk about some of the issues surrounding new actors and their impact on the space sector. The opportunities and challenges that having so many new players in space are represent for the future of our sector, our interest, our vision, and frankly, in this particular community, our aspirations for the future.

I think what we'll probably do is recognize that you've all I'm sure loaded this space foundation, space symposium app to your phone.

We're not going to reread everything that's in the bios. I think we'll star at the far end of the table here. Rich Leshner from Planet will give us a chance to hear from somebody that's looking like an old-time actor but hasn't been around all that long and we'll look forward to hearing your remark.

Rich Leshner: Is this working? Everybody can hear me? Please keep your dinner rolls to yourselves no matter how ridiculous I may sound.

[laughter]

Rich: In your opening remarks, Michael, you mentioned that it was actually an opportunity even to discuss what it means to be new. Who is a new actor? I think you could break this down into a relatively simple two by two matrix. You've got the "actor" and then you've got the concept say the thing that the actor wants to do.

You can have carries of new and new, new and old, old and new, old and old. You might have a lot of experienced hands in the space business going out and trying to execute a brand-new concept of operations, a new mission or architecture or something pushing the boundaries.

They're professionals and they've done this before and they have a great deal of interest in health and the sustainability of the space environment. All the things that we talk about in conversations like this one. Or you might have people who are brand new to the game via state actors or industry players who've come from one sector moving into another.

There's a big source of new learnings that they have to engage in. I think no matter what community or what pairing you form in that two by two matrix we at Planet have observed that you often make the wrong guess about the ratio between known unknowns that you'll have to deal with and going about and accomplishing your mission in unknown unknowns.

In particular, the combination of old hands or experienced hands and new mission concepts will often overweight the known unknowns and underestimate the unknown unknowns. Now by definition of course you can't estimate the size of the unknown unknowns, but the point is you have a certain amount of confidence about how unlikely it is that there's going to be things that surprise you.

If you are trying to do something new, but you are not new to the industry. I would say to all of those who are experienced and thinking about changing and disrupting and creating innovation and evolving that innovation into commercial solutions that the unknown unknowns are much harder than you think they are.

Again, that might be true by definition and yet we often forget about that fact. That stresses the need for the three most important words when it comes to navigating your way through the emergence of unknown unknowns and the emergence of players in your regulatory environment or commercial environment or whatever that would potentially create a roadblock.

Those three most important words are community, community, community. What I mean by that is a couple of different things. There are the industry associations that have historically been brought together to help tackle this regulatory challenge or help industry speak with one voice or something.

Then there are the informal gatherings some fortunately happening this year in a fun way amongst the variety of different emerging players that will eventually maybe evolve into something a little bit more formal.

Nonetheless whether it's through those formal mechanisms or more informal gatherings or whether it's through luncheons like this, there is that informal knowledge sharing, that informal information transfer where one company says, "Yeah, we went through that a year and a half ago and finally figured out that the way to get over the hump is to do this thing."

The difference between that fact and what's in the handbook is things that are in the handbook are maybe the sources of where you've got to go like, "Check this box or talk to this office." Getting through the process making that offer happy or at least getting them to be unafraid has its own secret sauce. That's not going to be in here and that's where the community comes in.

The community is one where there are competitors in different working industries working together for the benefit of the appall, and it has to also be one where governments and industry and not the profits and all of the whole all work together too for the benefit of the whole.

Anybody who's heard me talk about regulatory environments and getting over historical models and commercial remote sensing as an example has heard me say many times about or talk many times about why we need to rethink the fundamental nature of our industries being something different than it was when it was initially regulated.

One quick story I'll share is we had so much laser focus on remote sensing and that regulatory process and because we thought we really understood the spectrum process and the FCC, we were trying to go on autopilot on the FCC. Not the FCC specifically, but actually the NTIA and the federal agencies response to how industry players come forward to try to utilize spectrum.

That some surprises popped up on that side that we hadn't been prepared for because we thought it was a known unknown and in fact it turned out to be an unknown unknown. Now we got through it and we have our licenses and we're operating, that's fine. We quickly developed a community based solution to help us all to understand each other.

The acronym that we flip around is informal grouping, the CSSMA, the Commercial Satellite Spectrum Management Association, where NOAH and NASA and some others came together with small sat players and started and started to talk about what the future is going to look like for some spectrum sharing issues or at least cooperation and certain spectrum areas.

That was a community that had to emerge in order for everybody to be able to get the best out of the future opportunities. I'm going to stop there and I'm just going to fist pound community, community, community.

That no matter where you are on this matrix of two by two and no matter how well you think you can navigate most of the combination on known and unknown unknowns at some point you're going to need a community and the community is going to need you. Let's all not lose the plot on why that's important.

Michael: Audrey, there's probably a DoD perspective in this whole set of issues that it might well include a certain amount of community. Let's hear from you, please.

Audrey Schaffer: Thanks, Mike, and thank you to both Secure World Foundation for inviting me to speak as well as for the Space Foundation for organizing what's always an exceptional event here at beautiful Colorado Springs every year. First of all, I really want to applaud the Secure World Foundation on the handbook. I know, as Mike said, this has been like 18 months in the making.

It's a really fantastic resource point. A lot of information, as you said, not just from new actors in the space domain, but for any actor in the space domain. I'm really pleased in that context to be speaking here to you all today as one of the oldest actors in the space domain.

