Joel Spark, Co-Founder and VP of Space Systems at Spire Global

Satellite Evolution Global

Q&A

Solidify its position in the NewSpace economy

Spire Global, now publicly listed on the New York Stock Exchange, provides space-based Earth data and analytics to myriad commercial and government organizations. With the Earth observation market on track for rapid growth, we asked Joel Spark, Co-Founder and VP of Space Systems at Spire Global about the company's current strategy to solidify its position in the NewSpace economy.

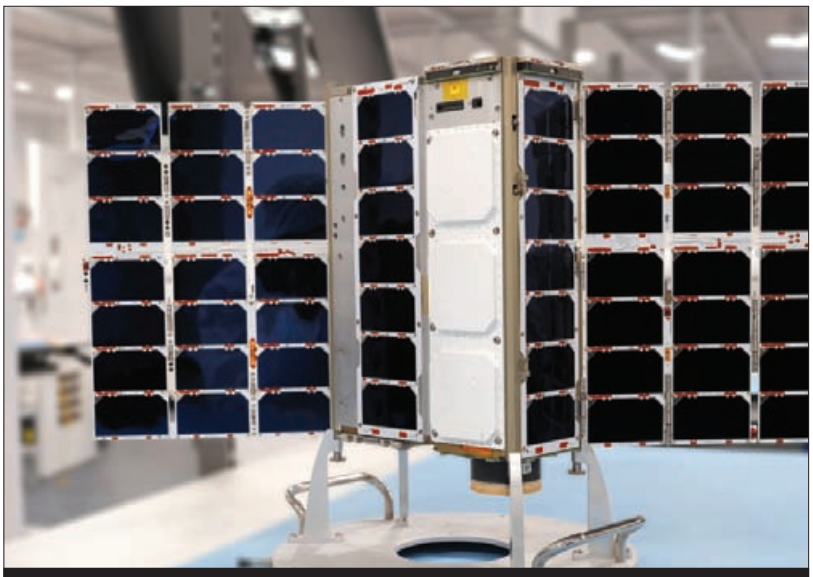
By Laurence Russell, Assistant Editor, Satellite Evolution Group

Question: What are some of Spire's recent achievements and ongoing developments?

Joel Spark: We successfully launched our 150th satellite into low-Earth orbit (LEO) and deployed our first 6U satellites. These extend the frame of the 3U standard carrier to provide additional payload volume and external surface area for sensors, antennas, etc., while maintaining the flight-tested subsystems of the Spire Low Earth Multi-Use Receiver (LEMUR) 3U Satellite Bus. We also reached orbit with two separate launch partners on a single day, sending multiple space services customers' applications into orbit.

Spire's "Racksat" concept enables it to carry multiple customer payloads in a flexible and expandable manner and offers multi-payload capabilities, which are at the core of Spire's own constellation concept of operations. Our satellites are software-defined, which enables us to continuously update, innovate and adapt the sensors remotely.

We launched two LEMUR nanosatellites with new optical inter-satellite links (ISL) capabilities. Optical Intersatellite Links are a cutting-edge technology, creating a mesh-like network of satellites, delivering



