Blue Origin, Lockheed, Northrop join forces for Artemis lunar lander

Blue Origin is joining forces with three other major aerospace firms in a “national team” to develop a human lunar lander for NASA.

The company’s founder, Jeff Bezos, announced Oct. 22 his intent to work with Lockheed Martin, Northrop Grumman and Draper on the unnamed lunar lander, the proposal for which they will submit to NASA for its Human Landing Services competition.

“I am excited to announce that we have put together a national team to go back to the moon,” he said during an onstage interview at the 70th International Astronautical Congress here, where he received an Excellence in Industry award. “We could not ask for better partners.”

Under the teaming arrangement, Blue Origin will serve as the prime contractor and provide a descent stage developed for its Blue Moon lunar lander unveiled earlier this year. Lockheed Martin will build a crew-rated ascent stage, leveraging systems it developed for the Orion spacecraft. Northrop Grumman will build a transfer stage to move the lander from the lunar Gateway to low lunar orbit, based on its Cygnus cargo spacecraft. Draper will provide guidance systems and avionics for the lander.

Executives with the four companies said the urgency required by the goal of returning humans to the moon within five years led them to team up rather than pursue separate lander projects. “A national priority requires a national team, so we brought who we feel is the best in class to the job,” Brent Sherwood, vice president of advanced development programs at Blue Origin, said at a briefing with reporters.

Both Blue Origin and Lockheed Martin in particular had previously discussed plans to develop lunar landers on their own. Bezos hosted an event here in May to discuss plans for Blue Moon, including a “stretched” version of the descent stage large enough to host an ascent module for crewed missions. Lockheed Martin showed off its own designs for lunar landers in April that it said could be ready in time to meet a 2024 lunar landing goal.

“It’s not uncommon for all companies to lay out an architecture for an entire system,” Sherwood said. Given both the work required and the 2024 deadline, though, “the most sensible thing was to get together to try to deliver this for NASA.”

“All of us coming together and taking existing systems that the government’s already invested in, and we’ve already invested in, seemed like the best use of the American public’s money,” said Lisa Callahan, vice president and general manager of commercial and civil space at Lockheed Martin.

Frank DeMauro, sector vice president and general manager at Northrop Grumman, said the pairing made sense even without the 2024 deadline. “It became very clear to us, as we broke apart the architecture into these pieces, that [it] was in the best interest of our team,” he said.

The lander, Sherwood said, is designed to “fully exploit the capabilities” of Blue Origin’s New Glenn rocket, but could also fly on other vehicles. He declined to say how many New Glenn vehicles would be needed to send the complete...
OMEGA, COUNTING DOWN TO LAUNCH
NASA, ESA agreements extend Luxembourg's space resources work

Agreements with NASA and the European Space Agency are the latest steps by the government of Luxembourg to support its emerging space resources industry.

NASA Administrator Jim Bridenstine and Marc Serres, chief executive of the Luxembourg Space Agency (LSA), signed a memorandum of understanding (MOU) Oct. 22 to discuss potential collaboration in NASA’s exploration plans. That agreement outlined cooperation in several areas, from space-related applications to utilization of space resources.

The MOU stems from a separate space cooperation agreement between the governments of Luxembourg and the United States signed in May. “Our aim is to really develop together all kinds of new activities in space,” Etienne Schneider, deputy prime minister of Luxembourg, said in an Oct. 22 interview during the 70th International Astronautical Congress.

The agreement is part of a broader effort to build links between the space industries of the two countries. “We’re trying to bring U.S. companies together with Luxembourg-based companies and see how they can cooperate,” he said. That cooperation, he added, could allow American companies to work on ESA programs and have Luxembourg companies participate in NASA’s Artemis program to return humans to the moon.

The NASA agreement comes four days after Luxembourg signed a separate agreement with ESA to study cooperation on space resources. As part of that agreement, LSA will establish a Space Resources Research Center in the country.

That center will build upon the existing work with institutes and the University of Luxembourg. “We came to the conclusion that, in order to really progress in research in space resources, we should have a proper space resources research center,” Schneider said. “ESA is very much interested in cooperating with this research center.”

That ESA support, he added, is pending a decision by member states to fund ESA’s proposed European Exploration Envelope Programme at the upcoming ministerial meeting in late November. “We hope to get the support of member states to get ESA on our side developing this,” he said.

Luxembourg started its SpaceResources.lu initiative in 2016, at a time when there was strong interest in asteroid mining by startups like Deep Space Industries and Planetary Resources. Luxembourg’s support included an investment in Planetary Resources and an MOU with Deep Space Industries, but both companies have since been acquired by other companies with no asteroid mining plans.

