

## PredaSAR takes back seat to Terran Orbital's SDA work

Small satellite manufacturer Terran Orbital reported increased revenues Aug. 9 as it ramps up work on satellites for the Space Development Agency but is planning to sell stock as its cash reserves decline.

Terran Orbital reported \$21.4 million in revenue in the second quarter of 2022, an increase of 127% over the same quarter a year ago. The company said its backlog increased to \$224.1 million, a record high and 200% above the level at the end of 2021.

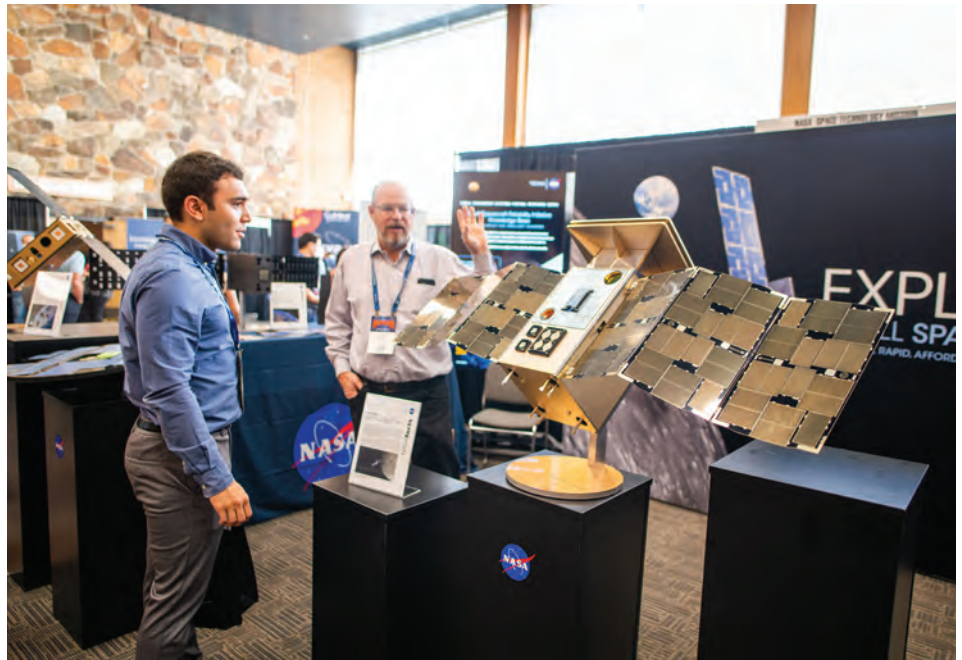
"We are delighted in our team's performance in the quarter, and we are happy to report that our business is rapidly expanding," Marc Bell, chief executive of Terran Orbital, said in an earnings call. The company had more than 400 employees on the payroll at the end of June, 20% more than the previous quarter.

Terran Orbital expects to complete an expanded satellite manufacturing facility in Irvine, California, this fall, that will provide the company with the capacity to handle its SDA work and more. Bell said the company is still in discussions with Florida to finalize an agreement to build an even larger manufacturing facility at the Kennedy Space Center but that there is no schedule for starting construction there.

However, the cost of that expanding business is growing even faster. The company reported a net loss of \$32.2 million in the quarter, compared to an \$8.9 million loss in the same quarter last year. Adjusted earnings before interest, taxes, depreciation and amortization (EBITDA) was a negative \$14.8 million in the quarter, compared to a negative \$2.5 million in the same quarter a year ago.

Terran Orbital ended the quarter with \$62.3 million cash on hand, down from \$76.7 million at the end of the first quarter. The company said it has entered into an agreement with an affiliate of B. Riley Securities to sell up to \$100 million in stock over the next two years to raise additional capital. The agreement is similar to one that launch vehicle developer Astra announced, also with B. Riley, Aug. 2.

JEFF FOUST



A model of NASA's CAPSTONE lunar orbiter on display at the Small Satellite Conference this week. Terran Orbital built the interplanetary cubesat mission, which launched in June from New Zealand atop a Rocket Lab Electron.

The agreement "provides us with a flexible option for access to incremental liquidity as needed," said Gary Hobart, chief financial officer of Terran Orbital, on the call.

Terran Orbital's near-term focus is to complete 10 satellite buses for Lockheed Martin for the SDA's Transport Layer Tranche 0. Bell said the company expected to have all 10 delivered by the end of the year and has started work on a separate set of 42 Tranche 1 satellites for Lockheed.

That work has taken precedence over Terran Orbital's own PredaSAR constellation of synthetic aperture radar satellites. "We've made it a priority to get the Tranche 0 buses done first before finishing the PredaSAR," he said. The first two PredaSAR satellites will launch in the first or second quarter of 2023.

The overall plan for the PredaSAR constellation, originally projected to include 96 satellites, is

changing, although Bell didn't disclose changes in the number of satellites or schedule for its deployment. "The plan is evolving. We are looking at getting the first two up," he said. "The satellites continue to evolve."

Those satellites will be significantly larger than other smallsats being developed for SAR constellations and will use the Tranche 1 bus. "We're seeing the benefits of going to a bigger bus with more batteries," he said, allowing for more sustained radar imaging. The larger buses can also accommodate secondary payloads, such as one satellite that will have an optical inter-satellite link to communicate with DARPA's Blackjack satellites.

Bell said that, once deployed, he expected PredaSAR to be competitive with existing commercial SAR systems. "MySpace was the first, but it wasn't the winner. We keep reminding ourselves that it's all about the endgame." **SN**



# ZERO TRUST SECURITY FOR ZERO GRAVITY ENVIRONMENTS

Radical increases in the number and uses of satellites are ushering in an era where operators are now using third-party ground stations, splitting the roles of spacecraft, and even sharing payload operators with other entities. In this hybrid, multi-party environment, **security can no longer be based on trust.**

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# Starlink satellites encounter Russian ASAT debris squalls

Debris from a Russian antisatellite weapon demonstration that caused “squalls” of close approaches to satellites earlier this year is now affecting a new series of Starlink satellites.