[laughter]

Audrey: Beauty is an operating satellite. Not quite the first but for pretty long. What I'm not here to do is tell you how to operate in space. That's not my place. What I'm here to talk about is our shared interests in the domain, both as new and established space operators.

DoD cares very much about ensuring that we maintain a safe, stable and predictable and sustainable space environment. We are not only one of the oldest actors in space, we're actually one of the largest purely in terms of the number of satellites that we have on orbit, although that's probably going to change actually in the not too distant future.

Like any operator, large or small, we care about the safety and predictability in the domain. The other relevant piece the DoD brings to this is that we have this space situational awareness mission, to detect, identify, track and characterize space objects in order to warn of both natural and man-made hazards and threats to activities in space.

A more cluttered space environment, no matter who it is old or new it poses not only potential operational hazards to our operational satellites it also complicates our SSA mission. Today I wanted to touch on two areas that I hope where new and emerging actors can engage toward the end of safety and vulnerability in the domain.

First, it's going to be the development of norms in space and second is just being mindful of spaceflight safety. First, development of operating norms, so as I said we reaped the benefits of a predictable operating environment. We really have a vested interest in seeing the development of pragmatic standards for operations in the space domain.

This issue has been around for a while, but I think there's been an emergence or reemergence of the issue with all the new actors in the space domain. There's just an incredible amount of energy and enthusiasm from the commercial sector right now, which I think is fantastic and frankly the DoD needs to figure out how we can buy your services.

Putting that aside, the question we have to ask as we have all these new actors coming on board is whether they're all following the same rules as one another. This isn't about whose rules are right or whose rules are wrong. The example I always like to use is driving on the road. In United States, we drive on the right-hand side of the road. In United Kingdom, they drive on the left.

It's cool. We still get into accidents, but not because people are driving on the wrong side of the road. If I take my car over to London and I try to drive on the right-hand side of the road, that's going to be a problem. If you extend that knowledge into space and you think about new and emerging actors, it doesn't matter who's driving on the right and who's driving on the left.

The point is that we all need to agree on which side of the road we're going to drive on, so that we don't create accidents just because we're operating under different assumptions. In terms of what norms or operating practices are out there today, you can argue that there are very few norms. You can also argue there are a lot of norms depending on how you want to define norms.

I'm pretty sure the handbook includes a lot of the discussion on international legal regimes you need to be mindful of. The Outer Space Treaty provides some of the broad legal framework and principles, but doesn't really get to that operational level detail of what specific practices operators might want to do in the space domain.

You can argue that some of those practices are normalized. Things like launch safety, operator training, collision avoidance, but they're not really written down anywhere. I don't want to leave you with the impression that nothing is being done. There are a couple of international efforts ongoing right now.

The United Nations Community on the Peaceful Uses of Space has an initiative to develop long-term sustainability guidelines.

There's also standards being developed through the Consultative Committee on Space Data Systems for things like orbital data-sharing. Also, DoD has an activity that DARPA's going to be kicking off shortly to foster development of operating norms for rendezvous and proximity operations. Those things are all great, and they're necessary but I'm not sure that they're really sufficient.

One of the things that we've been thinking a lot about is how do we catalyze the development of those standards and operating practices in space. The first question I ask is, what is the model you want to look at or how we might go about that?

There's a good example I like to use which is the Space Debris Mitigation Guidelines which were adopted by the UN Committee on the Peaceful Uses of Outer Space in 2007. But it didn't start in the UN.

It actually started with US Standards and Practices that were developed first by NASA as well as by GOP and those technical standards starting as agency standards, soon became US Government Orbital Debris Mitigation Standard Practices.

US brought those into an international technical form called the IADC, Inter-Agency Debris Coordinating Committee, that they came out with its space debris guidelines which were then taken to the UN and universalized the political temporary document.

The lesson that I like to draw from that example is that this started with technical exchanges among technical operators to build the best technical and operational solutions that were then universalized through multilateral diplomatic process.

The second question I want to put on the table is, who's been leading the development of those norms and standards?

I would submit that the Department of Defense is not the right organization to lead the development of international norms because quite frankly, the reality is, and I don't think this would be heretical to say in this room. The DoD is not going to follow 100 percent of the norm 100 percent of the time because we're always been the operational flexibility in certain circumstances.

That said, as norms developed and coalesce, our operations will follow most norms most of the time and it actually behooves us to participate in the norms development processes both to lend our credible expertise and also just to understand where the norms are going.

I would offer that industries should have a leading role in developing some of these norms along with our civil agencies and regulatory communities. In fact, the handbook is a great start. I also read a paper about...from one of the, I guess you'd call a new space companies, OneWeb, try to foster some of the discussions on what norms and standards might look like for space.

These are all out great initiatives and I hope that both established and emerging actors can come together and start having these technical bottom up exchanges that one day we can bring to forums like United Nations to universalize.

Quickly, I don't want to spend too much more time, but I just did want to give a quick plug for spaceflight safety. If my first request was to participate in the development of international norms, my second request to new actors in the space domain is to be mindful of spaceflight safety.

As we have more and more satellites and increasingly crowded orbital regimes, it's important that new actors not only be mindful of spaceflight safety, but that they acquire spaceflight safety services that they actually take seriously the recommendations that they received.

