Smallsat developers focus on improving reliability  By Jeff Foust

As cubesats and other smallsats transition from technology demonstration and student projects to operational missions supporting a growing array of applications, companies large and small are working to improve their reliability.

Those efforts, outlined in a session of the AIAA/Utah State University Conference on Small Satellites here Aug. 7, reflect as much the philosophical differences of the companies involved as the specific technical issues that affect satellite reliability.

The on-orbit performance of cubesats has long been a sore point. In a presentation at a pre-conference workshop Aug. 4, Lee Jasper of the Space Dynamics Laboratory noted that, historically, 22 percent of cubesats were never heard from after launch. That figure is significantly higher in special cases, such as some classes of university-built cubesats.

Companies developing constellations of cubesats, though, have much lower failure rates. Spire, which operates a cubesat constellation that provides weather and vessel tracking data, launched 47 satellites in 2017 using a cubesat design developed internally and incrementally improved over the last several years.

"We've learned the hard lessons over the last six years or so," Jeroen Cappaert, a co-founder of Spire, said. "We've built a robust satellite bus that is flexible and can be integrated with a variety of payloads."

Those improvements, he said, are enabled by vertical integration. Spire controls every part of the satellite product chain from manufacturing through the provision of data and services, with the exception of launch. That allows the company to iterate designs quickly, improve reliability and control costs.

Cappaert said Spire is now considering providing mission services to companies, who they would fly their payloads on Spire satellites. "We think of Spire today as a data provider, but we're also a mission provider," he said. "We've built all this infrastructure and we think we can provide value to other companies that don't necessarily want to spend the time and capital building all this from scratch."

NanoRacks subjects the cubesats it deploys from the International Space Station to an additional set of reviews to meet NASA human safety requirements, said Henry Martin, senior external payloads mission manager at the company. Those requirements address a variety of issues, from toxicity of materials to the design of batteries on those cubesats, to ensure the safety of crews on the station, but in many cases can also improve mission reliability.

The company has, to date, deployed 223 satellites from the ISS, and Martin said that those technical issues usually aren’t a major problem for developers compared to regulatory issues like FCC licenses. "The largest issue as to why they miss [their launch date] is that they don’t have a license," he said.

Companies moving from large satellites to smaller ones face a different set of challenges. James Loman, senior distinguished engineer at Space Systems Loral, noted his company has extensive lessons learned from developing large geostationary orbit communications satellites that has improved their reliability. He said that 20 years ago, the average satellite the company built had two “unit failures” of various components in the first year after launch. Today that failure rate is 10 times lower.

He acknowledged, though that those lessons can’t be directly applied to smaller satellites that are intended to be less expensive and built more rapidly. “We will continue to use some of our heritage processes that ensure high reliability and quality, but we’ll need to be scaling back to meet ‘new space’ expectations,” he said.

Among those trade-offs is the use of commercial off-the-shelf (COTS) components for some low Earth orbit smallsats versus radiation-hardened, but more expensive, items. “COTS parts are probably OK for LEO short-duration missions,” he said, but urged radiation testing of those components for the given mission profile. “Otherwise that will cause problems.”

“We need to transition from ‘old space’ to ‘new space,’” he said, “but we need to do it in a manner so we do not forget all the lessons learned and meet the expectations of commercial customers.”
Vega’s Small Spacecraft Mission System (SSMS) is a product of the innovative culture that prevails at Arianespace. The SSMS payload dispenser will revolutionize and democratize access to space for countless new satellite companies that would otherwise remain grounded due to lack of launch capacity. With its perfect record and competitive pricing, the Vega is the right vehicle at the right time.
D-Orbit to launch 10 Astrocast satellites on a Vega rocket

By Jeff Foust

D-Orbit, an Italian company entering the rideshare market, won a deal to launch 10 Astrocast cubesats on a future Vega mission as it develops an advanced, free-flying deployer.

In a ceremony during the AIAA/Utah State University Conference on Small Satellites here Aug. 7, the two companies signed a contract covering the launch of the 10 Astrocast cubesats as secondary payloads on a Vega rocket in late 2019 or early 2020. The satellites will be deployed into sun-synchronous orbits at an altitude of between 450 and 600 kilometers.