A replica model of the Spire Global cubesat. Photo courtesy Spire

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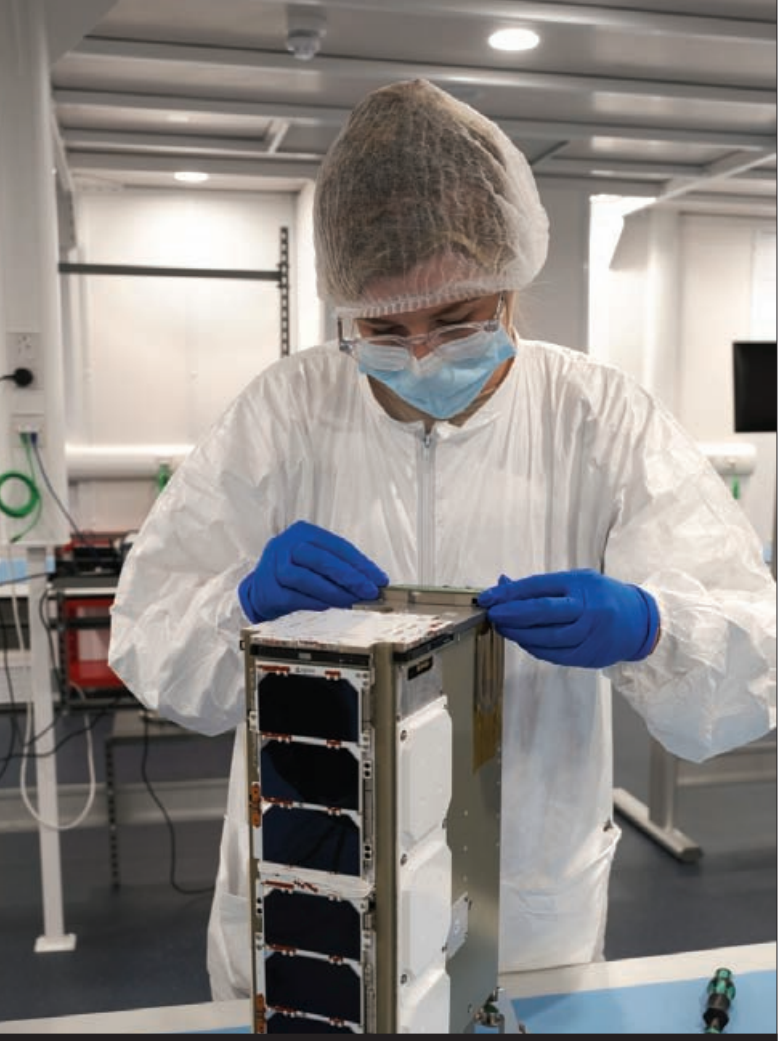

Photo courtesy Spire Global

lower latency and more secure data to customers. We completed the first stage of our testing program and look forward to rolling out the technology in 2022 and 2023.

We also enhanced our computing at the edge (moving processing power to the satellite) which helped a recent client, SpaceChain, perform at the standard they required.

Question: Spire is launching a new "software in space" solution, allowing customers to utilize their modular satellite fleet via software defined radio (SDR) to test and scale their orbital applications. Could you walk us through the service?

Joel Spark: We offer our customers the possibility to run their own software in space without launching a satellite. They can launch, scale, or test their application without the need to launch dedicated spacecraft by uploading their software to existing Spire satellites.

We fly a variety of Software Defined Radios (SDR) and On-Board Computers (OBC) on board our deployed and operational constellation which are easy to configure and upgrade: a simple software update will adapt the behaviour of the equipment to suit the application needs, within its performance capabilities. That doesn't just run the customer's software on-board but also updates it as needed during the service period.

Based on our extensive experience with RF sensing, space-based data collection, and processing operations of a broad range of payloads onboard our LEMUR satellites we can also customize the payload to meet the specific customer mission requirements and deliver the unique and global data sets they require. We have the flexibility to support multiple applications, making it possible to run software-based services.

These include signal transmission and/or reception for Earth observation, the ability to listen to signals of opportunity, the testing of new signal characteristics and low data rate communications.

We offer three distinct services:

- **Solutions in Space**: Build your application on top of our global space platform, using one of the world's largest networks of sensors, software-defined radios, and high-performance computers;
- **Software in Space**: Deploy your software to existing satellites, using software-defined radios in space to test and scale your application without the need to launch a dedicated spacecraft; and
- **Payloads in Space**: Host your payload on a trusted, fully integrated platform and benefit from a flexible and consistent launch schedule to get into on-orbit operations faster than with any other provider.

Question: One of your customers already committed to this service is SpaceChain, which hopes to bring blockchain cryptography to space technologies. How can the space economy benefit from blockchain securities?

Joel Spark: What SpaceChain is developing provides a great example of how the space economy can benefit from blockchain in space. SpaceChain is building an open and neutral decentralized satellite infrastructure (DSI) for the NewSpace economy by integrating space and blockchain technologies to create a mesh-network of heterogeneous spacecraft owned and operated in Low Earth Orbit (LEO) by multiple parties in multiple jurisdictions.