That has not slowed down the overall effort, Schneider said, which includes passage of a law granting companies in the countries rights to space resources they acquire, as well as the establishment of LSA last September. The agency expects to launch a venture capital fund by the end of the year, while the government will consider a new comprehensive national space law in 2020.

Schneider said that the initiative has led about 50 companies to establish offices in Luxembourg, with more than 150 other companies in the pipeline. However, he added, very few of them are as focused on space resources as those earlier asteroid mining companies, with most being more general entrepreneurial space companies.

“If you focus on space mining, you will not have revenues for many years,” he said. “You need to have short-term initiatives as well to make some money on the way.”

Schneider said that the demise of Planetary Resources in particular, which led the government to lose 12 million euros ($13.4 million) invested in it, did not have any long-term repercussions for the initiative. “Since the beginning, I’ve said this initiative is high risk,” he said. “You have to accept that sometimes you’ll fail. It’s not a dramatic situation. It’s life.”

Jeff Foust

lander system to the moon.

Proposals are due to NASA for the Human Landing Services competition Nov. 1. NASA previously stated it intends to select several proposals for initial studies, depending on available funding, and then select as many as two for full-scale development. The landers will be owned by the companies, with NASA purchasing landing services rather than the landers themselves. Sherwood said he expected a “very rapid selection” of proposals, with work starting as soon as January.

“It’s a relatively small community. We talk to each other all the time,” Sherwood said when asked how the companies decided to join forces. “When it became clear what NASA was going to ask for, to us it seemed like the most sensible approach.”
Noosphere Venture campaign coming together with radar constellation

EOS Data Analytics (EOS), an Earth imagery processing and analysis company, plans to begin launching high-resolution synthetic aperture radar (SAR) satellites by 2022 as its owner Noosphere Venture Partners takes another step toward its goal of creating a vertically integrated space powerhouse.

Many people know Noosphere Ventures, a Silicon Valley investment firm, for the lifeline it provided in 2017 to Firefly Aerospace when the small launch vehicle developer was running out of money. Other Noosphere Ventures portfolio companies are less well-known and some remain in stealth mode.

For about six years, Noosphere Ventures has been working methodically to create a vertically integrated holding that includes firms capable of producing satellites and sensors, launching satellites, and analyzing and disturbing data.

“It’s not about satellites, it’s about constellations and constellation management to create a successful business case,” said Max Polyakov, Noosphere Ventures managing partner. It could take 20 to 25 years to build the type of company he envisions, Polyakov added.

In 2015 Noosphere Ventures established EOS, a company focused on processing and analyzing Earth observation data, to learn about the market and customer needs.

Two years later, Noosphere invested in Firefly, a firm whose launch capability is “perfectly sized to deploy constellations of remote sensing satellites into dedicated orbits needed for rapid revisit,” said William Woods, Noosphere Ventures entrepreneur in residence.

Now, Noosphere is “focusing on everything in between, which is constellations and other systems,” Polyakov said. “SAR is a very sexy area that has not been disrupted yet. We have been working on this quietly for a year and a half.”

Space Electric Thruster Systems, another Noosphere company, will supply propulsion for the small SAR satellites.

“All the work is feeding into this remote sensing venture,” Woods said. “The big picture is finally coming together.”

Noosphere’s radar startup, EOS SAR, plans to launch a constellation of small satellites weighing about 200 kilograms with 3.6-meter deployable antennas to gather imagery with a resolution of 25-centimeters per pixel. EOS SAR plans to offer customers imagery and data in three modes: Stripmap, Spotlight and Interferometric, a technique often used to create maps and digital elevation models.

“We believe that’s what government and commercial customers need,” Polyakov said. A single Firefly could launch three or four EOS SAR satellites, he added. Plus, the launch vehicle deployment mechanisms will be sized to fit the SAR satellites. “There will be deep integration,” Polyakov said.

EOS already has 40 to 45 people working around the world on data analytics, SAR satellites, sensors and antenna design, Polyakov said. “We have already done enough so we will get the right strategic partnerships, which will help us evolve even faster,” he added.

EOS SAR says on its website it will launch its first satellite in 2022 and begin commercial operations in 2023. The company might even beat that schedule but Polyakov said he wants to be careful not to overpromise and disappoint customers.

In Brief

Firefly Aerospace announced it will work with Aerojet Rocketdyne, an agreement that could lead to use of an Aerojet engine. Aerojet Rocketdyne and Firefly said they will collaborate on multiple fronts, including the Orbital Transfer Vehicle that Firefly is building to ferry LEO satellites up to the geosynchronous arc. While Firefly is developing its own engines for its Alpha small launch vehicle, whose first flight is scheduled for early next year, the company said it’s considering Aerojet’s AR1 engine, originally developed for potential use on ULA’s Vulcan rocket, for its larger Beta rocket.