Astrocast is a Swiss company developing a constellation of 64 cubesats that will provide connectivity services for Internet of Things applications. Fabien Jordan, chief executive of Astrocast, said in an interview after the signing ceremony that the company is finalizing the design of its operational satellites, which will differ slightly from two demonstration satellites scheduled to launch on Spacelift’s SSO-A dedicated rideshare Falcon 9 mission late this year.

“We’re starting to manufacture some parts while working on the design at some levels,” he said. Those satellites will be built in the company’s facilities in Switzerland.

The launch D-Orbit will provide will populate the second of eight orbital planes with eight operational satellites and two on-orbit spares. Jordan said Astrocast has an agreement with an undisclosed provider to launch satellites for the first orbital plane in the third quarter of 2019.

The Astrocast award is the second for D-Orbit’s InOrbit Now rideshare payload service, which won a contract last year with Sky and Space Global to launch an unspecified number of its Pearl cubesats to provide communications services. D-Orbit completed a critical design review with Sky and Space Global in June, with the initial set of satellites scheduled for launch in the first half of 2019.

While D-Orbit will initially use standard cubesat deployers, the company is developing a customized free-flying deployer, called Ion. The vehicle will be able to deploy up to 48U of cubesats, ranging in individual size from 1 to 12U, after it is released from the upper stage of a launch vehicle. Ion is scheduled for its first test flight next June.

A free-flying dispenser with its own propulsion will provide for more accurate and customized deployment of individual cubesats, said Renato Panesi, chief commercial officer of D-Orbit. “Basically, we are able to provide fast dispersion and precision deployment,” he said, allowing cubesats to be phased into their final orbital slots within a few weeks, rather than months.

The Astrocast launch currently plans to use D-Orbit’s standard DPOD dispensers, but Panesi and other D-Orbit officials say that the future Ion carrier will be well-positioned to meet the increasingly sophisticated needs of cubesat developers, who once were satisfied with flying on almost any orbit but now seek specific orbital planes to meet their business needs.

“This gives the choice to have a dedicated orbit and to have separation and dispersion along the orbit, so a constellation doesn’t need to do a lot of complicated differential drags to get into their orbits,” said D-Orbit’s Stefano Antonetti. “Of course that would be a premium service that would come at a small extra cost, but we see customers ready to pay for such a service.”

D-Orbit Chief Commercial Officer Renato Panesi (left) and Astrocast CEO Fabien Jordan sign a launch agreement Aug. 7 at the 32nd Conference on Small Satellites.
Electric propulsion to send smallsats from LEO to GEO orbit, moon

In an effort to cut launch costs, companies are looking to technology to transport small satellites from low Earth orbit to geostationary orbit and to the moon.

Roccor, a small company based in Longmont, Colorado, that specializes in deployable space structures, kicked off a program recently to produce a solar array for one such mission. After a rocket drops the spacecraft off in low Earth orbit, Roccor solar arrays will generate “several kilowatts of power” to move it to geostationary orbit, said Doug Campbell, Roccor chief executive. Campbell declined to name the customer due to a nondisclosure agreement.

“It is expensive to launch satellites to geostationary orbit,” Campbell told SpaceNews during an interview at the Small Satellite Conference here. “We see this as a huge unmet need.”

By participating in this project, Roccor has develop a new product it intends to market: a full solar wing that can be stowed compactly for launch and deployed in orbit, Campbell said.

By Debra Werner

New thruster aims to help microsats bust out of the kiddy pool

Stellar Exploration, a space technology company based in San Luis Obispo, California, is in the midst of qualification testing of a miniature propulsion systems for planetary microsatellite missions.

What’s unusual about the technology Stellar Exploration developed with Malin Space Science Systems of San Diego is its power, said Mike Loucks, president of Space Exploration Engineering, a Seattle company that specializes in cis-lunar, lunar and deep space missions. The new thruster fueled with hydrazine and nitrogen tetroxide is designed to move a 12-unit cubesat, which weighs about 28 kilograms, at a speed of two kilometers per second.