During a presentation at a Secure World Foundation event during the Small Satellite Conference here Aug. 8, Dan Oltrogge, director of integrated operations at COMSPOC, said his company found a “conjunction squall” affecting Starlink satellites Aug. 6, with a spike in the number of close approaches of debris from the former Cosmos 1408 satellite.

That debris, created when a Russian direct-ascent ASAT destroyed Cosmos 1408 in a November 2021 test, is in an orbit that lines up with satellites in sun-synchronous orbit. COMSPOC found earlier this year that this created surges of close approaches, or conjunctions, as the satellites run head-on into the debris.

In the Aug. 6 event, Oltrogge said there were more than 6,000 close approaches, defined as being within 10 kilometers, involving 841 Starlink satellites, about 30% of the constellation. It’s unclear how many, if any, of the satellites had to maneuver to avoid collisions.

This conjunction squall was exacerbated by a new group of Starlink satellites. SpaceX launched

the first set of “Group 3” Starlink satellites July 10 from Vandenberg Space Force Base into polar orbit, followed by a second set July 22. A third batch of Group 3 satellites is scheduled to launch Aug. 12.

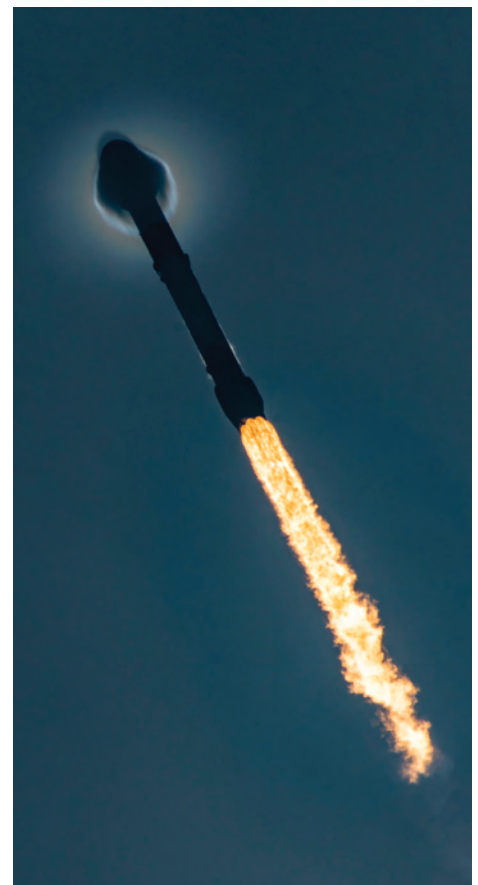
Those satellites are in similar orbits to the remote sensing satellites in sun-synchronous orbit whose orbits lined up earlier this year with the ASAT debris, causing conjunction squalls. “It’s the very orbit that’s put at risk by the ASAT,” Oltrogge said.

SpaceX has long emphasized the ability of its Starlink satellites to autonomously maneuver to avoid conjunctions. The company said that, between December 2021 and May 2022, Starlink satellites performed nearly 7,000 collision avoidance maneuvers, of which 1,700 were linked to Russian ASAT debris.

While SpaceX may be able to manage those conjunctions with its technology, it may be more difficult for other operators of satellite constellations. “If you didn’t have that automated system taking care of a spike like this, it could be really challenging to work it, though,” he said.

Those conjunction squalls will subside over time as the debris decays. However, Oltrogge said that might only shift the risk to other orbits, notably the International Space Station. “It’s going to put ISS and others at risk.” **SN**

JEFF FOUST



SpaceX started launching a new group of Starlink satellites to sun-synchronous orbits in July, putting them in the path of debris created by a Russian ASAT test last year.

## Benchmark’s Cola Kit offers collision-avoidance in a can

Benchmark Space Systems unveiled a collision-avoidance kit designed to help small satellites dodge debris and steer clear of other spacecraft.

Benchmark is taking orders for its “Cola Kit,” which the company plans to begin shipping to customers in early 2023.

The Cola Kit is the size of a two-unit (2U) cubesat. “If you give me 2U in an ESPA class [satellite], I can give you two to 10 collision-avoidance maneuvers for \$100,000 to \$150,000,” Chris Carella, Benchmark executive vice president of business development and strategy, told *SpaceNews*.

Benchmark developed the Cola Kit in response to demand from prime contractors that are equipping their spacecraft with electric propulsion

systems but still lacking the ability to maneuver quickly in response to conjunction alerts.

“They are flying these high-cost, high-value assets, but they have this vulnerability that’s just not acceptable,” Carella said.

Orbital conjunctions are becoming more frequent thanks to the growing number of satellites launched and detailed information on objects in orbit being provided by companies.

The Cola Kit is our “response to all the great data that the space domain awareness and space traffic management companies are coming out with,” Carella said. “The Cola Kit is a cheap, small, lightweight insurance policy for your high-cost asset.”

Benchmark’s Cola Kit combines the company’s chemical propulsion tanks and thruster, which have flight heritage, with control electronics, inlet

and outlet manifolds, and an adjustable mount.

In addition to avoiding collisions, the Cola Kit is designed to give satellites and orbital transfer vehicles the ability to perform controlled deorbits.

“We think the demand is strong enough for Cola Kits that when we have capacity on the production floor, we’ll use it to build metal plasma thrusters and Cola Kits,” Carella said.

Benchmark is forging partnerships to market Cola Kits with several electric propulsion and space traffic management companies. The first company to sign on was space safety startup Scout Space.

“Scout will deploy our fleet of in-space and on-orbit systems to provide continuous situational awareness services to support sustainable space operations,” Scout CEO Eric Ingram said in a statement. “Scout and Benchmark have shared missions in the past and we have strong synergies in our respective roadmaps that highlight several opportunities to work cooperatively to bring pre-integrated, bundled solutions to benefit the market.” **SN**

DEBRA WERNER

# SpaceX sees continued strong demand for rideshare missions

**S**paceX, whose rideshare services have reshaped the smallsat launch market, says it continues to see strong demand with missions booked into 2025.