DoD is one such provider of spaceflight safety services. We both share SSA information on both the routine and emergency basis through a public website called Space-Track.org as well as through agreements we have with individual, commercial and international operators.

I'm not going to go into a whole lot of detail because I see Diana McKissock there in the corner who can give you a whole lot more technical detail if you'd like about how the process works. I also know the DoD isn't the only provider of these services. Commercial Space Operation Center, the ComSpOC, also offers services to their customers.

There's a new industry association called the Space Data Association, who also provides spaceflight safety and electromagnetic interference resolution to their members. I'm not trying to...I am, kind of, trying to plug DoD, but that's not what I'm up here to say.

[laughter]

Audrey: What I'm up here to say is that one way or another new actors should find their way to spaceflight safety services and, like I said, take seriously the information that they received because a collision in space is a bad day for everybody. With that, I'll stop there. I'm happy to answer any questions, and thank you for the opportunity to speak.

Michael: Thank you very much, Audrey. Now, we move third of the way around the world to the United Arab Emirates. Salem, it would be wonderful for you to talk with us a bit about what's going on there and get the Mohammed bin Rashid Space Centre.

Salem Humaid Al Marri: Thanks, Mike. I'm going to shift gears a little bit and show a video. Maybe people will have a look here. I usually tell people that I took this with my iPhone, but nobody believes me.

[laughter]

Salem: You can have a look.

[music]

Salem: You can see we're planning to take that building to Mars.

[laughter]

Salem: A lot of people ask me why is the UAE going to Mars, but if you look at the beginning of the video, you see that the UAE actually looks a bit like Mars if you look at the color of our soil. That's one reason.

[laughter]

Salem: The UAE is one of the most ambitious countries in space and is a major player in the Gulf and the Arab world. We're quite active and diverse. We're developing missions, interplanetary missions and our Mars mission. We have also geostationary satellites. We run sensing missions and educational missions.

We're also trying to develop the infrastructure to have a sustainable space program in the UAE. As you can see, these are some of the players that we have in the UAE. We have government, private and universities. Basically, the UAE has been active in space for under 20 years. That's quite diverse.

Just to give a quick introduction to Mohammed bin Rashid Space Centre, I wanted to give you some context on who we are, what it is we are doing before I delve into bit of the topics of this symposium here. The Mohammed bin Rashid Space Centre was established in 2006 and we were named the Emirates Institution for Advanced Science and Technology.

In 2015, our name would change to the Mohammed bin Rashid Space Centre. The main goal is to nationalize development of space systems and do that through UAE nationals. What we did was we partnered with South Korea and we developed two satellites jointly with them. The first was DubaiSat-1 that was through a know-how in technology transfer program.

The second one was DubaiSat-2 which was through a joint development program. We identified early on that maybe, one of the quickest ways for us to grow was to partner with a nation that could support us in our goals of developing technology, but giving us the know-how to do that technology. That was one of the key aspects that we looked at.

After that, obviously, now we're developing a KhalifaSat which is our third satellite and this will be the first satellite developed in the UAE and we have about a hundred engineers working on it and it should be launched next year in the first quarter.

With all these successes, the government also wanted to push our engineering capabilities as well as our scientific capabilities a bit further. The government announced the Emirates Mars Mission, which is basically the first interplanetary mission for an Arab or Islamic country.

The main goal of this mission was to continue the engineering capabilities that we did with DubaiSat-1 and DubaiSat-2 and KhalifaSat and try to build a probe to Mars. At the same time, there's a scientific objective which is, basically, continuing where science left off on Mars atmosphere. For the first time, EMM will explore the dynamics of the atmosphere of Mars on a global scale.

We've partnered with different entities. Here, we partnered with entities here in Colorado. We partnered with the University of Colorado, University of Berkeley and Arizona State University on some of the instruments and some of the aspects of the mission.

The reason we partnered with, the first one is we partnered with South Korea, the second here we partnered with the universities, is because that knowledge transfer aspect. We see that entities that are either developing small countries or small companies or universities are the ones that are willing to transfer the knowledge.

Then, as I mentioned, we've developed our facilities and we're now planning our phase III which is, basically, complete satellite testing facilities in the UAE. This is just a quick introduction to what we're doing in Mohammed bin Rashid Space Centre.

Now, maybe, to delve in a little bit about what's the rationale of emerging space programs, specifically the UAE. Why is the UAE investing over $5 billion in space activities in the last 20 years, and why is it going to invest even more going forward? It's quite obvious that we're looking at economic diversity, we're looking at the post-oil economies.

The UAE is very well known as an oil-based economy, although Dubai by 97 percent non-oil. However, it is dependent on neighboring countries that are oil-based. There's education now reaching national capability development. One of the key strategic aspects is that we develop our own capabilities through UAE nationals and that's one way that we're doing a technology transfer.

We try to bring manufacturing to the UAE, we try to develop an SME ecosystem to develop some of the components in the UAE as well as national pride and other reasons.

Some of the challenges and opportunities that new actors face, I'll be more specific more to the UAE. Some of the challenges are technology transfer restrictions and export license as and ITAR. When you look at these two aspects, these will define where you go as...in our case, where we went in terms of partners.

The third point is private sector partnerships. When I mean true partnership, I link that to the first two points. There's a lot of entities in the private sector that are willing to cooperate, willing to give, let's say, developing space nations' technology. However, they are not willing to give the knowledge.

