

Globally Agreed Legal and Ethics Framework and Transformational Business Models Needed in Readiness for Forecasted Mars 2040 Landing

Global Aerospace Summit 2016

PANEL DISCUSSION:

GLOBALLY AGREED LEGAL AND ETHICS FRAMEWORK AND TRANSFORMATIONAL BUSINESS MODELS NEEDED IN READINESS FOR FORECASTED MARS 2040 LANDING

With celebrated US astronaut Buzz Aldrin predicting humans will be on Mars by 2040, new space players are calling for an international move towards establishing space mining and colonisation legalities and ethics in readiness for a Red Planet landing.

The call came at the Global Aerospace Summit 2016 in Abu Dhabi at a dedicated panel discussion probing the new generation of space exploration and asking ‘How Far Can We Realistically Go?’

The panel, moderated by noted journalist Joe Anselmo, Editor-in Chief of Aviation Week & Space Technology, included representatives of leading space players including: Vincenzo Giorgio, Vice President, Institutional Marketing & Sales, Thales Alenia Space; Steven Mirmina, Professor of Space Law, Georgetown University Law Center; Peter McGrath, Director of Business Development, Space Exploration, Boeing and Dr. Andrew Aldrin, Director of the Buzz Aldrin Space Institute and an Associate Professor at the Florida Institute of Technology. All panellists agreed a human on Mars would be a likely scenario sometime within the next 14 to 24 years.

PLUG THE LEGAL GAPS FAST

The panel admitted that though technology was gaining readiness, little had been done for ensuring an international approach to the many legal and ethical issues which could arise from space mining and colonisation of the Red Planet. Professor Mirmina explained that currently there’s no international law covering these issues and that States needed to get together before the situations arise. Peter McGrath said the matter was one of urgency if the international space communities were to make a global decision to put people on Mars permanently.

Samira Al Hajeri of the UAE Space Agency posed the question: What is the legality of space mining? Once again, said Professor Mirmina, the legalities were blurred. He explained that in December 2015 the USA passed a law that said if any individual could extract resources from space then once the resources were extracted they could essentially do what they liked with them. “They could sell them, they could bring them back to earth, they could keep them – so what they extracted would be theirs,” he explained. Yet the law differed from the Outer Space Treaty which more than 100 countries, all the major space faring nations, are party to. “Article 2 of that treaty says that outer space is not subject to national appropriation. So the question is, what is national appropriation? Some would say that national appropriation is if the US went to the moon in 1969, planted flags and said we claim this on behalf of the US – that didn’t happen. But the US did bring back lunar samples and Russia brought back samples; even Japan brought back some samples from an asteroid, so



there is an established state practice. The US law says specifically that the USA, when this becomes operational, will guarantee that it will follow international treaties. So what they want to do is provide certainty for private companies in new space that if they did go to an asteroid and mine it and extract resources, then they could keep those resources and sell them otherwise it wouldn’t be worth their investment.”



Vincenzo Giorgio pointed out that the USA had made a start on regulating space resources and Europe would follow soon but a globalised approach was the real way forward: “We have to play with the same rules because this deals with commercial operators getting into the business. If organisations believe that going to Mars and extracting some resources is going to be economically sustainable, then it’s right that they should do it. The point is, is it a US company, a Russian company, a European company or a UAE company? So we have to establish rules starting from the nationality one and then the commercial way of utilising them.” Dr. Aldrin added the rules of commercial competition also needed to be established.

NO GOING IT ALONE

Mr Giorgio’s panel participation came ahead of his flying for the launch of the ExoMars mission which is to land in October 2016 with a second mission, taking a rover to Mars to search for life, already planned.

“What we are aiming for after this mission is to build a future for Mars. What we need is an entire road map in

which everyone can bring their own building blocks and participate in this big enterprise. In my view there is no way we can do a return mission to Mars whether it's a simple return or with humans returning to earth, that can be done by one country alone. It can only be done with large international co-operation and when you have this kind of co-operation every actor needs to have its own added-value and its own building blocks. And that's what we are doing today: We are building, in defined phases of this project, the technology just to be ready for when this happens."