In a presentation at the Small Satellite Conference Aug. 9, Jarrod McLachlan, director of rideshare sales at SpaceX, said the company had launched more than 400 customer payloads through its series of Transporter missions and other rideshare opportunities with "several hundred more" payloads manifested for launch.

"One of the questions that we're getting a lot is, 'How full are you guys?'" he said. "All the Transporters are fully manifested in 2023, and we're getting pretty full in 2024. We've really seen a strong market demand."

SpaceX has performed five Transporter missions to date, with another scheduled before the end of the year. The company expects to average about three Transporter missions a year, all to sun-synchronous orbits, as well as occasional rideshare opportunities on Starlink and other launches.

While the near-term manifest is full, McLachlan said there should be opportunities for customers looking to find a slot for last-minute rides. "We get

a lot of movement in the manifest, a lot of customers coming off and on," he said. "We're often able to backfill customers." In addition, launch brokers who procure ports on Transporter launches often have room to accommodate latecomers.

SpaceX has rideshare customers booked on missions to sun-synchronous orbit as late as 2025, he said. The company is also booking rides on Starlink missions as well as "traditional" rideshare opportunities where a launch of a primary payload has excess capacity. There are also rideshare opportunities for missions to geostationary transfer orbit and the moon.

SpaceX recently updated its rideshare payload users guide. "Based on what we've seen in regards to mission assurance, we've simplified our testing approach," he said. Some tests are now advised rather than required, or in other cases, testing requirements have changed.

Cubesat testing has also been simplified. "For fully containerized cubesats, we've actually reduced the test requirements drastically," he said, focused on random vibration, electromagnetic interference and pressure system testing. However, he said the company still strongly advised customers to perform integrated testing of their satellites for mission assurance.



A SpaceX Falcon 9 lifts off May 25 on the Transporter-5 rideshare mission carrying 59 payloads. SpaceX says Transporter missions through 2023 are fully booked.

Those rideshare missions have been using the Falcon 9, but McLachlan said SpaceX is starting to think about rideshare missions involving the much larger Starship vehicle in development. "We are working on the rideshare configuration and smallsat offerings for Starship," he said, although the company is not ready to announce any specific rideshare opportunities. "The team is fully focused on first flight." **SN**

**JEFF FOUST**

## D-Orbit to deploy 20 Astrocast satellites over three years

**Italy's D-Orbit** said Aug. 9 that it will launch 20 nanosatellites over three years for Swiss startup Astrocast with its orbital transfer vehicle.

The first mission under their agreement is slated for no sooner than November 2022 on a SpaceX Falcon 9, which will launch D-Orbit's ION Satellite Carrier with four Astrocast satellites onboard.

Each satellite in this batch is 3U, or the size of three cubesats, and will be dropped off at a 500-600-kilometer sun-synchronous orbit to improve coverage for Astrocast's internet of things (IoT) constellation.

D-Orbit plans to launch another batch of six 6U satellites for Astrocast in 2023 and 10 more in 2024 to complete the launch agreement.

Astrocast currently has 12 3U satellites,

including two test spacecraft, and aims to expand its network to 20 satellites before the end of 2022.

In addition to D-Orbit, Astrocast chief financial officer Kjell Karlsen said the Swiss operator also has launch agreements with U.S. rideshare provider Spaceflight this year.

Astrocast plans to grow the constellation to 40 satellites in 2023 and to operate 100 of them by 2025. To help fund this expansion, Astrocast — which already trades as a public company on Norway's Euronext Growth Oslo stock market — is looking to raise more than \$60 million by listing shares on the Euronext Growth Paris junior stock market.

The company had been preparing to complete this offering of shares this summer, but "global market conditions prevented it," Karlsen said. "We are now working with our advisers to determine the right window for the offering," he added.

In May, Astrocast said it plans to issue new shares to buy Dutch connectivity solutions provider Hiber, which agreed to invest around \$11 million in Astrocast's second stock market as part of the acquisition. Karlsen said that the acquisition is contingent on Astrocast's secondary stock market listing in France, "but we have full confidence that we will meet it and close during 2022."

Fabien Jordan, Astrocast's CEO, said in a statement: "It is important for European space companies to work together to find solutions that increase the competitiveness of European space, and we believe that working with D-Orbit enables this for Astrocast," Astrocast CEO and co-founder Fabien Jordan said.

Following the launch with D-Orbit via U.S.-based SpaceX, Jordan said Astrocast is looking forward to "potential future missions on European rockets." **SN**



D-Orbit CFO Renato Panesi (left) with Astrocast CFO Kjell Karlsen at SmallSat.

**JASON RAINBOW**

# Sidus Space could launch LizzieSat-1 without thrusters

**S**idus Space could launch LizzieSat-1 without thrusters if it can't get safety clearances in time to deploy its first satellite from the International Space Station early next year.

LizzieSat-1 is the first of 100 satellites Sidus plans for a constellation that would initially provide in-orbit testing services. The 100-kilogram spacecraft is slated to use a deployer on the ISS that Florida-based Sidus manages as part of its existing government contractor business.

It is unclear if Sidus can get all NASA approvals to add operational-life-extending thrusters to LizzieSat-1 for a cargo trip to the ISS in February, Sidus chief mission operations officer John Curry said Aug. 8 during the Small Satellite Conference. LizzieSat-1 was previously slated to launch on a mission to the ISS in October before NASA re-manifested it for early 2023.

"It's possible we may end up deciding not to fly the thruster," Curry said, so that it can "just get through the safety process and go ahead and fly."

If deployed from the ISS without thrusters, Curry said LizzieSat-1



"[W]e may end up deciding not to fly the thruster," Sidus chief mission officer John Curry said at SmallSat.



would only provide services for around 130-200 days before losing operational altitude.

While that would still be enough time to demonstrate core technology, Sidus satellites with thrusters could last 18 months to three years, depending on mission requirements.