If you're trying to create a sustainable program, and the first one, which is technology transfer restrictions is a key aspect. This is what we look at in terms of true partnership.

One has always spoken about space debris. Obviously, more small satellites, more congestion that equals space security sustainability issues, which can equal more restrictions or resistance to these activities by emerging space players.

A problem that I see is that emerging space players, new entrants in space, universities, whoever it may be, tend to start with the smaller satellites which, honestly, tend to end up as debris. This is the problem that we have to look at.

How can we, I would say, empower the smaller countries to get into space using smaller satellites, but make sure that they go along with the guidelines that would keep space as a sustainable asset.

One thing also that I see as a challenge is cooperation between the emerging state actors. If we look at maybe there's 60 or 70 different countries now that has space activities, but the emerging players are not cooperating with each other. They want to cooperate with the big player. They want to cooperate with NASA. They want to cooperate with ISA.

I believe if they start to cooperate with each other, we would be able to solve some of these issues. Each emerging player would go through the same process and repeat the same, let's say, way of entering space with smaller satellites, etc.

Obviously, there are opportunities. I think successful technology transfer programs can promote best practices in the space domain. I use the UAE as an example on that.

If you have participated or cooperated with an existing space nation that is a responsible player, then by default, you will take that same route. I think countries that are either from the government level or they encourage their private sector to support and cooperate with emerging space players very openly.

That will create an environment where best practices in space will naturally go down to the new actors in space. Also, another key aspect is cooperation. Cooperation can increase the benefits to all. We would be able to achieve larger, more expensive projects. Easier, ISS 2.0 with emerging nations' participation.

Going forward, if you're looking at the next 10, 15, 20, 30 years, if we have a very large-scale project, like the ISS or whatever it may be, and we include all of these players, that would obviously really helps us towards being able, first of all, to achieve such a large project but, at the same time, keep those emerging space nations.

Number one, interested, so they're having an active space program. Number two, they would really not then go to, maybe, some of the activities that could be classified as not responsible.

Another aspect I see is new space entities or new space...Basically, the private sector have many synergies with emerging government space actors. This can be an opportunity for both. In UAE's case, we're pretty much open to cooperate with all nations, which I think has really helped in speeding up our activities and goals.

My last slide, in summary, I would say emerging and established actors need to agree on what constitutes acceptable behavior in space, or their combined activities may threaten the long-term usage of that space. Cooperation and partnerships, I believe, are very helpful and key to supporting best practices and support the responsible use of outer space as they build trust and strong relationships.

Maybe I'll end here with a question or a comment. I didn't speak about this. UAE has announced they plan to set up a colony on Mars by 2117. Obviously, it's going to be doing that through international cooperation. What I would say is could this be the start of that ISS 2.0? Could this be a partnership of all nations new and old? Thank you very much.

Michael: Thank you very much, Salem.

[applause]

Michael: Also, congratulations for being the kind of example of the new actors that every time I've gone to the UAE, I've seen representatives of other countries. They're trying to learn from you. While you learn from your partners, you're obviously partnering with people who are learning from you. Congratulations to that.

Salem: Thank you.

Michael: Pete, in some ways, SES is an example of what which we're saying about being a seasoned actor. Let's not say an old actor.

[laughter]

Michael: It's done a number of really new things. You were at the founding level of the Space Data Association. You've taken O3b under your wing. You're a company that can speak from both sides of the spectrum, so let's have some spectrum analysis from SES.

[laughter]

Pete Hoene: That's a great introduction. Thank you very much, Mike. Thank you for the opportunity to be here. My name is Pete Hoene. I'm the president and CEO of SES Government Solutions. We're a wholly-owned subsidiary of our parent company. SES is headquartered in Luxembourg. We operated under a proxy board that allows us to do business with the US government up to top-secret and SCI-level work.

We have a proud heritage, to your point, Mike, 40 years of service from back in the RCA AmeriCom days to where we are today. That was in the late '70s to here we are today. We have, I would say, a foot in both camps, quite frankly, a foot in the camp of a traditional space actors, seasoned veteran, if you will, as well as a new space actor.

If you look at the set of satellites, we have 54 satellites at GEO. We have 12 at MEO, Middle Earth Orbit. That's the O3b that Mike mentioned.

O3b is a euphemism for "other three billion" that doesn't get serviced by the traditional GEO actors. It's a zero-degree inclination. Basically, we're orbiting around the equator and providing services at those customers that need that type of service. One of things that I think is absolutely critical as part of this discussion...I appreciate you teeing-it-up here, Mike, and the Secure World Foundation.

As a traditional actor, we have been able to work very effectively with other actors. It's absolutely in our best interest to coordinate with other space actors. For example, if we have a problem with the Eutelsat satellite, we need to be able to work that out very, very quickly. Our livelihood, our survival, it depends on it.

Furthermore, we have a lot of US government customers that rely on our service in the heat of the battle. Impact of the interference, whether it's purposeful or accidental, is devastating in terms of our support for those warfighters. Just imagine being an arm's away and not having the ability to communicate effectively.

One of the things that we're a big supporter of is establishing norms of behavior. As a traditional actor, to be able to support that...I liked you comments, Audrey. I think that the Department of Defense is, what I would say, a very...Probably the best to say it is it's a benefactor for everyone. They're looking at it in the sense of, "How do we go ahead and make sure that all parties continue to operate in a peaceful domain in space?"