“The miniaturized bi-prop system Stellar has developed suddenly allows cubesats to take on the missions normally associated with much larger and more expensive spacecraft,” Loucks said by email. “None of the currently marketed propulsion systems for cubesats are even in the same ballpark. This is a serious, grown-up propulsion system based on well-known technology that allows microsatellites to bust out of the kiddy pool.”

Stellar Exploration developed the new thruster with funding from NASA’s Small Innovative Missions for Planetary Exploration program, which supports the formulation and development of small spacecraft science missions. The company is proposing to fly it for the first time on a cubesat that would ride to Mars along with NASA’s Psyche asteroid exploration mission in 2022. Psyche is slated to perform a Mars fly-by, which means a cubesat riding along will need its own powerful propulsion to enter Martian orbit.

“We are looking for other potential applications,” said Tomas Svitek, Stellar Exploration president. The new thruster could be used, for example, on a small robotic lunar lander, a microsatellite moving from geostationary transfer orbit to geostationary orbit or a satellite traveling in a highly elliptical polar orbit, known as a Molniya orbit, Svitek told SpaceNews at the Small Satellite Conference here.

Stellar Exploration designed the new biprop thruster with a low pressure tank to ease range safety concerns. Compliance with the launch safety regulations is inherent in the design, Svitek said.
Made In Space proposes printing large solar arrays for small satellites

Made In Space, the Silicon Valley startup focused on additive manufacturing in orbit, plans to boost the power available to small satellites with Archinaut, the company’s in-space manufacturing and assembling technology.

“Small satellites have solar panels that produce a kilowatt to a kilowatt and a half,” said Andrew Rush, Made In Space chief executive. “We can give you four to five kilowatts of power.”

Made In Space proposes launching a 150- to 300-kilogram satellite with a tightly-packed solar cell blanket and raw material needed to feed an onboard 3D printer. On orbit, the satellite would manufacture solar arrays optimized for microgravity.

Solar arrays built on the ground are reinforced to withstand launch forces, stowed to fit in launch fairings and equipped with mechanisms to deploy in orbit. Instead, the Archinaut solar arrays would be designed for microgravity with a core lattice structure and a robotic arm to integrate the solar array blanket.

Some emerging smallsat applications, from remote sensing to communications, demand more power than solar cells on smallsats typically provide. With Archinaut, Made In Space plans to give satellite developers a way to equip small satellites with solar arrays as large as 20 square meters.

“In space manufacturing of satellites is an area of huge promise for commercial and government customers,” Rush said July 25 at the International Space Station Research & Development conference here.

In 2016, NASA’s Space Technology Mission Directorate awarded Made In Space and its partners Northrop Grumman and Oceaneering Space Systems a two-year $20 million contract to develop Archinaut, robotic manufacturing and assembly platform to produce large structures in microgravity. The award was made through NASA’s Tipping Point program, which funds space technologies that promise significant benefits for government and commercial customers through public-private partnerships. Made In Space is seeking a follow-on contract for an on-orbit demonstration of its Archinaut technology, Rush said.

Since it was established in 2010, Made In Space has focused on microgravity manufacturing. The company sent its first 3D printer to the International Space Station in 2014 and a second printer, known as the Additive Manufacturing Facility, to the space station in 2016.

“We are coming up on 200 parts manufactured in space,” Rush said, noting one of the factors limiting the number of parts printed was waiting for an astronaut to take the part out of the machine.
Capella’s solo debut launches this fall

By Debra Werner

**Startup has big plan for world’s smallest commercial radar satellites**

Capella Space is preparing for its first launch on a SpaceX rocket this fall, an important milestone in the company’s plan to build a constellation of the world’s smallest commercial radar satellites.

Capella satellites will weigh less than 40 kilograms, which means four will fit on a single Rocket Lab Electron rocket, said Payam Banazadeh, Capella co-founder and chief executive.

By launching four satellites on each rocket and sending rockets into different planes, Capella will “build a constellation of many planes and orbits with the least amount of operational and deployment complexity,” Banazadeh said. “It allows us to deploy our constellation efficiently in a shorter time frame and with less capital” than constellations of larger satellites.

Several companies around the world are developing constellations of small satellites equipped with Synthetic Aperture Radar (SAR), which unlike optical cameras can gather imagery in all weather conditions day and night. U.S. military and intelligence agencies are eager for access to the persistent global observations that commercial radar satellite constellations can provide. In the long run, though, industry analysts expect the commercial market to eclipse government demand if small satellite constellations begin offering reliable and inexpensive radar data.