LizzieSat-1's customers include NASA and Mission Helios, a financial services startup that aims to test technology for NFTs.

Curry said that these and other future customers don't care about the length of time they spend on orbit,

and a LizzieSat without thrusters has more room for payloads.

However, a LizzieSat with thrusters is the standard design for the company's constellation and would enable more control over the satellite's de-orbit trajectory.

While launching LizzieSat-1 from the ISS remains Sidus' baseline plan, Curry said rideshare is still an option. Because astronauts could take 30-60 days to finally deploy LizzieSat-1 once it reaches the ISS next February, a rideshare mission could deliver the satellite to its orbit sooner even if it

lifts off a little later.

An ISS launch, Curry said, would also require Sidus to deliver a "fully outfitted" satellite more than 10 before launch, compared to four weeks for a rideshare mission.

That means using rideshare providers for future satellites would give customers more time to provide the payloads they want to test on LizzieSat satellites. It would also guard against the possibility of supply chain delays.

Sidus is negotiating with "a number of different providers" for launching other LizzieSats later in 2023. **SN**

**JASON RAINBOW**

## NanoAvionics expands into heavier smallsat market

**NanoAvionics extended its range of modular satellite buses** in another step toward the heavier end of the small satellite market.

The addition of the MP42D bus enables the Lithuanian smallsat maker to host more powerful customer payloads of up to 145 kilograms.

This opens up new applications for customers, NanoAvionics CEO and co-founder Vytenis Buzas said, including synthetic aperture radar (SAR) imagery that requires larger antennas.

With payload envelope dimensions starting at 74 x 73 x 50 centimeters, he said MP42D could also be used as an orbital transfer vehicle.

The bus is based on NanoAvionics' flagship MP42 platform that gained flight heritage in April, marking the company's expansion out of the 10-kilogram-and-under nanosatellite class.

NanoAvionics also announced another bus based on this platform, the MP42H, for payloads of up to 22 kilograms. The initial MP42 sits in the middle of the two new buses and can accommodate payloads of up to 75 kilograms.

Lower launch costs are encouraging operators to order heavier, more powerful satellites to improve capabilities and forge new markets, Buzas said.

MP42D and MP42H buses are already in production after securing customers. According to Buzas, demand from customers is currently split

50/50 between nanosatellites and its larger set of satellites, despite only announcing the MP42 product line in March 2021.

The market for nanosatellites is still growing, he added, but not as fast as it is for larger spacecraft.

The product announcement comes a month after Norwegian company Kongsberg Defence & Aerospace bought a majority stake in NanoAvionics for about \$67 million.

Despite its new owners and a portfolio branching out into heavier satellite classes, the company is sticking to its NanoAvionics branding for now, Buzas said. "We do not have any plans to rename ourselves to MicroAvionics NanomicroAvionics or SmallAvionics." **SN**

**JASON RAINBOW**



# Telespazio eases into smallsat market with digitized ground solutions

**S**paceflight services company Telespazio is beginning to offer a family of products to help commercial space companies set up a digitized ground segment in the cloud.

Under the brand name Ease, Telespazio offers products to help satellite operators control spacecraft and receive telemetry and data — services the Rome-based company has performed for decades in support of government and large commercial space missions.

Telespazio is continuing to support large complex spacecraft through Ease Mission. Ease Rise is the company's product designed to simplify the management of large constellations, cubesats and small satellites.

Ease Access offers access to ground stations operated by Telespazio and partners, including Leaf Space and AWS Ground Station.

"Any customer can come to us, and by using our products, they don't need to procure different

ground segment elements from different companies," Andres Martinez, Telespazio Germany sales director, told *SpaceNews*.

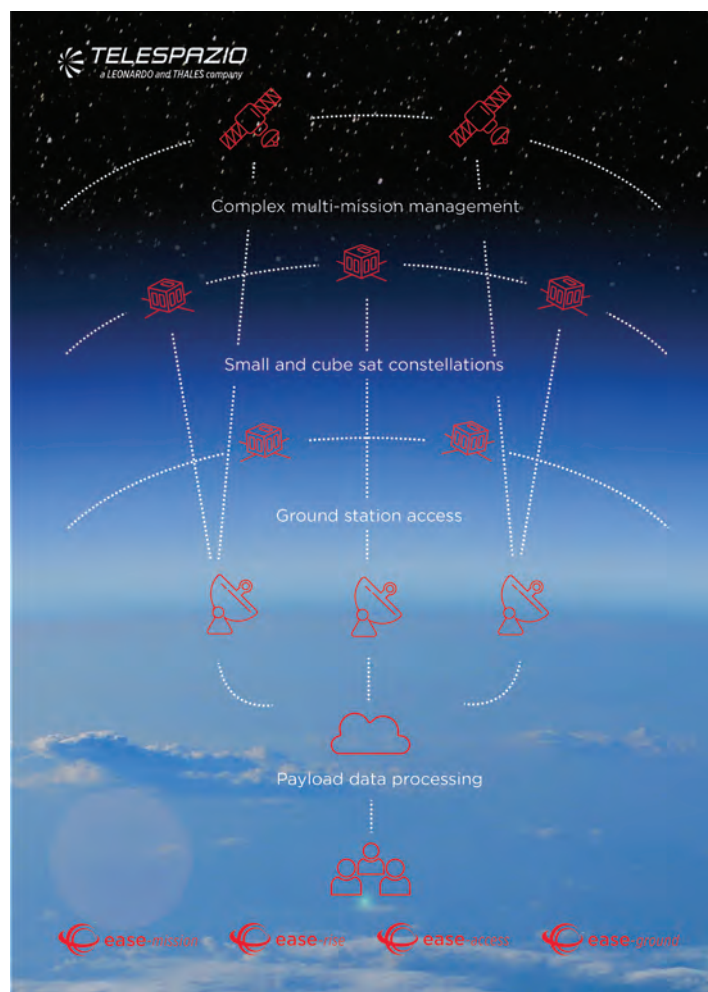
Rounding out the family of products is Ease Ground, which obtains data from space-based payloads, processes data and imagery, and delivers them to customers.