One of the challenges, as just an example, that we face -- economically, this is huge -- is we have anywhere from 30 to 40 transponders that are impacted by interference every day. You say, "OK, what's happening?" Well, a transponder equipment's roughly 36 megahertz. That means we're talking about, let's say, 1.4, 1.5 gigahertz of capacity impacted.

What does that mean economically? One transponder is roughly $1 million per year. Think about $40 million worth of impact based on purposeful or unintentional interference. We've got to be able to do things better. We've got to be able to coordinate and identify, characterize and mitigate interference events very, very quickly.

Furthermore, there are threats out there. You've heard at this symposium that Chinese and the Russians pose a clear and present danger not only in LEO but in MEO and in GEO.

The question is, how do we behave in a responsible manner, to Audrey's point earlier, that ensures our global commerce can continue to excel and grow? If we have those kind of threats, especially at GEO, it's going to cloud...Let's just say an ASAT.

The destruction of satellites at GEO, the debris cloud will fundamentally change our global economic picture. It's just almost unconscionable to me that we would have that kind of scenario. There's certainly capabilities out there that pose that threat.

We've got to be able to collaborate as you pointed out. I think cooperating and collaborating is huge being part of the mission partners, the Space Data Association, Space Situational Awareness at large.

If you look at what the JSpOC is doing and what we're doing with the JSpOC as part of the commercial integration cell, we help the uniform members on the floor, the JSpOC, identify, characterize and geolocate EMI and RFI events as well as conjunction analysis.

We have tools and processes, procedures that help them in that regard. Then we go ahead and notify our parent companies whether or not they need to maneuver a satellite to avoid the impact of close approach.

Without that kind of capability, it's...You really need to see the COMSPOC. I'm putting in a plugin for them. The whole Space Data Association, the things that they do to track up objects in space is absolutely critical to our long-term health and well-being. One of the other things I would say about SES Government Solutions and SES my parent company weren't innovator -- first, to GEO on SpaceX.

First, just to GEO, one SpaceX with a reusable first stage. We have a number of different string of successes in hosted payloads, commercially-hosted IR payloads for Department of Defense launched in 2011. Magnificent success.

We have a satellite down at Kourou, French Guiana waiting along, assuming that the strike will ever end there. That is going to have an FAA Wide Area Augmentation System payload to help the FAA with vertical and horizontal separation and landings in difficult conditions.

We have another satellite. It's for NASA. Hosted payload on satellites for NASA could be launched later this year for a re-sensing mission. We've taken it to the next level at the GEO belt. With O3b at MEO, we have what I would say is one of the more innovative...Maybe this is where the new space actor comes in along the more innovative activities and capabilities than no one in the space industry.

It's not well-known. The MEO belt is actually not as congestive and contested as the GEO and LEO belt. When you look at OneWeb, and Boeing, and SpaceX at LEO, there are going to be thousands of satellites. Right now at MEO, we have the benefit of a less congested, less contested environment, and with O3b, a very high-throughput, low-latency capability.

The point where we can transfer 100 gigabits of data in about 25 minutes...Just think about it. It's an unprecedented. Where we have the Department of Defense with very high intelligence surveillance, reconnaissance, bandwidth needs, we're able to support those needs with that high-throughput, low-latency. The latency is roughly equivalent to 125-130 milliseconds.

With that, I'll stop and say that I think that there is absolutely a need for these types of venues. We deeply appreciate your leadership in this area. Thanks for the opportunity to speak.

Michael: Thanks for being here, and also get this from you. Thanks for being here. Thanks for being part of the old and new guard at the same time. This is useful. I think if we really realize how the sector is...It's not reinventing itself but evolving in a very, very interesting way in terms of the combination of new ideas and older approaches. Again, thank you for doing that.

I'm sort of bursting with questions, but I think to be fair to everybody who has devoted their lunch time to this forum, I'm going to give you the first crack of questions in the audience. Are there questions out there that you would like to bring to the panel as a whole or to anyone member of the panel? OK. Victoria.

Victoria Samson: When you organize a panel, you get to ask first question at the panel.

Michael: Oh, right.

Victoria: Hi. I'm Victoria Samson, Secure World Foundation. Actually, I have questions for two of the panelists, Salem and Pete. Salem, I'm curious has the UAE looked at cooperating Russians and with Chinese on your space program.

Pete, you mentioned there's interference in how much making in your company. If you were king for the day, how would you make an international system fix it short of making them stop interfering, of course. Thank you.

[laughter]

Salem: We have activity cooperating with the Russians. Some of our satellites have been launched on Russian rockets. We do have discussions with them. We have a framework agreement between Roscosmos and the UAE government. That does exist.

With China, we don't have anything concrete. Nothing in terms of an agreement has occurred or as, let's say, some technical contracts or something has been bought. Really, Russia, yes. China, no, at the moment.

Pete: With respect to interference, we have the ability to identify, characterize, and geolocate the interfering event. That's not the issue. The issue is once you determine where that interfering event is, whether it's purposeful or accidental, what do you do about it?

The ITU is not an organization that can resolve that kind of problem for you. It just takes too long. I mean, they're well-intended. Certainly, the norms of behavior that they aspire to are well-founded.

I look at this as two or three steps in continuum. The first and foremost is identify the interfering party and notify either the interferer or the satellite owner or operator that's supporting that.