Decentralized satellite infrastructure (DSI) supports a wide range of applications involving satellites. It provides distributed ledger technology that connects various separated networks. The satellites further increase the accessibility of the ground segments where the internet is not available. Here are the application scenarios that will be integrated with the DSI:

- **Satellite multi-signature wallet**: Use satellite payloads to host the clients' private keys for secure transactions;
- **Space data access and ordering services**: Enable users to acquire the space service in a more specific way; and
- **Satellite and blockchain-enhanced IoT network**: Support the global connectivity of the IoT devices in a secure and collaborative way.

While blockchain gained prominence as a cryptocurrency tool, organizations are now exploring its benefits for supply chain management, cybersecurity, and other tasks.

Thanks to working with Spire, SpaceChain was able to test their software directly in space by uploading the software onto a satellite within Spire's existing constellation and leveraging satellite-based computing.

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Photo courtesy Spire Global

Question: The satellites-as-a-service model has been discussed a fair bit in the industry, with the main obstacle understood to be the highly disparate needs of space tech customers. What does it take to deliver true flexibility to that market?

Joel Spark: It requires vertical integration**.** Spire owns and maintains the whole value chain from API on the ground to the device in space. Our system is designed to be flexible and adapt to the different needs of customers.

We offer customers access to our network and our know-how in a couple of different, flexible ways. For example, we provide software in space solutions, enabling access to existing satellites in space with a simple software upgrade that can launch a new application and immediately begin production. We can also integrate customer devices into the satellite(s) using our end-to-end in-house manufacturing process. This allows us to rapidly turn new technology into integrated satellites ready to fly.

Finally, we can design and customize a bespoke solution incorporating our tried and tested multifunctional LEMUR nanosatellite fleet and established constellation operations, thus accelerating our customers' business operations.

Question: In a world where satellites can be re-appropriated for wholly new purposes by new clients, and potentially maintained by the emerging orbital servicing market, they may never need to come down, becoming as permanent as any Earth infrastructure. Do you anticipate that situation? Is a more sustainable satellite industry something Spire is working towards?

Joel Spark: Our space services solutions tie in well with the trend of increasing sustainability of the satellite industry. Our satellite constellation is multi-payload and multi-functional in nature, which allows us to use the same spacecraft for different types of data collection. The satellites are software-defined so upgrades and new technology iterations can be activated on the already deployed and operational satellites, extending, or improving their productivity. The constellation services that we offer also allow the broader use and re-use of already existing infrastructure.

Our small satellites are designed to disintegrate into the atmosphere within a matter of years. This is due to the size, materials, and our orbit of 400-600km. A good analogy to use is that the satellites disintegrate faster than the paper bag that one gets at the supermarket.

We monitor and operate our satellites up until the point that they disintegrate into their atoms, leaving no space debris.

We, along with more than a dozen other companies, are signatories of the World Economic Forum's policy statement on this issue.

Question: In the past, you've worked with space situational awareness (SSA) and disaster recovery business cases, both of which are in increasing demand as Earth comes to recognize new challenges. Do you anticipate Spire specializing in these kinds of observational tasks, or will it always prioritize a generalized focus?

Joel Spark: We're proud to represent customers in the SSA area such as those concerned with space debris or our recent ADLER-1 Mission.

The ADLER-1 spacecraft is a 30 by 10 by 10 cm nanosatellite, based on the Spire LEMUR family of satellites. It will measure debris particles with a deployable piezoelectric array provided by the OeWF and a short-range radar provided by Spire. There are plans to launch the ADLER-2 satellite in Q4 2022.

Question: What can we expect to see from Spire in 2022?

Joel Spark: Spire has a proven space platform with more than 300 years of space flight heritage. With this knowledge base, we will continue to innovate, grow, and adapt to the current and future needs of our customer base.

Using our space technology and expertise in satellite constellation management as well as 30 global ground stations and automated operations system, we are proud to continue to enable other innovators, commercial organizations, and governments to deploy their own applications and constellations into space quickly and efficiently.