In orbit, Capella plans to unfurl antennas made of a flexible material the company declined to specify. Once deployed, the antennas will span eight square meters, Banazadeh said during a recent tour of the firm’s San Francisco headquarters.

Capella will not sell imagery from its first satellite but will use the data it gathers “purely for internal testing,” Banazadeh said. However, the firm is signing up customers for demonstrations and pilot experiments for its second satellite, slated to launch on an Indian Polar Satellite Launch Vehicle in early 2019, Banazadeh said.

In March, the National Oceanic and Atmospheric Administration awarded Capella a license to send two X-band SAR satellites into polar orbits between 450 to 600 kilometers with a 97.5 degree inclination.

Later in 2019, Capella plans to launch six additional satellites into two orbital planes. With those spacecraft, Capella will offer customers the ability to monitor any location in the world with a maximum revisit rate of six hours, Banazadeh said. Customers have signed “tens of millions” of dollars in contracts for data from those satellites, he added.

“Customers need persistent imagery to see how patterns are changing,” Banazadeh said. “We have found customers care about consistency. If you could do an average revisit of three hours but you have huge gaps in your coverage that is not as good as if you could make consistent measurements.”

With its first-generation satellites, Capella plans to offer imagery with a resolution of one meter or better, which Banazadeh said is “sufficient for 80 percent of current SAR applications.” Capella’s second-generation satellites, which will be slightly larger, will offer imagery with resolution better than one-half meter, he added.

Capella has about 40 employees in San Francisco and Boulder, Colorado, and is expanding quickly “because the contracts are all for the operational constellation we plan to have in place in 2019,” Banazadeh said.

Since it was founded in 2016, Capella has raised more than $15 million in private investment, including $12 million raised in 2017 through its Series A investment round led by Nabeel Hyatt of Spark Capital. Capella is currently raising Series B funding.

The Defense Innovation Unit Experimental, or DIUX, awarded Capella an additional $10 million in 2017 before issuing a stop-work order in October due to a lack of funding. That stop-work order has been lifted and Capella has resumed its DIUX work, Banazadeh said July 24 by email.

Hyatt said by email he’s backing Capella because it is “the only company with the capability to bring the cost of SAR down by 10x while still keeping the quality images the industry expects. In our experience when that happens, it not only transforms the current market, it often creates new markets no one has seen before.”

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**Diagram:**

Capella satellites are small enough for four of them to fit on a single Rocket Lab Electron rocket.

**Image:**

Payam Banazadeh, Capella co-founder and chief executive.
Small satellite sector grapples with cybersecurity requirements, cost

By Debra Werner

For cybersecurity experts, it’s clear-cut: smallsat operators should take the same precautions as large satellite operators, including encrypting uplinks and downlinks, safeguarding ground stations and monitoring network activity.

“We’ve learned that everybody is a target,” said David Fidler, an Indiana University law professor whose report, “Cybersecurity and the New Era of Space Activities,” was published in April by the Council on Foreign Relations. “It would be a gigantic mistake for small companies to think they don’t need to worry about cybersecurity because they are not well known and are flying below the radar. If you are engaged in commercial space operations, you better believe you are on the radar of foreign intelligence agencies.”

Todd Harrison, director of the Center for Strategic and International Security’s Aerospace Security Project, agreed.

“Every link to and from a satellite should be encrypted,” Harrison said by email. “There is really no excuse for passing data in the open anymore. Every satellite, no matter how small or whether or not it does anything national security-related, is a target for hackers and can be used to affect the safe operation of other satellites.”

In many cases, however, small satellite developers and operators are not focusing on cybersecurity. Many of the hallmarks of the rapidly growing sector — low-cost satellites, lean operations and continual hardware and software improvements — are the same characteristics that make cybersecurity challenging.

Nevertheless, there is a growing recognition within the industry that small satellites could become targets if hackers identify ways to profit from gaining access to their networks or ways to inflict harm by controlling or disabling them, which is prompting some companies that have not taken the threat very seriously to enhance security.