For example, if we have a SES satellite or Africa and we're being interfered with because of a very small dish operating on a Eutelsat satellite that's two degrees away. They're just spraying energy because they're not properly peaked and poled. They're not practicing good satellite operating techniques.

What we would do almost immediately is to go to Eutelsat to get down to shut down that offending party. Absent Eutelsat doing that, then we try to figure out who that offending party is. We try to go to them in parallel. In general, we end up working it out with the other owner or operator pretty well. Eutelsat, Intelsat, SES cooperate and collaborate a lot of these different types of events on a regular basis.

What if it's purposeful? What do you do about that? The easiest thing would be if this is in support of a wartime mission than if it's a Department of Defense mission, that they can identify and take that offending actor out somehow.

I'm not sanctioning that. I'm not suggesting it. I'm just saying that that's a possibility. Shutting that offending carrier down at the operator level or doing other means to go ahead and resolve that issue.

What I see as maybe a bigger issue with the proliferation of submeter VSATs...Think about the lottery networks. They're .85 meter and sometimes, even smaller.

There will be tens of thousands of these in the United States, as an example, all trying to access a satellite without proper peaking and poling procedures and proper operational discipline. What ends up happen? They spray energy to adjacent satellites that causes significant disruption.

We're facing that almost on a daily basis. We stay on top of it. We go back to that company and say, "You need to go ahead and shut this down, or else we're gonna figure out other...Whether it's legal, or at the crack, or working with the sponsor of that particular activity." I'll stop there. Thanks.

Michael: Other questions? Yes.

Male Participant: Hi. Thank you very much for that great panel and also the Secure World Foundation for today's lunch. I have a question about the UAE. You were speaking about your strategy.

I was wondering if you might be able to give some information on a national space law, whether this is something that is already in place or if there are currently plans to enact a piece of national space law. Related to that, what would be your priorities within that?

Salem: The UAE Space Agency was established in 2014. They are the ones that are in charge of that. Currently, we've launched a UAE space policy. I believe that was launched last year. This year or the beginning of the next year, they will launch the space law. It will be approved pretty much soon.

The content of that space law is in line with international norms. There's regulation of entities that are in UAE and how they're acting and ensuring that whichever entity is under UAE flag is a responsible entity, in line with some of the UN guidelines and aspects such as that. It should happen very soon.

Michael: Other questions? Yes, right there.

Debra Werner: Hi. I'm Debra Werner from SpaceNews. I'd like to ask the panelists what you think of the rule that satellite should move out of orbit 25 years after the mission ends. Will that be good enough as space becomes more congested?

[background sounds only]

[laughter]

Debra: Thank you.

Michael: Whoever has more satellites.

Debra: Thank you.

[laughter]

Audrey: I'm not going to speak to the technical merits of the 25-year rule. I do know that it is being examined by a number of folks. There is talk about whether that's too long. I think actually what's important is essentially to be a responsible operator, and to think about the lifetime of your satellite and its lifetime after its operational mission has ended, and ensure sure that you don't leave your satellite up there to create a hazard to other operators for longer than what's really necessary.

I don't want to come down in one place or another in terms of the specific timeline, but I think the idea, the intent of the 25-year-old remain sound.

Rich: I think something that we think a lot about is -- I'm not going to articulate this as well as I wish -- the idea that you utilize and operate in the environment only as long as you need to be in

the environment. If you got a five-year mission, you should try to be in the space for five years. Different time frames would be different.

The "25-year-old" may or may not make sense in that if you take it to that kind of principle, or it might be perfectly fine, or you might find that there's no more "X-year rule." Rather, there's a more subtle or nuanced review of beginning to end-of-life operations.

What I would say is that whatever that kind of emerging principle is, all parties should endeavor to follow that principle equally so that commercial and/or university and/or other kinds of players aren't doing their best to achieve those goals and live in that principled world and others are.

[off-mic conversation]

Michael: I saw other hands.

Pete: Hold on. I'd like to respond to the question.

Michael: Wait. There you go. You're ready to go.

Pete: I believe that as one of the largest, if not the largest global owner/operator, we have a pretty responsible set of norms and behavior, basically that we've been using for the last 30 to 40 years. We design our satellites for about 15 years of life.

In some cases, we go ahead and super-sync those satellites when they get to that 15-year end of design life. We take it out of the slot to clear the orbital slot and box for other satellites.

In the event that we need that satellite specifically for a continuing operation, we go ahead and often stop north-south station-keeping and put it in an incline mode for a few more years. In general, then, what we do is we super-sync that satellite as well.

Our pattern of behavior, and I think it's very responsible, is to go ahead and super-sync those satellites that are no longer being used so that they don't end up being orbital debris and cause problems in the orbital regime. Does that answer your question?

Salem: Can I also add that I think once your satellite mission is complete, I think then you need to get your satellite out of orbit. To use your traffic analogy, when your car breaks down, you don't just leave it in the road. Then we'd have congested roads.

I think there should be maybe a cost-effective technical solution, especially for the smaller university satellites that are like one cube. How can you put something in there, either a propulsion or a deorbit mechanism that's cost-effective so that the new entrants can then easily implement that and deorbit their satellites after end of life?

Michael: OK, your turn.