Peter McGrath agreed a mission to put a man on Mars had to be an international endeavour which may, he said, include participants we had not yet identified. "It may even include actors you are not thinking of today. When we started the space station a long time ago the cold war was still in effect and Russia and the US weren't getting along and the next thing you know we have an international space station that includes the Russian elements. So there's a lot of things possible when you talk about going to Mars. The other thing is when you look at the international community today, everyone agrees that the ultimate destination is Mars. The only debate is what's the next step and how long until we're getting there. I think where the debate typically starts is around the moon. From a NASA perspective and the US perspective they've been to the moon and they're not interested in going back. Their focus is either an asteroid mission and then getting to Mars, but when you look at the international community, you talk to Russia and the Europeans, there's a lot of interest in going to the moon because they haven't been there before."

"So when you look at the architecture at least that NASA and the international community has been working on together, it talks about the next piece being a destination in proximity to the moon that allows the flexibility for international partners to go to the surface of the moon but also is a staging point to go to Mars. I think you will come to see that evolve as probably the next piece."

NEW SPACE TRANSFORMING BUSINESS

The panel said the legalities were lagging behind new space business transformation with Peter McGrath defining new space as a fresh governmental means of reaching out to industry as to how they are participating in the space market. "What you are seeing more of today is more of a public-private partnership when you look at commercial crew and commercial cargo. The government is still putting up the preponderance of the funding but the difference is

that it's a fixed-price contract to us, the commercial provider. So they are buying services. We are taking on the development risk in terms of costs and scheduled growth will roll onto us." He added that commercial companies are taking over the government traditional role which allows the government to reduce service costs and concentrate on technology development.

But for Professor Mirmina, new space is more of a contractual mechanism. "It could also be defined by who the actors are and what the activity is. So in terms of who are the players: there's Blue Origin, SpaceX and Planetary Resources just to name a few deep space players. In terms of the activities, there's the commercial transport of humans to outer space and with the new contracts that are coming up for the very first time, private companies are going to bring astronauts to the space station – that's certainly new space – and if we are ever going to talk about colonies on Mars or asteroid mining, you can define the term by activities as well."

Vincenzo Giorgio though begged to differ saying new space means new models, not contracts. "And just to be very clear," he said "new space does not necessarily mean new actors. New space means new models which can bring new actors – it's a consequence, but it is not the starting point." One example, he said was the fact that Thales Alenia Space has been building half the habitable volume of the international space station using the old model of having substantial government investment just to build a single piece. Now, he said, that experience was being transferred into a more commercial venture. "Into a service provider like the crew resupply services contract, which is a commercial contract, and which has put us as an actor in this commercial environment, rather than being forced into it by a government institution within the business. And the same can be applied to any other future enterprise. The thing that makes the difference is when you want commercial actors to come in, you have to see what is the interest of those guys either to invest or build new things and that makes the difference."

A WHOLE NEW BALL GAME

For Dr. Aldrin new space meant a whole new approach. He cited an example of Moon Express building a 1000lbs engine with a total new cycle, which had never been done before, using clean sheet design in just four months. The example, he said, proved a heightened delivery mentality in the development cycle when investment money had to be found. "You had to do things because if you didn't get something done, you wouldn't get investors coming in for the next round of investment." New space he asserted is "about creating new entrepreneurial companies and they are different. And in some ways its enabled by the technologies of miniaturisation and CubeSats and the fact that we can build satellites and we don't care if they only last a year because we can launch them at a fraction of the cost if they're going up literally hundreds of space craft at a time or they are flying as secondaries. There's a lot going on here and a lot of it has to do with finance. We have money coming in from private corporations, not just venture capitalists but wealthy investors. You have institutional investors, like Fidelity, so there are a lot of things in new space and there's an energy there that's reaching a critical mass and is going to be offering different ways of doing things in space. And a lot of it is



hype – I'll be honest with you there's a lot of hype around it but there is, at its core, a different sort of development process when you have to go out there and scramble for money."