“There are some emerging systems, under 100 kilograms, that are quite capable,” said David Langan, a member of NOAA’s Advisory Committee on Commercial Remote Sensing. “In my opinion, these are potential targets like dams or power stations that an adversary may attempt to exploit or disrupt at a time of national crisis.”

Small satellite industry executives and engineers discussing the steps they need to take to safeguard their spacecraft agree there is no one-size-fits-all solution.

Small satellites range from simple cubesats built by university students to capture low-resolution imagery or atmospheric data for a few months before they re-enter Earth’s atmosphere to spacecraft weighing 100-kilograms or more and providing communications or high-resolution imagery to the U.S. military.

No one really expects the university teams to take extensive precautions. Even if a hacker took control of the cubesat, “what’s the worst that could happen?” asked Michael Swartwout, a St. Louis University engineering professor whose students build them. “With no propulsion and no pointing control, it’s very likely you couldn’t do anything other than turn the camera off.”

It’s a different story for commercial satellites, particularly the ones with onboard propulsion. “If someone hacks in, they could take your satellite and ram it into something else,” said a satellite industry executive. “It’s in our best interest to make space safe and secure. But we can’t do exactly what DigitalGlobe or Intelsat does. If you have a satellite that costs $1 million you can’t spend $2 million to ensure its cybersecurity.”

Langan, agreed with that assessment but added, “It’s not necessarily a $2,000 problem either. It will require thought and investment to make sure you get it right.”

In terms of cybersecurity, Langan sees the biggest threat occurring when networked systems are connected to a global internet. “Properly encrypted and authenticated communications are relatively secure,” he said.

Gregory Falco, a research fellow at the Harvard Kennedy School’s Belfer Center Cyber Security Project, underscores the threat posed by internet connections. Falco, who has focused extensively on the Internet of Things, equates cubesats to IoT devices.

“At the end of the day, they have the...
"All our security requirements for our government customers trickle down to our small satellite customers."

— Katherine Monson, KSAT’s U.S. business development director

"< > same characteristics," said Falco, whose report, "Job One for Space Force: Space Asset Cybersecurity," was published in July. "They are ubiquitous, they rely on open-source operating systems and anyone with money can throw one up there."

The danger is that cyber criminals or nation states could use cubesats or small satellites as an entry point to complex communications networks or billion-dollar satellites. If that seems unlikely, imagine warning people five years ago that hackers would employ refrigerators, digital video recorders and other IoT devices to take down Twitter, Netflix and Spotify, as they did in 2016.

"History tells us it’s absolutely going to happen at some point," Falco said.

To keep the threat at bay, companies employ a variety of approaches to cybersecurity. Not everyone adopts encryption.

"Demanding the uplink encryption misses the purpose," said Tomas Svitek, president of Stellar Exploration, a small aerospace manufacturing company in San Luis Obispo, California. "Instead, we need to focus on authentication, thus assuring that only authorized commands are executed. That can be implemented by various well-established computer network techniques."

As examples, Svitek cited popular approaches to verifying data integrity, including Secure Shell tunneling, Transport Layer Security, passwords and tokens. "Encrypting RF links is an excessive and unnecessary burden, and a major potential mission-reliability risk for many low-cost spacecraft missions," Svitek said.

Another way to address the problem is to rely on a ground network with robust security built-in, said Katherine Monson, U.S. business development director for KSAT, a Norwegian company.

"All our security requirements for our government customers trickle down to our small satellite customers," Monson said. "Because we work with many different missions, we can help newer companies get up to speed with respect to data security."

NOAA REJECTS ONE-SIZE-FITS-ALL SOLUTION FOR DATA PROTECTION

Because satellite capabilities and the threats they pose vary widely, the National Oceanic and Atmospheric Administration’s Commercial Remote Sensing Regulatory Affairs office plans to roll out a tiered approach to evaluating company data-protection plans.

Data protection requirements for satellites that pose no significant national security or foreign policy risks will be much less stringent than those of complex, highly capable systems, Tahara Dawkins, NOAA’s commercial remote sensing regulatory affairs director, said by email.

