Meir Moalem, CEO of Sky and Space Global ● ● ●

Connecting the world

Incorporated in the UK in 2015, Sky and Space Global plans to launch a constellation of 200 nanosatellites into equatorial low Earth orbit (LEO) for narrowband communications. With inter-satellite links and the ability to autonomously monitor and manage satellite health and the in-orbit communications network, Sky and Space Global is set to shake up global communications. Amy Saunders met with Meir Moalem, CEO of Sky and Space Global, to learn more about the company's plans and market assessment.

The core Sky and Space Global business is to construct a communications infrastructure based on nano-satellite technology and develop the highly complex and sophisticated software systems that will deploy, maintain orbit control and handle communication code between each of the nano-satellites to give a global coverage.

Sky and Space Global aims to provide low cost, nano-satellite communication coverage on an anywhere to everywhere base with relatively low maintenance costs. Due to the experience and expertise of the founders in the aerospace industry, the business will be able to develop inherent upgrading capabilities within short intervals, utilising their unique IP-nanosat software protocols.

Question: From the outside, Sky and Space Global appears to be well on the way to developing its own unique satellite constellation. Can you tell us more about the company's vision?
Meir Moalem: Sky and Space Global will connect the unconnected. It's a very innovative, disruptive NewSpace company based on nanosatellite technology that has set out to provide narrowband communication services. We're talking about voice conversations, text messages, instant messaging, machine-to-machine (M2M), Internet of Things (IoT), to anyone, anywhere, anytime.

At the moment, we're focused on the equatorial region, because there's currently no infrastructure there. If you try to provide narrowband services in London, nobody would use them, because you can use your phone to connect to the Internet. But, in the equatorial region, there's almost nothing. That's where the market is, that's where the demand is, and that's where we're going to be.

Question: June 2017 saw the launch of the 3 Diamonds nanosatellites. What can you tell us about these three satellites, what they've achieved so far, and what they mean for the planned constellation?
Meir Moalem: It's an interesting story. The 3 Diamonds satellites were a pathfinder mission; they were supposed to be technology demonstrators to help us gain further investment for the constellation. They were designed to be very small and very efficient, but also able to deliver narrowband communications services. Most notably, they were built to demonstrate inter-satellite communications, which is key to building a satellite network. No one has created inter-satellite links between nanosatellites before: We're the first.

As we started to negotiate with potential customers, they asked whether they could procure services on the existing 3 Diamonds nanosatellites, even though they're only passing overhead once or twice a day for several minutes. So, the 3 Diamonds satellites became actual commercial assets, as well as providing validation for the business model by proving that people are willing to pay for these kinds of services.

We've achieved a long list of world-firsts with the 3 Diamonds satellites. The first ever text message, voice recording, phone call, the first email, data transfer, data store-and-forward, financial transaction, cyber-security measures, and inter-satellite links. All of those were

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world-firsts for nanosatellites. When we started the business several years ago, we were told it was impossible, that you couldn't do a phone call over a nanosatellite; we've proved them wrong.

Question: What can you tell us about the full constellation plans?

Meir Moalem: Our satellites are being manufactured by GOMspace in Denmark; we have a contract with them to develop 250 satellites. We plan to start launching a year from now, and by 2020, we'll have the full 200 required for the low Earth orbit (LEO) constellation in space. At first, it'll take a time to manufacture each satellite, but towards the end of the process, we'll be producing two or three satellites each week. We're building a production line, and once it's working and we've cleared out the early problems and technical issues, manufacturing will really speed up.

The constellation latency is expected to be very low,. Of course, latency is only really an issue for phone calls, it doesn't really come into play with the other services we provide. Latency comes not only from the location of the satellite or the relative distances of the satellites, but also from the hardware and software involved. It's all about how the data is processed, encoded, and compressed, and that's the biggest challenge. We're working very hard to ensure we're very efficient.

The satellites will operate over S-band; we're not selling the customer bandwidth or throughput, but availability. Our promise to our customers is that when they try to use our service, we will provide the availability. It's the same as when you make a regular phone call – you don't know what the bandwidth is, all you care about is that it works when you need it. Because we're providing narrowband services, we don't need a great deal of spectrum; we only need a few MHz, and we can squeeze millions of network users onto this very narrow slice of spectrum, over the entire equatorial region.

The inter-satellite links are based on S-band as well, using a small flat panel antenna. We've tested them up to 3 Megasymbols per second on the 3 Diamonds satellites, and I think they can achieve more than that. The links work over distances of 500-1,000km.

On the next generation of nano satellites, the Pearls, which are a slightly larger satellite with a more advanced payload, we think the links will work over greater distances still, which is more than enough for our purposes. The challenge right now is the ground devices and connecting many end-users to the network.

We have a contract with Virgin Orbit to launch our satellites – we've acquired four dedicated launches, and we have the possibility to buy more. I think we'll be looking at around 20 satellites per launch, but of course it depends on the actual performance of Virgin Orbit, which we won't know for sure until they do their first launch. It also depends on the final mass of our satellites, which are still under development.