India is still studying the cause of the loss of its Vikram lunar lander last month. In an Oct. 21 interview, S. Somanath, director of ISRO’s Vikram Sarabhai Space Centre, said engineers were using simulations to reconstruct what happened to the lander, part of the Chandrayaan-2 mission, after contact was lost 2.1 kilometers above the surface during its attempted landing Sept. 6. ISRO is holding off on an announcement about the lander until that work is finished, but he acknowledged the lander likely hit the lunar surface at a high velocity, “beyond its survivability.”
Entrepreneurs and international partnerships key to future lunar exploration

Entrepreneurs and international government agencies will play important roles in NASA's future lunar exploration, according to speakers at the 2019 International Astronautical Congress here.

While previous lunar campaigns were directed and funded by the U.S. government, future missions will involve many private companies and international partners, said Ryan Whitley, National Space Council civil space policy director.

Through public-private partnerships, NASA intends to buy transportation for astronauts traveling to the International Space Station as well as astronauts traveling to the lunar surface.

"Public-private partnerships are essential to what we are trying to do," said Margaret Kieffer, NASA Export Control and Interagency Liaison Division director. "Entrepreneurs see the advantage and the economic benefit of putting their own skin in the game."

Public-private partnerships also benefit the U.S. government, "because we know that giving companies a chance to innovate and compete with one another will bring the best out of everyone," said Kevin O’Connell, director of the Commerce Department’s Office of Space Commerce. "It doesn’t mean we give up on safety and the standards we apply."

By investing in industry partners, the government is taking steps toward reducing the cost of space missions and helping companies establish a robust space economy, Ryan said.

The Office of Space Commerce is working closely with entrepreneurs as it seeks to foster economic growth and streamline regulations, O’Connell said. "It is important to pay attention to the kinds of capabilities entrepreneurs are offering," he added. "There’s sometimes a disbelief in government that something can happen or can happen as fast as entrepreneurs think it can."

Entrepreneurial spirit

To help entrepreneurs succeed, O’Connell mentioned "the possibility the government could make a small investment" in companies to further government goals "even as the companies pursue commercialization."

The panelists, who were discussing lunar exploration in the New Space age, frequently referred to Space Policy Directive One, which calls on NASA to "lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and to bring back to Earth new knowledge and opportunities."

Entrepreneurs are helping to ensure future lunar campaigns are sustained, O’Connell said. "We see entrepreneurs thinking about training and feeding people who will live and work on the moon for long periods of time," he added.

Moon Express, for example, has a long-term vision for lunar operations including mining.

"The moon is the next stepping stone," said Bob Richards, Moon Express CEO and founder. "It’s close to the economies of earth. It’s absolutely the next logical place for governments and the private sector to work together to push the boundaries of not just economics and entrepreneurship but of policy and law."

International partners also will help to ensure a sustained human presence on the moon, panelists said.

"When you look at the whole picture of exploring the moon both robotically and with humans, NASA is one small part of that," Kieffer said. With Artemis and the lunar Gateway, "the intention is to create an open architecture that industry and entrepreneurs can leverage for their own purposes. The goal is to encourage everyone to partner with NASA or with others in the international and commercial community."

The panelists pointed to the space station as a good model for cooperation.

"You have resilience and risk reduction as a result of multiple partners being engaged on the architecture," Ryan said. "It provides sustainability, resilience and affordability as countries participate and have the benefit of other nations investing with them."

This type of international cooperation also offers geopolitical benefits. "It’s a diplomatic tool we cannot ignore," Ryan said.

NASA has about 700 international partnerships in force now, Kieffer said. Those agreements have become even more important since March when Vice President Mike Pence announced the Trump Administration’s policy of returning astronauts to the moon within five years.

That direction keeps NASA “laser-focused on the task at hand,” Kieffer said. SN
Arianespace targets 2023 for lunar Ariane 6 rideshare mission

European launch provider Arianespace is planning a rideshare mission to the moon in 2023 as an early step toward increasing Europe’s involvement in lunar activity, CEO Stéphane Israël said Oct. 22.

Israël, speaking at the 70th International Astronautical Congress here, said the rideshare mission will be able to deliver 8,500 kilograms into a lunar transfer orbit. Orbiters and/or landers would reach the moon three days after liftoff, he said.

“In 2023 we are ready to offer the first rideshare mission to the moon with Ariane 6,” Israël said, adding that Arianespace is “contemplating public and private customers” for that mission.