Increasingly, Telespazio is seeing a new breed of spaceflight customers who do not want to establish their own ground stations or manage the transfer of data to and from satellites.

"If a customer wants to deploy a constellation, they will knock on our door, and they can select our products," Martinez said. "They will forget about anything that has to do with ground segments."

Telespazio's family of standard products is designed to reduce the cost of the ground segment.

"In space, traditionally, every system was tailor-made for every mission," Martinez said. "We're running away from that approach because it's costly, and



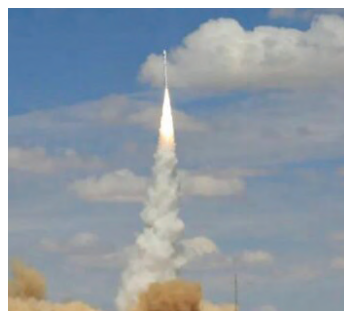
it takes time."

In 2019, Telespazio subsidiary Telespazio Germany began selling a cloud-based platform for space operations. The platform, now part of Ease Rise, has evolved and matured in terms of

the features and capabilities based on customer feedback, said Zeina Mounzer, Telespazio Germany's chief commercial officer.

"The Ease products are complementary rather than overlapping," Mounzer added. **SN**

## In Brief



The Aug. 9 liftoff of the third Ceres-1 solid rocket from China's Jiuquan Satellite Launch Center.

■ **Chinese commercial launch service provider Galactic Energy** successfully launched its third Ceres-1 rocket Aug. 9. The four-stage rocket lifted off at 12:11 a.m. Eastern from the Jiuquan Satellite Launch Center and placed three satellites into orbit. The solid-fueled Ceres-1 has reached orbit in all three launches as the company works on a larger liquid-fueled rocket, Pallas-1, slated to debut in 2023. The rocket carried Taijing-101 and 02, two remote sensing satellites developed by Minospace, as well as Donghai-1, developed by Shanghai-based ASES Space for testing remote sensing and related technologies.

■ **The FCC** is considering opening up more Ku-band spectrum for satellite broadband constellations. The FCC said last week it would seek public comments on a proposal to open the 17-gigahertz band for non-geostationary orbit (NGSO) satellite systems after approving plans for GEO satellites to use that band. Several companies, including SpaceX, OneWeb, Amazon and SES, say they support the move. However, some GEO satellite operators are opposed, arguing that the FCC should wait until technical studies confirm that GEO and NGSO systems can coexist in the band.

■ **The Pentagon's Space Development Agency** is seeking proposals for a demonstration of laser communications between orbiting satellites and aircraft in flight. The SDA issued a notice to companies last week seeking proposals for how to conduct a live demonstration of laser crosslinks between SDA's Transport Layer satellites and a moving aircraft. The test will involve one or more of the 20 Tranche 0 satellites projected for launch in September. SDA planned to test this with a pair of cubesats launched last year, but the satellites failed after launch.

# Aerospace Corp. develops low-cost optical ground network

**T**he Aerospace Corp. is developing a network of remotely operated optical communications terminals to support existing and future small satellite missions.

To date, much of the optical communications research and development has focused on reducing the space-based terminal's size and cost. To make optical communications operational, it's also important to develop a cost-efficient ground infrastructure, Darren Rowen, Aerospace Small Satellite Department director, told *SpaceNews*.

Aerospace, a federally funded research and development center focused on space, demonstrated laser communications in 2018 with two Optical Communications Satellite Demonstration cubesats. For OCSD space-to-ground communications, Aerospace built an optical ground station prototype that two people operated in El Segundo, California.

With the same technology, Aerospace established optical communications ground stations in Maui, Hawaii, and at Kirtland Air Force Base in

New Mexico. Aerospace is evaluating whether to install a third station at Edwards Air Force Base in California.

"We are going to have a network of three off-the-grid stations that are remotely controllable," Rowen said. "And we're working toward making them fully autonomous."

Aerospace operational missions underway, including the Rogue Alpha and Beta cubesats, are delivering imagery to the remotely operated optical ground stations. The Rogue cubesats, which Aerospace built and operates for the U.S. Space Force Space Systems Center, gather visible and shortwave infrared imagery of rocket launches, volcanoes, wildfires and weather phenomena.

For decades satellites have primarily sent data to the ground through radio frequency transmission to satellite dishes worldwide. Those dishes require no human operators.

"We're trying to get to the same operational point because paying people to operate the ground stations would be too expensive," Rowen said.

Government agencies and companies are experimenting with optical communications to



An optical ground terminal Aerospace Corp. installed in Albuquerque, New Mexico.

speed data transfer. Aerospace's OCSD mission has transmitted data at a rate of 200 megabits per second. Engineers are working on an upgrade to increase the speed to 800 megabits per second. **SN**

DEBRA WERNER

# Atlas Space Operations upgrades user interface to ease scheduling

**A**tlas Space Operations upgraded its user interface to make it easier for customers to schedule communications with their satellites and to quickly confirm whether data was transmitted.

Through the new user interface, Atlas shares the data and metrics the company gathers at each ground site for every satellite pass.

"Through our user interface, our customers can see all of the checks that our operations team goes through and flags for every single pass," Brad Bode, Atlas founder, chief technology officer and chief information officer, told *SpaceNews*. "That gives the operators insight into how our team determines the success or failure of a pass. Passes don't fail that often, but people want to know what's going on."

By sharing information on each pass, Atlas is "empowering customers to solve problems as quickly as possible," Bode said.

For instance, if a satellite fails to transmit

data during a pass, the user interface shares that information with the satellite operator.

"That tool is important to put in the hands of those customers who don't have a large software team that can code the solution," Bode said. "We as an operations team know what to look at, and we want to offer that to our customers for free."

The new user interface also is designed to make it easier for customers to schedule satellite passes. The satellite operator can visualize the passes that have the highest probability of being awarded or scheduled.