"This is an important change because any U.S. citizen, company or organization seeking to operate a private remote-sensing spacecraft must first obtain a NOAA license. As part of the licensing process, NOAA reviews an applicant’s data protection plan, which describe the steps an individual or organization will take to secure its system architecture, facilities on the ground, communications networks and data. In addition, data protection plans reveal how companies will comply with specific terms and conditions of their license, like resolution restrictions over certain geographic areas."

This fall, NOAA plans to begin evaluating data protection plans along three tiers.

"Class 1 will be for systems where loss of data would not be deemed sensitive and the impacts of loss of control of the space vehicle would be minimal," Dawkins said. "Class 2 will be for systems with sensors that produce sensitive data which is superior to non-U.S. sources, but still fairly distributable to customers. Some restrictions may be placed on these systems to protect national security or foreign policy. Class 3 systems would include sensors that produce very sensitive data for which unauthorized dissemination would pose a clear and significant threat to national security or foreign policy as well as loss of control of those space vehicles would produce significant hazards."

In addition, when reviewing data protection, NOAA may consider whether a satellite will be gathering Earth imagery or observations and whether it will observe artificial or naturally occurring phenomena. "Additionally, we are looking more specifically at the type of technology and application rather than resolution," Dawkins said.

This tiered approach was recommended by the NOAA Advisory Committee on Commercial Remote Sensing, a group comprised of industry, academic and government officials who produce, study or employ space-based remote sensing data.

"It will allow NOAA "to focus its resources, regulatory and auditing systems, on satellites that would present a national security threat if compromised," he said.

"The need for security measures is real. It is important to make sure it is proportional to the risk level and commercially viable. If you increase the bar to a point where commercial companies can’t get licenses, I would argue you would harm national security by limiting the commercial space sector in the United States."
Helios Wire sees a hidden fortune in finding lost assets  By Debra Werner

At an oil and gas conference earlier this year, Scott Larson found a receptive audience for his startup’s future asset-tracking service.

“We lose stuff all the time,” an oil industry executive told Larson, chief executive for Helios Wire, a satellite-enabled Internet-of-Things startup based in Vancouver, Canada. If an employee parks equipment, like a $3 million fuel drum, in a farmer’s field but leaves the company before retrieving the drum and the company’s inventory management system fails to pick that up, the drum can be lost, the executive said.

Oil companies won’t pay $400 a year to insure that type of asset but they would pay Helios Wire “a couple dollars a month” to track it, Larson told SpaceNews.

Larson co-founded Helios in 2016 shortly after stepping down as CEO from UrtheCast, the now publicly traded company he started with brother Wade Larson in 2010 to capture live views of the Earth with an ultra-high-definition video camera mounted on the International Space Station.

Helios is preparing to launch its first satellite in October on a SpaceX Falcon 9 rocket. The firm’s previous attempt to send a satellite into orbit in November 2017 was unsuccessful because it was riding on a Russian Soyuz-2.1b rocket that failed. Helios plans to send another satellite into orbit on a Soyuz in December and a third on a February Soyuz flight.

Astro Digital, an Earth-imaging and analysis company, is building the 20-kilogram satellites with a machine-to-machine communications payload built to Helios Wire’s specifications.

With one satellite in orbit, Helios will begin booking revenue. With three, the venture will start to make a profit. From there, Helios will add more satellites to its constellation based on demand, Larson said.

Helios owns 30 MHz of priority mobile satellite system S-band spectrum it acquired from Sirion Global Ltd. of Australia.

“Spectrum is the asset,” Larson said. “If you don’t have that, you spend all your time trying to coordinate landing rights with various countries spread out all over the world, and those discussions aren’t for the faint of heart.”

With that spectrum, Helios plans to offer monitoring and tracking services to industries that can handle some delay in data reporting like infrastructure, transportation, shipping, energy and agriculture.

Helios customers will attach devices as small as cell phones to whatever they want to monitor or track, Larson said. The devices will “beep information to space, whatever information you want: location, elevation, temperature, proximity,” he added.

The Helios network will send that information through its satellites to existing ground stations and then uploaded it to a cloud, where customers can view it online or download it, Larson said. With one satellite, Helios will pick up the information once every 12 hours. With two, it would be every six hours and every four to five hours with three satellites, he said.