Ariane 6, which has its first flight in 2020, will not launch humans, Israël said. But Arianespace would like to see Europe conduct its own crewed missions and is poised to lobby for that goal. Israël said Arianespace will push for a European crewed space-flight program at the European Space Agency’s 2022 ministerial meeting, where its member states will decide on what programs to fund for the following three years.

“I would like, for this [2022] conference ministerial, [that] we start working on human flight through a European launcher,” he said.

Israël said Arianespace would not make that push at ESA’s Space19+ ministerial next month in Spain.

Arianespace’s flagship heavy lift launcher, the Ariane 5, was designed to launch a crewed European spaceplane called Hermes, but ESA canceled the project in 1992 after schedule delays and cost overruns. Ariane 5, in its history of more than 100 flights, has mainly launched telecommunications satellites. From 2008 to 2014, Arianespace launched a series of five cargo vessels — European Automated Transfer Vehicles — to the International Space Station for ESA using Ariane 5 rockets.

Israël said Arianespace is aware of two ESA lunar programs to be considered at the 2019 ministerial for which Ariane 6 is “perfectly adapted.” France and Germany, the two biggest financial and industrial backers of the Ariane 6 program, are also considering a robotic lunar mission using Ariane 6, he said.

ESA to seek Prometheus funding at Space19+

The European Space Agency will ask its 22 member states next month to fund an additional two to eight Prometheus reusable engines so that the agency can further the engine’s development.

ESA, with prime contractor ArianeGroup, has two Prometheus engines being built today, leveraging funds granted at its 2016 ministerial, plus earlier work supported by the French Space Agency CNES.

Jérôme Breteau, ESA’s head of future space transportation, said Oct. 21 at the 70th International Astronautical Congress here that those two engines are on track for test firings in late 2020 at the German Space Agency DLR’s Lampoldshausen facility. ESA will continue engine tests into 2021, but what follows “is the subject of our proposal to the Space1+ ministerial,” he said.

ESA’s tri-annual ministerial conferences are where the agency and its members allocate funds for future space programs. ESA is seeking 12.5 billion euros ($13.9 billion) at its upcoming ministerial, dubbed Space19+, Nov. 27-28 in Seville, Spain.

Breteau said ESA needs to know the outcome of the ministerial before it can lay out the next steps for Prometheus. The agency has “very ambitious” plans for the liquid-oxygen and methane engine, he said.

ESA’s goal with Prometheus is to manufacture the engine for 1 million euros ($1.1 million) each — a tenth the price of the Vulcain engine used on the first stage of Europe’s Ariane 5 rocket. Prometheus is also designed to be reusable.

Breteau said Lampoldshausen’s hydrogen engine test bench, used for Ariane 6’s Vulcain 2.1 engine, will need upgrades to support the methane needed for Prometheus.

Breteau wouldn’t go so far as to name a launcher that might use Prometheus.

“System engineering on the target launcher configuration is ongoing,” he said. ESA has what Breteau described as “more than a notional idea” of how to cluster Prometheus engines together on a launcher, a detail he said gives an “idea of the maturity of the system activities.”

CALEB HENRY
African nations eye smallsat programs to boost space capacities

"All African countries with space programs have small satellite programs, which is an indication that African countries are embracing small satellite programs as an affordable ticket to space."

For instance, Nigeria collaborated with Surrey Satellite Technology (SSTL) from the U.K. to build the NigeriaSat-1 and NigeriaSat-X satellites, and Nigeria’s Federal University of Technology Akure (FUTA) partnered with Japan’s Kyushu University of Technology to build NigeriaSatEdu-1, a 1U cubesat developed under the Japanese BIRDS project.

Ibeh says that numerous African states are leveraging their small satellite programs to foster their human capacities, know-how, and space infrastructure.

“African engineers built 14 of the 35 satellites, including those they built in Africa and others using facilities outside of Africa. There are multiplying business opportunities for local and foreign companies across the various sub-sectors of the African space industry,” Oniosun and Ibeh wrote in Space in Africa’s African Space Industry Annual Report released last June.

For a number of African states, “small satellite programs have been valuable for amassing complete capacities in small satellite subsystems and payloads manufacturing. For instance, South African new space companies are at the front line of supplying cutting-edge technologies in small satellite subsystems, altitude control systems and imaging payloads to many global satellite missions,” Ibeh said. “Other African countries such as Algeria and Egypt are also making tremendous progress in terms of human capital development, space infrastructure and IP knowledge.” SN
SpaceX plans to start offering Starlink broadband services in 2020

SpaceX is confident it can start offering broadband service in the United States via its Starlink constellation in mid-2020, the company’s president and chief operating officer Gwynne Shotwell said Oct. 22.