"It affords the satellite operator, especially the one who only has one or two satellites, the ability to visualize which passes are the highest probability of success or guaranteed to succeed as opposed to guessing," Bode said. "A lot of times, customers ask for a pass, get rejected and ask for another one without knowing what's available or not available."

To remedy that, Atlas is exposing its scheduling through the user interface.

Every time a customer's satellite is visible overhead and communications are possible, Atlas shows the likelihood of contact.

If the likelihood is 100% for a specific pass, that means there is no conflict in the entire Atlas network, and communications are virtually guaranteed.

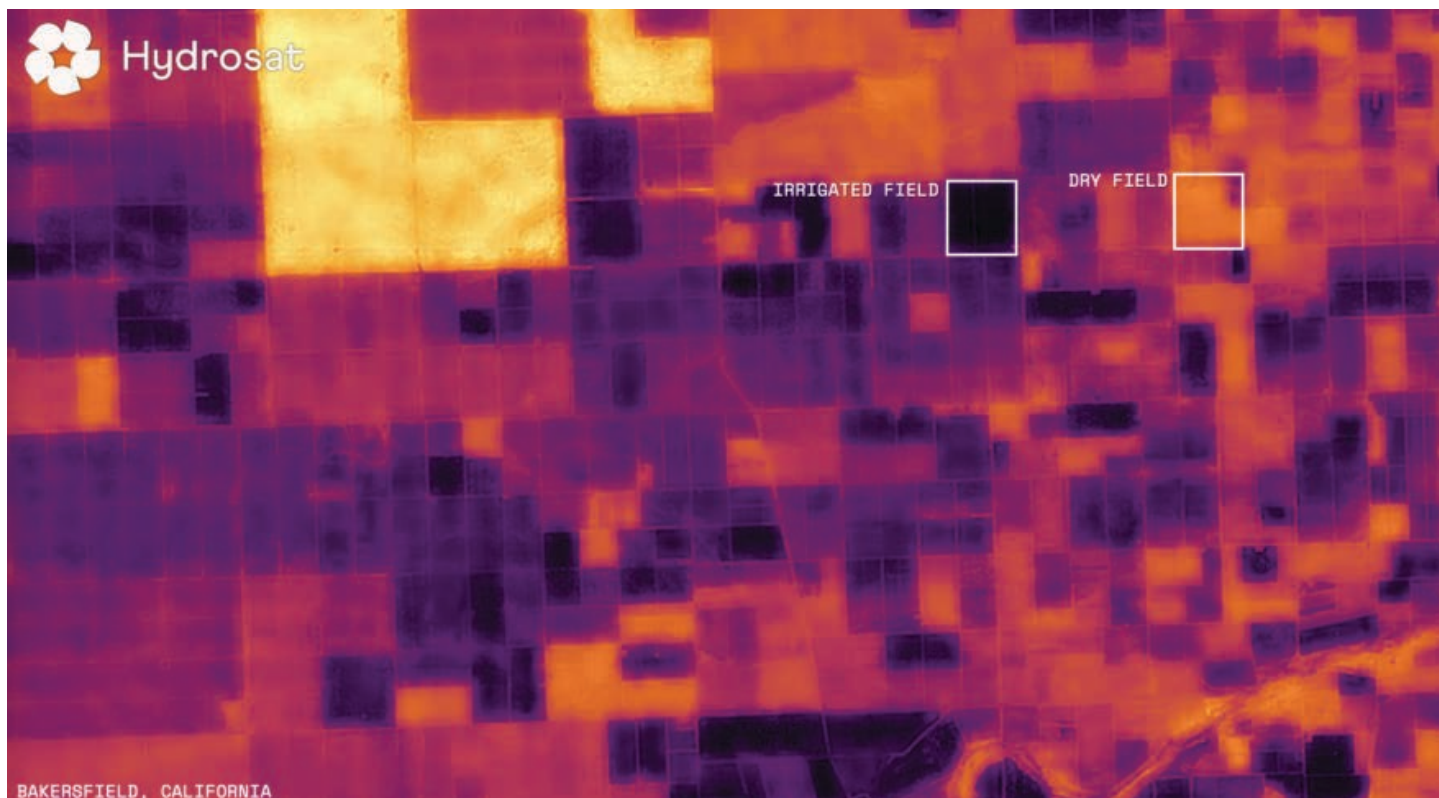
"If you have an urgent task, you want to choose the visibility that is 100% free," Bode said. "Now, if you see 80% free, you can request a little less of the visibility. What we're saying is you can get request a little less time, and we'll get it for you, rather than an all or nothing approach."

Atlas revised its user interface to help companies or government agencies without extensive satellite communications experience.

"We want to foster a new community of what everyone is calling NewSpace," Bode said. "But it's complicated and takes a long time. We have to use software abstract away some of these problems and make them easier to solve until people can get fully machine-to-machine integrated." **SN**

DEBRA WERNER

# Hydrosat secures Tier 1 remote sensing operating license



**H**ydrosat secured approval from U.S. regulators in late July to provide global services from its upcoming thermal imaging system.

The Washington-based geospatial data and analytics startup was awarded a National Oceanographic and Atmospheric Administration license at Tier 1, which has the fewest conditions under a streamlined regulatory regime that came into effect in 2020.

Tier 1 systems have capabilities deemed similar to systems not licensed by the U.S. Commerce Department, such as the U.S. government's Landsat-9 satellite or foreign commercial systems.

Tier 2 remote sensing ventures offering data matched only by other U.S. systems and Tier 3 systems seeking to provide a "completely novel capability" are subject to stricter regulatory constraints, making it more difficult to sell commercially or internationally.

**JASON RAINBOW**

Hydrosat CEO Pieter Fossel said Tier 1 certification for VanZyl-1 gives the startup the highest degree of flexibility in how it can collect and sell data commercially. VanZyl-1 is Hydrosat's first satellite mission. It is set to launch on a Loft Orbital condosat via a SpaceX Falcon 9 rideshare mission early next year.

The license "gives us the most freedom to operate independently, and signifies that NOAA has determined that what we're doing as a commercial organization, as an exporter, as a job creator is worthwhile," Fossel said.