One participant challenged the idea of sending small craft into what could be congested space. Dr. Aldrin admitted there were challenges adding that there were norms covering the issue but the industry needed to be more rigorous about them to avoid "a real danger of a massive space debris." Vincenzo Giorgio pointed out that while there was no fixed regulation, Thales Alenia Space followed the clean space requirements so that every one of its satellites at the end of its life had enough fuel for disposal.

Professor Mirmina said the era of 'spacepreneurs' had come. "What I see is more of the prototype mentality with a lot of the entrepreneurial spirit versus more of the engineering focussed approach that's more the traditional model." He said in new contracts there was a kind of melting of old business models and new: "because you are seeing a prototype being driven by a lot more rigorous design process and you are seeing the rigorous design process being pushed back to a less constrained process. But the key is finding the right balance where, especially as we are talking about humans, you don't sacrifice safety and that's where the prototype side tends to be a little more risky than the top-down engineering side."

Dr. Aldrin said the acid test lay ahead: "The magic is really going to come when you have real commercial customers. Much of what we have talked about is still the government simply executing different kinds of contracts but if Virgin and XCOR are successful and they really do have commercial customers, then it's going to be a very different sort of animal, it really is."

TAKING A DIFFERENT APPROACH

For Vincenzo Giorgio there needs to be a whole new approach. He said manufacturers were used to working with an extremely high reliability factor which drove up costs and schedules but a reversal was needed. "The way we have to change is to come closer to this new environment and its new actors, for them to help us, which is the other way around, to start thinking of a different model. I mean companies going into this megaconstellation business don't want a reliability factor of 0.999, you can rely on things that can break but you can easily replace. It's a mentality point that with most of the traditional space industry is going to be very difficult to get. And we are trying, as companies, to come closer to outer module manufacturers just to try to get a different model which is working with less reliability but with serious high process."

Dr. Aldrin also wanted to challenge mainstream thinking particularly the debate about building on what we have to get to Mars. "I think we have to flip that around if we want to make real progress. That is what do we want to do when we go to Mars? Do we want to plant flags and footprints or do we want to be a multi-planet species? Do we want to be on Mars permanently? And if you answer that question differently you end up building different things. I also think it's a false economy to say its moon or Mars. If you are serious about going to Mars, you've got to



get stuff off the moon. You have to start with a real programme and decision: do we want to be on Mars permanently?"

Though largely in agreement Peter McGrath sounded a warning against putting an unknown technology barrier in the way of the ability to get to Mars. "Otherwise," he cautioned, "we may never get there. What I struggle with is when I hear things about mining the moon for oxygen and hydrogen and if you are going to base your whole exploration trajectory on that you will fail, because there's not enough that we know and we haven't demonstrated our ability to do it yet. I am OK with building an architecture that gets us there, we'll discover it, and then augment the architecture going forward. I'm not OK when we start to make it the anchor in the architecture." Dr. Aldrin believed the answer lay in good systems engineering. "If you are serious about a permanent presence on Mars you probably look at lunar resources as a critical path," he said. "You need to go figure that out quickly because if you end up with the wrong answer there, you'll end up with a very different Mars architecture."

GETTING DOWN TO BASICS

One participant agreed that reasoned outcome had to drive decision-making and asked panellists for the overriding rationale of going to Mars. Vincenzo Giorgio said there were various reasons including the chance to run technology which could be of benefit later down the line. "Today, in studying how to live on Mars we have been able, in our labs, to recycle something like 85% of liquids and you can immediately imagine how important this is going to be in our world where we don't take care of our own resources," he explained. "The other point is to understand how this planet works. To a certain limit robotic missions can help but there's a moment from which humans are necessary. Making an outpost there allows us to study the planet, allows us to understand what went on there which makes Mars so harsh to live on and how it's probably most similar to our earth." ■