Question: The satellite market has seen a great deal of change in recent years, and Sky and Space Global is poised to be a part of that. What's your assessment of the market today, and where will Sky and Space Global fit within it?

Meir Moalem: There are around three billion people living in the areas we're

SAS constellation (by SCISYS) ●●●

looking at i.e. Africa, South America and Southeast Asia. Those are areas with either no infrastructure at all, or poor infrastructure. It's a huge market: Demand is there, and it's growing. There's no foreseeable future for deploying terrestrial networks in these areas, it's just too expensive. That means that the only way of providing connectivity is through space.

There is connectivity provided to those areas right now from space, but it's too expensive; for phone calls, you're looking at US$1-2 per minute, on top of fees of around US$50 per month just to have that connection. It's not really affordable for the people. However, it's not just about the individuals; it's also about the corporate entities, the businesses, the governments. They all need connectivity as well.

The market is growing for both narrowband communications and other applications as more and more IoT and M2M devices are deployed all over the world.

We're the first company to provide these kinds of services, and we're also the most advanced. The other constellations we're hearing about are mainly for M2M and IoT, which is a very small part of what we do. We believe the market is big enough for multiple players, for a lot of companies to step in and still be able to resell their services. We're very different from companies like OneWeb or SpaceX because they're planning to sell high speed Internet, which is a different kind of service that requires expensive ground infrastructure which isn't particularly mobile. It's an entirely different market to ours. Traditional space industry constellations require billions of dollars to develop systems, while we, as a NewSpace company, only need tens of millions – that's quite a difference. Traditional space industry constellations are also looking at much longer lead times before they're operational, while we'll be fully up and running in the next two years.

Question: Interest in NewSpace is booming the world over, but opinions are mixed on what it all means. What's your assessment of the NewSpace movement?
Meir Moalem: We're building our company based on NewSpace technology. The nanosatellite tech-

nology has really matured: I think that two or three years ago, people were talking about nanosatellites as 'toys for boys,' or objects for students to explore, with no commercial viability. But they've matured, and nanosatellites are very reliable today. Our 3 Diamonds satellites, for example, have been working perfectly for almost a year now, and another nanosatellite, key management people from SAS were involved in that was developed by High School students, is still operating perfectly in space after three years.

Nanosatellite technology has reached a point where you can actually do something with it. The question is, can we build commercial applications for nanosatellites in space? We believe that we can. Planet, for example, believes that it can provide remote sensing capabilities with nanosatellites, and they're doing that. I think the future is really promising.

Question: The digital divide remains a pressing issue throughout much of the world; do you feel enough is being done to address the issue, and how will Sky and Space Global attempt to tackle this problem?
Meir Moalem: It's an opportunity because it's such a pressing issue. If you solve the problem, or at least provide a partial solution, you're improving your business. If you're connecting more people, your business develops.

My PhD dissertation is about space programmes and their importance, and there's a chapter about the information, communication and technology (ICT) revolution. In today's research, there's a lot of proof about the benefits of ICT; with connectivity, there can be better healthcare, better education, improved financial systems and government organisations. Everything is improved with an ICT infrastructure.

The areas that we're talking about have almost no infrastructure, so just imagine the possibilities once they do! If you have an infirmary manned by a paramedic or nurse with no ability to consult with a medical doctor; with connectivity, they can make a call to a doctor, or send a photo of a medical problem, and can be advised on the best course of action. How about a government which has no idea there's been a flood in a remote location? With

connectivity, not only can the government be aware of what's going on, it can receive an early warning to warn people to evacuate the area.

We believe that, not only because of what we're doing, but other providers as well, we can create a major leap in the existing infrastructure that will improve the ecosystem in these countries. That means these areas can expect an economic boom.

As for the power requirements for devices and infrastructure, solar panels are probably the answer. For your phone, for example, you can get a small folding mobile solar panel that you can charge from anywhere. More and more in Africa, people are installing solar panels on top of their houses because it has become quite affordable. It's a circular process: No one is investing in power supply in these areas because there is no demand, but if you provide an incentive for people and companies such as connectivity, then the pressure to build power supply infrastructure increases. It works both ways. We're creating an incentive for the economy to improve, which in turn improves our business.

Question: What's on the horizon for Sky and Space Global in the near future?
Meir Moalem: I'd divide our plans into three different channels.

The first is the technology channel; developing the satellites. We're almost at the Critical Design Review (CDR), which is the step before actual production. Once we've passed that, we'll have a high level of confidence that our plan will work. We expect this in the very near future.

The other channel is the commercial channel. We're talking to additional customers and trying to develop new agreements and finding out what customers are willing to pay. Moving out of our comfort zone in Africa, where we already have a lot of agreements set in place, we've moving on to the Americas and Southeast Asia.

The last channel is the funding. We're talking to investors and strategic partners, and we strongly believe that we can acquire the US$100 million that will secure our constellation. This is not required all at once, and a lot of options are on the table, so I am confident we will find the best one for the company.