VanZyl-1 will use multi-spectral infrared sensor technology to track water stress, assess wildfire risk and support agricultural monitoring applications.

Hydrosat ultimately plans a constellation of about 16 satellites, which Fossel said would enable it to "image every spot on Earth twice per day."

Combined with in-house analysis, Hydrosat says its surface temperature data enables a variety of geospatial intelligence solutions, including

Hydrosat shows how its thermal imagery technology provides insights to increase crop yields.

services for helping farmers understand local crop conditions and supply.

The startup raised \$10 million in seed funding last year, bringing total funding for its goal to develop global thermal infrared maps to \$15 million.

Other startups developing thermal imagery satellite constellations include U.K.-based Satellite Vu and Germany's OroraTech.

OroraTech deployed its first satellite, FOREST-1, in January and is focused on monitoring wildfires.

Satellite Vu, which expects its first satellite to launch in the first quarter of 2023, specializes in tracking heat waste from buildings for climate change applications.

The British startup said July 21 it has ordered a second satellite slated to launch in early 2024. **SN**



# BlackSky adds Airbus inputs to Spectra AI

**B**lackSky Technology is bringing Airbus electro-optical and synthetic aperture radar imagery into its cloud-based Spectra AI Platform.

BlackSky will resell 23 different Airbus tasking and archival imagery products including very-high-resolution optical imagery from Pléiades Neo and Pléiades, OneAtlas Basemap products, and SAR imagery and digital elevation models from WorldDEM Neo and WorldDEM, under an agreement announced Aug. 3.

"It's common for our customers to use a mix of rapid-revisit electro-optical and SAR imagery to accomplish their missions," BlackSky CEO Brian O'Toole told *SpaceNews* by email.

DEBRA WERNER

BlackSky's small satellite constellation gathers electro-optical imagery, which the company fuses with various sensors and sources to monitor locations and track events.

In the past, BlackSky has integrated imagery and services from SAR constellation operators "on a project-by-project basis," O'Toole said. "The Airbus partnership is the largest SAR imagery integration into BlackSky's Spectra AI tasking and analytics platform to date."

François Lombard, Airbus Defence and Space head of intelligence, said in a statement, "I warmly welcome our partners at BlackSky and look forward to the strategic contributions our partnership will make as we support customers' needs for high-revisit, high-resolution on-demand imagery, to address a wide variety of missions." **SN**



BlackSky will resell 23 different Airbus tasking and archival imagery products, including SAR imagery and digital elevation models like the WorldDEM Neo view of Vietnam above.

## Oxford Space, SSTL unfurl Wrapped Rib SAR antenna

**T**he U.K.'s Oxford Space Systems and Surrey Satellite Technology Ltd. completed the construction of a deployable, Wrapped Rib antenna for small synthetic aperture radar satellites.

OSS designed the 3-meter parabolic reflector to stow compactly during transportation. SSTL supplied the high bandwidth radar instrument and radio frequency electronics.

With funding for the project from the U.K. Space Agency's National Space Technology Programme, the companies have tested the antenna, which could be demonstrated in orbit as early as 2023.

The Wrapped Rib antenna is sized for SSTL's CarbSAR platform. CarbSAR is a 140-kilogram X-band SAR technology demonstration satellite to showcase radar applications for defense and security, maritime, disaster response, environmental and infrastructure customers.

OSS already is "seeing strong international customer interest for this product," OSS Chief Executive Sean Sutcliffe said.

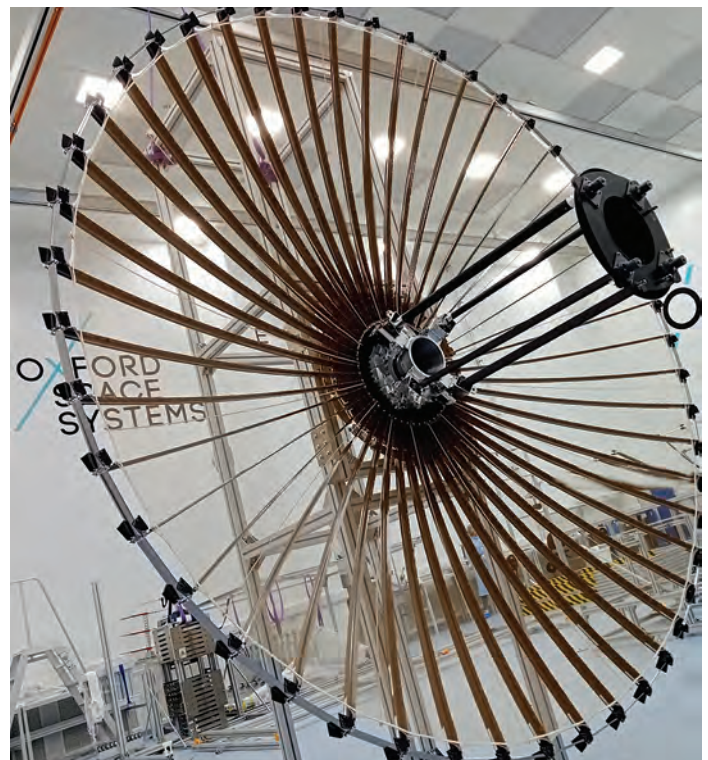
DEBRA WERNER

Andrew Haslehurst, SSTL chief technology officer, said SSTL embedded the SAR electronics into its core avionics to simplify the antenna architecture.

That feature "combined with the impressive stowage volume of the Wrapped Rib has enabled SSTL to develop a very capable CarbSAR product providing high-resolution X-band SAR imaging capabilities day, night and whatever the weather," Haslehurst added.

The U.K. Space Agency provides funding for companies like OSS and SSTL "to deliver new space capabilities that will help us tackle challenges, including disaster monitoring, urban planning and transport management," Paul Bate, U.K. Space Agency chief executive, said in a statement.