Larson estimates the space portion of the global Internet of Things market is worth “a couple billion dollars a year” shared by Inmarsat, Iridium Communications, Orbcomm and Globalstar. “We think we can capture 10 percent of the market with something that is just good enough,” Larson said.

“Spectrum is the asset. If you don’t have that, you spend all your time trying to coordinate landing rights with various countries spread out all over the world, and those discussions aren’t for the faint of heart.”

— Scott Larson, Helios Wire CEO
French propulsion startup ThrustMe received 2.4 million euros ($2.8 million) from the European Commission to commercialize an electric propulsion system for small satellites.

ThrustMe is one of a growing number of startups creating products for the fast-growing small satellite market. Like the proliferation of launch startups targeting small satellites, other parts of the small satellite ecosystem, such as satellite control, data downlinking and component manufacturing, are gaining entrants.

ThrustMe received its European Commission funding Aug. 1 following a May selection through the EC’s Horizon 2020 research and innovation investment program, ThrustMe founder and chief executive Ane Aanesland told SpaceNews.

“Now we are setting up a pilot line for production of the propulsion systems,” she said.

ThrustMe is commercializing technology from France’s Ecole Polytechnique plasma physics laboratory and CNRS, the French National Center for Scientific Research. The 18-month-old company has raised 4.6 million euros to date, and in April moved into a newly built 300-square-meter headquarters in Paris.

The company has 15 people on its payroll, according to Aanesland.

ThrustMe’s 1-kilogram propulsion system has produced up to 9 millinewtons of thrust in ground demonstrations with the French aerospace research lab ONERA.

Aanesland said the first satellite with a ThrustMe propulsion unit is scheduled to launch next year. She declined to name the satellite or its launch vehicle.

ThrustMe’s first product is a 30- to 70-watt thruster capable of propelling small satellites between 10 and 50 kilograms in size, Aanesland said. She said the company is developing a 300-watt thruster for satellites between 200 and 300 kilograms. Customers can use multiple thrusters to match different satellite masses, she said.

ThrustMe’s thrusters run on xenon, an inert gas commonly used for electric propulsion, but future systems will support iodine. Since iodine doesn’t need to be pressurized, it requires a fraction of xenon’s storage volume, Aanesland said.

“It is extremely efficient in volume, and also efficient in the way we have integrated the iodine propellant and feed system into the propulsion system,” she said.

Iodine is more corrosive than xenon, making it more difficult to use, she said, but ThrustMe still sees potential for it. By using iodine and breakthroughs in propulsion technology, ThrustMe claims its thrusters can generate twice as much thrust with 40 percent the mass of traditional gridded and hall-effect xenon thrusters.

Aanesland said ThrustMe is taking orders for iodine thrusters now for a beta version that will be ready in mid-2019. The initial iodine thruster will produce less thrust than its xenon counterpart; Aanesland said ThrustMe is working on an upgraded version with thrust equal to xenon for delivery in the early 2020s.

Aanesland said ThrustMe anticipates shipping five thrusters for two customers next year, and scaling up by 2020 to be able to ship 50 to 70 thrusters a year.

ThrustMe is one of many startups developing new propulsion systems for smallsats. Others that have raised funding the past few years include Accion Systems of Boston, Expansion in Austria, Phase Four in El Segundo, California, and Apollo Fusion of Mountain View, California.

Like executives with many of those companies, Aanesland said she suspects there are more startups emerging than will make it, but added that demand abounds for those that can prove themselves.

“If you look at the number of satellites that are planned and the complexity of producing propulsion systems, it is sure that we cannot even meet the market today,” she said. “I think the requests for propulsion systems is higher than all of the means that can deliver. But then again it depends on the technologies. Not all of the technologies are proven. Some have better performances than others. Clearly we believe ThrustMe has the technology to compete.”
SMPM-T

SMPM-T is the smallest threaded open source connector on the market. Its unique and innovative combination of a MIL-STD-348 SMPM female interface connector together with a retractable threaded nut provides an integrated solution offering unprecedented electrical and mechanical performance. The SMPM-T handles high density requirements with a connector centreline-to-centreline spacing of just 5 mm (0.20 in) while offering unmatched electrical stability at frequencies up to 67 GHz in even the harshest operating environments.

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