Chris Lee: Chris Lee, UK Space Agency. A question that is often used in these constant discussions is best efforts. One of the real challenges we do see is that the speed of the new space community is moving at such a pace that governments simply can't react as quickly as new space

would like. On the other hand, governments recognize that they have to have some degree of regulation.

It's not just simply an open market. Space is actually a constrained environment we need to protect it. Whilst I think space agencies and other regulatory bodies must move faster and they must commit themselves to moving faster. Is it also fair to say that the new space actors must accept regulatory burden could come at a price?

Rather than best efforts we actually had legal consequences for example not removing your car out of the road will actually cost you a lot of money. The best efforts goes so far, can we turn it into something much more transactional?

Michael: Sounds like we have the right people to answer that question. Why don't we hear from folks about best efforts versus a more deliberate, more focused regulatory environment?

Rich: What I think you're speaking to specifically is the idea of incentives. Is there a structure in place that creates incentives beyond the good will of the operator to behave in a particular way? I think you asked your question in two phrases where you said, "New space actors need accept a certain amount of regulatory oversight." The answer should be yes.

There is what I was saying before it's still a place like nuance and subtle approaches to do it right so you don't harm innovation and economic opportunity has got to be kept in mind. Therefore, speed on the regulatory front well maybe it never will happen. Doing something too big or too broad or too overzealous too soon is certainly not what anybody wants and nobody is advocating that.

Then I wouldn't go so far as to say the solution that makes sense is financial penalties which you proposed. That might be a tool in a toolbox for certain things that have to be regulated, but instead what you're really talking about is, is there a way beyond the goodness of somebody's heart to decree incentive structures for people to behave a certain way in concert with norms and in a way that has relevance outside of what would otherwise be good for their own business purposes.

Whether you're a longstanding actor doing new things, as my colleague at the end of the table or whether or not you're really brand new as some folks who I've seen in the audience today, we all have a need to maintain the quality of the department.

What's the unique incentive that would be in place in way that you describe that would be useful, and purposeful, and effective, and efficient as compared to the incentives in place inside a commercial organization's desire to maintain an environment because it's the environment through which they generate profit, revenue, and setback.

I'm not saying the answer to your question is strictly no, but I think the question is how do you intelligently develop the right incentives that don't duplicate or unnecessarily just add inefficiency to the system than existing inherent incentives would do just fine.

Male Participant: You want it?

Male Participant: Yeah.

Pete: I think that there need to be a range of options and those range of options could be best effort starting out, but could then have thresholds by which if they don't respond that you escalate to include financial implications. I'm not sure what all of those options are.

I think we should have a range of options to address and have predefined thresholds by which we go ahead and determine the escalation of those options.

Michael: Let me jump in here with a follow up question. Just how resilient are your operations literary across the board to the situation that Audrey mentioned that a collision in space is a bad day for everybody?

We talk about incentives, we talk about the need to protect the environment, but we need to connect these two a collision in space to at what level does that make your operations unattainable or non-resilient? How much of an incentive is that to a deal with some rules of the game that provide predictability?

Maybe start at the end, Rich. Obviously, you guys will have a lot of assets. Not huge, but a lot of assets. How challenging is it the debris cloud in your orbits?

Rich: It's very challenging. I do not want to get in a discussion of like the mathematical aspect of a percentage of those, the size of the debris cloud at a particular order or anything. I think it's in our capacity to do whatever in response. I think that in some respects that's a good conversation to have and we have done some analysis and we think about some who are doing analysis.

We talk to our friends at the DOD all the time as we're going through certain regulatory things about stuff like that. The truth is that we operate and maintain the principle that we want to be as close to zero bad days as possible.

What I'm I trying to say that anything is bad, any collision, any incident like that is bad and we want to be the best actor possible to not contribute, to help again a community understand how what we're doing is what we think is good for the environment how we can help others understand what we're doing.

We believe in things like openly publishing our estate, for example. I'm a little hesitant to jump into a detailed answer, Mike, in part because I feel like when you start opening the door and thinking about how resilient are you to a bad day and how bad is really bad if it's going to be a bad day.

You maybe start down a road where you forget about that day. Wait a minute, we don't want any bad days and what's the thing to do to make sure that we avoid them in the first place.

Michael: That said at least it makes it pretty clear you guys are thinking pretty hard about these issues and something we want to avoid is people up there with a lot of assets not thinking hard about these issues. Salem, my comment or question for you KhalifaSat, as you mentioned, is a source of major national pride to the UAE.

How much time in the planning for its eventual launch to do you have to invest in the planning for its eventual launch do you have to invest and making sure you don't have that really

frustrating experience that Ecuador had with putting its first satellite in orbit only to lose it to a debris field in a week?

Salem: Obviously, that's a good question. We do put some time. What I would say openly when we look at the progression that we've had with our different satellites. As a space entity now currently we have three in orbit and with the first one it's a nonissue. You're not thinking about it at all. You just want to get into space.

Then second one you're starting to understand the community, how things are, the environment and start to become an issue that you start to pay more attention to. Then with KhalifaSat, as you mentioned now, this is the first satellite to build. That's a worrying fact. First of all, you're worried about the launch.

You're worried about your operations and anything that happens to that satellite seeing that it's the first one that's built domestically there's always going to be a lot of eyes on it, the ,"OK, it wasn't built correctly," or something like that. It could be debris or something that's affected it.