To test the deployable reflector, OSS worked with QuadSAT. QuadSAT's drone-based measurement system removes "the complexity normally associated with testing large space deployable antennas which are subject to gravitational effects," Carlo Rizzo, QuadSAT chief commercial officer, said in a statement. **SN**



Oxford Space Systems developed a Cassegrain reflector antenna with a metal mesh surface. The Wrapped Rib antenna, with a 3-meter diameter parabolic reflector, is designed to stow in a small volume.

**OPINION | DEAN BELLAMY**

# Preparing for Maneuver Warfare in Space — The Next Battleground

**Incentivize preparedness by requiring satellites to incorporate hardware for space situational awareness and maneuverability**

**T**HE CONCEPT OF RAPID MOVEMENT TO KEEP AN ENEMY OFF-BALANCE is as old as war itself. Known in military circles as “maneuver warfare,” this mode of fighting has occurred in every domain, from land to sea and air. It’s only a matter of time until this strategy enters a new domain — space— underscoring why satellites need greater agility and resiliency to defend themselves in the newest warfighting domain.

Speaking today at SmallSat 2022 on building resilient and secure constellations, I offer a historical warfare perspective and how we can enhance satellite survivability, and how government can ensure commercial satellites are more agile in today’s threat environment.

## LESSONS OF HISTORY

In ancient Greece, Athens was dominant at sea while Sparta was superior at land warfare. To achieve advantage, Sparta dropped huge planks onto Athenian boats to bring the battle to them. During the Anglo-Spanish War, Spain relied on its faster sloops to maneuver around England’s larger, less mobile fleet to gain a strategic edge in maritime warfare.

During Iraq’s invasion of Kuwait, U.S. forces leveraged satellites to pinpoint and destroy targets even in low-visibility conditions in the desert, a feat that resulted in decisive victories and fewer lost lives. The precision of American satellites also served as a wake-up call to the rest of the world that space was critical to future warfare.

Satellites continue to demonstrate how essential space is to today’s military missions, providing surveillance, situational awareness and communications to inform military movement and strategy, as evidenced by the real-time satellite feeds that tracked Russia’s troop movements during the invasion of Ukraine. That intelligence gave the much-smaller Ukrainian defense forces an advantage.

Despite their utility for connectivity and ISR, today’s Space Force satellites remain vulnerable to attack. They’re still built with a 1980s Cold War mentality — their overarching purpose was to provide space-derived information to the ground in a non-threatening space environment with



minimal maneuverability. Those days are gone.

## GOING BEYOND SPACE DEBRIS

Satellites already must navigate debris fields caused by irresponsible handling of defunct satellites and other space junk. It’s well documented that China and Russia have developed offensive space weapons and capabilities for rendezvous and proximity operations. Two ASAT missile tests — one by Russia last November and the other from China in 2007 to destroy a defunct weather satellite — created significant debris in low Earth orbit. In fact, those two events accounted for nearly 40% of all high-risk conjunctions in space in the first four months of 2021, according to analysis by LeoLabs.

## THE ANSWER: MORE AGILE SATELLITES

Clearly, space is now a contested environment, with satellites crucial to American national security. As we see this type of warfare, we must change the way we’re building our satellites to make them more agile. One way could involve rolling up their solar arrays. National security customers are asking for this feature as it makes the satellite a smaller target while improving maneuverability.

Adding sensors, flexible satellite designs and AI capabilities may increase the cost of tomorrow’s more agile satellites, but the biggest hurdle may be that more regulatory action is required.

## GOVERNMENT CAN SPEED INNOVATION

The government can incentivize satellite developers by requiring all future satellites to incorporate hardware for space situational awareness and maneuverability.

How fast we innovate depends on how efficiently we can deploy engineers with clearances to these advanced projects. Increasing the number of clearances awarded to firms with the most promising technology would accelerate our progress. The more engineers dedicated to these critical design efforts, the sooner we can introduce new capabilities on agile timelines.

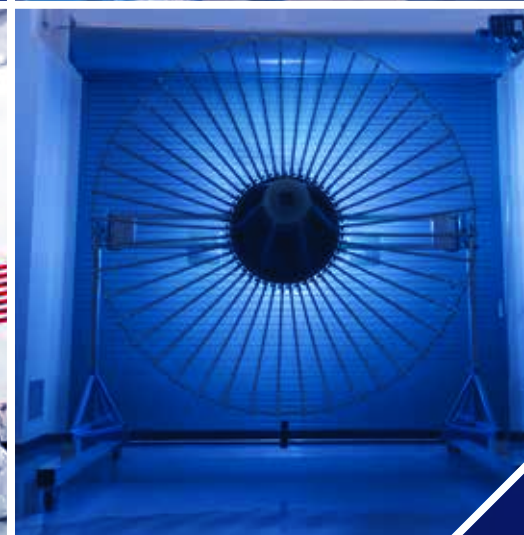
Given what’s at stake in this new domain of modern warfare, the imperative for our industry to innovate faster has never been greater. **SN**

## RETIRED U.S. AIR FORCE COL. DEAN BELLAMY

SERVES AS EXECUTIVE VICE PRESIDENT OF NATIONAL SECURITY SPACE FOR REDWIRE, A LEADER IN SPACE INFRASTRUCTURE FOR THE NEXT-GENERATION SPACE ECONOMY. PRIOR TO ENTERING THE PRIVATE SECTOR, COL. BELLAMY WAS A CAREER U.S. AIR FORCE OFFICER, WHO CONCLUDED HIS GOVERNMENT CAREER AS CHIEF OF THE POLICY AND STRATEGY GROUP IN THE NATIONAL RECONNAISSANCE OFFICE.



# SMALL SATS BIG MISSIONS



**MILLENNIUM  
SPACE SYSTEMS**  
A Boeing Company



# BIG DREAMS START SMALL.

Blue Canyon Technologies has the best pointing accuracy of any small satellite manufacturer in the world. With our revolutionary fleet of spacecraft and components, we're bringing our passion for the stars down to earth by equipping your team to build, test, launch and operate all from the comfort of gravity.

FIGURE 1

XB12 CLASS CUBESAT



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