We do put a lot of thought into it, but just to show you that progression that when we started early on in 2005 actually we weren't really thinking about that. Now it's a key issue for us.

Michael: Thank you.

Pete: We have 54 satellites GEO, so we have to address this and it really depends on the nature of the collision. If it's a simple collision, a baseball size collision that doesn't destroy the satellite and break it up, but would go ahead and cause it to malfunction, then what we need to do is to have a backup plan to probably super-synch that satellite.

I'm speculating here, but really, we want to get it out of the orbital regime and that scenario. What we do is we have a free management plan that allows us to move satellites in those scenarios to go ahead and accommodate contingent service at that location.

Now when something more catastrophic like an ASAT at GEO would fundamentally change our entire global commerce. It is going to cause mayhem in space, and as all of us know we all depend significantly on space for everything from precision navigation, timing like GPS, and transactions at the stock market, from GPS to communications. It's going to be a bad day if that happens.

Michael: Other questions?

Female Participant: Like your focus on space debris. We focus primarily on the future missions, but we still have this remaining problem of all debris that's already in orbit. What is your position with regard to active debris removal?

How do you think it's going to be implemented if ever? How can they deal with those debris that are already in there and how can we apply someone to remove them or how can we allow someone to remove them?

Audrey: So we can? I'll just start and say, so you raise a really good point but I do want to foot stamp one thing which is that the most important thing that space operators can do is prevent the

creation of debris in the first place. I've seen a variety of different studies, but not enough detail to make any particular claim.

For me that's the most important thing is to just think about how do we prevent the creation of new debris in the first place. Now at the point at which active debris removal becomes something that is actually being seriously considered I think the most important thing to think about is how we make sure we do no harm.

If you're going to do a mission you shouldn't create more debris in the doing of the active debris removal then you remove through the execution of the mission. Active debris removal mission should follow the same norms and guidelines and standards that all other missions in space do, because that defeats the whole purpose of it.

Michael: Any other comments?

Salem: I think active debris removal could be looked at as a weapon as well. That's something that people need to think about.

Michael: It is worth pointing out? I think there's now an active debris removal mission announced by ISA that tried to bring down Indisat, but that's still 2021, 2022 target for doing that. Exactly what you say their biggest issue is how do they make sure they bring down this six and half ton piece of now defunct satellite then without creating more harm and without inspiring here that it's just Moonraker reinvented.

[laughter]

Michael: Other questions? I do have another one and what I'm interested in is to follow up a bit and allow you to lead on this, Salem. You made the comment that one of the goals of the UAE space program is to create the infrastructure that permits sustainable space activity.

One of these countries that is already using the UAE as an example comes to you and says, "What do I need? What's the infrastructure that would enable me to sustain space activity?" What's your answer?

Salem: My answer is very simple. For us it's people. If you've got knowledge, you've got people, you've got people that have been trained, that are either living in your country or they're part of your nationals then that's the major asset that you need to have a sustainable space program.

Obviously, there's many other things that come with that, but we're talking about a country that has the capabilities of buying components or whatever it is. For us it's really about the people that we have a strong group of engineers and scientists that are able to take the country to the next level.

That's why you see there's a big jump in the ambitions of the projects. Each one is bigger and bigger and that's depending on the people that we do have.

Michael: Your first investment is people and there's their tools that come with, their expertise grows?

Salem: Yes. That's from the start.

Michael: Rich, in some ways part of your comments about the challenge of working your way through the regulatory environments and learning that some parts of it are different than others means that you probably acquired a little expertise on this new infrastructure being developed in the US for government industrial communication and decision making about space missions.

You get to be king for a day and how do you structure that so it works well for both the social need and the need for your company to prosper?

Rich: I would actually say that if I were king for a day, all I would try to do is accelerate a lot of what's been happening over the past, I don't know, 9 to 18 months, wherein many of the people inside the niches of the regulatory regime have opened themselves up to more frequent and informal dialogue that enables shared understanding of sources of concern or just complexities and process or some combination of those two things.

I think there was a time when somebody who had a new idea would want to figure out what hiccups that new idea might encounter, had a bit of a Catch-22 situation where a response might be "Come talk to us when your idea is real and you're about ready to go." Somebody would say, "I don't know if I can actually get ready to go unless I know you guys are going to say this is OK."

I think the recognition of that chicken-egg problem or whatever metaphor you choose to use has led to much of the different buckets of regulatory folks being much more open to saying, "OK, you might be two years away from ever doing this or pulling it off, but what do you need to know about how we might respond or where we might need to engage with you sooner rather than later?"

I think that can be informal. It can remain that way for quite some time. It might be more efficient to keep it informal like that, but it's still that aspect of developing community and developing relationships that are the grease that turns the wheel.

Michael: I certainly would like to thank the panel for having given us as good an overview as I could have hoped for of what we mean by "new," what we mean by "actor," in fact what we increasingly mean by "in space." I think what we find is every one of us has that element of new and that element of seasoned in our thinking.

Hopefully, as we go forward, we're going to keep that edge, because I think it's adding an increasing level of excitement to the sector. It's bringing about new opportunities for interactions between the many communities that now make up the space sector. If you would, please join me in a hand for the panel.

Michael: Watch this space for next year's Space Symposium, where the lunch forum will probably be on yet again another topic, but hopefully one that will contribute to your success as we all work together to take us further, farther, and more interesting places in our work. Thank you very much.