Getting there will require the company to launch six to eight batches of satellites, Shotwell told reporters during a media roundtable. SpaceX also must finish the design and engineering of the user terminals, which is not a minor challenge, Shotwell acknowledged.

SpaceX CEO Elon Musk has a Starlink terminal at his house and he used it to send a tweet early Oct. 22. “Sending this tweet through space via Starlink satellite,” he tweeted to his 29 million followers. “Whoa, it worked!”

Shotwell said SpaceX will need to complete six to eight Starlink launches — including the one that already took place in May — to ensure continuous service in upper and lower latitude bands. “We need 24 launches to get global coverage,” she said. “Every launch after that gives you more capacity.”

The company caused a stir last week when it requested the International Telecommunication Union to approve spectrum for 30,000 additional Starlink satellites to build the world’s largest low-Earth orbit broadband constellation. This was in addition to 12,000 already approved by the U.S. Federal Communications Commission.

Shotwell said SpaceX is not certain that will need that many satellites. Far fewer are needed for global coverage but the company wants extra spacecraft to be able to offer customers customized service options. Starlink is a mesh network of satellites connected to each other by space lasers.

“We’ll continue to upgrade the network until mid to late next year,” said Shotwell. “We’re hoping for 24 launches by the end of next year.”

Shotwell said many of the Starlink features are being tested by the U.S. Air Force Research Laboratory under a program called Global Lightning. SpaceX in December 2018 received a $28 million contract to test over the next three years different ways in which the military might use Starlink broadband services. So far, SpaceX has demonstrated data throughput of 610 megabits per second in flight to the cockpit of a U.S. military C-12 twin-engine turboprop aircraft.

SpaceX wants to offer the service to the U.S. government but is now focused on how it will serve the consumer market. Many of the details of how the service will be rolled out remain to be worked out, she said. When possible it will be offered directly to consumers following Musk’s Tesla model for selling cars. In many countries the company will be required to partner with local telecom firms to offer the service.

Shotwell recognized a lot of this is uncharted territory for SpaceX. “This is very different business for SpaceX,” she said. “It’s leveraging space technology but it’s a consumer business.”

She said Starlink is considered “additive to our business,” meaning that it will not replace space launch services as SpaceX’s primary source of revenue.

SpaceX must hire a whole new workforce to deal with sales, tech support and product engineering. User terminals are a major concern. “The more engineering we do on the user terminal, the less service people we will have to hire,” said Shotwell. Terminals are one aspect of the Starlink business that the company has to “get right,” she said.

When consumers sign up, “they are going to receive a box from SpaceX” with a user terminal and a cord, said Shotwell. How that gets connected and where the terminals should be placed in someone’s home are still issues to be ironed out. “We still have a lot to do to get that right,” said Shotwell. “Knowing Elon, he wants everything to be beautiful. So the user terminal will be beautiful.”

Outside the United States, SpaceX is working nation by nation to get authorization to offer the service. “Every country has its own process,” said Shotwell.

The satellites today are being produced at SpaceX’s factory in Hawthorne, California. But mass manufacturing in the future will move to a different location Shotwell declined to name.

SpaceX is racing to get Starlink in operation as several other companies continue to build competing broadband constellations. Shotwell said there is probably room in the market for at least two competitors. “If we do well and make money, there will be competitors.”

As more Starlink launches are planned, SpaceX wants to use previously flown Falcon boosters as much as possible, said Shotwell. “I think we’ll manage the fleet how best we manage the fleet,” she said. “Our intent is to use Starlink to push the capability of those boosters and see how many missions they can do.”

A single Falcon booster was designed for 10 flights. The next Starlink mission scheduled in mid-November will be launched by a booster on its fourth flight.

Since SpaceX started returning boosters in 2015, 44 first stages were recovered: 26 at sea and 18 on land. So far 23 of the recovered boosters have flown.
Boeing is hoping to sign up international buyers for its new communications satellite bus aimed at the small geosynchronous market. At the 2019 International Astronautical Congress this week, the company will be pitching the Boeing 702x spacecraft to several potential customers, Eric Jensen, vice president of Boeing’s global commercial satellite sales, told SpaceNews.

“We have a team at IAC,” he said. “We’re going to engage customers on a national and commercial level.”

Boeing announced in September at Euroconsult’s annual World Satellite Business Week conference in Paris that it was introducing the 702x family of spacecraft to compete for what is expected to be a growing market for small geostationary orbit satellites. The 702x small GEO bus is based on the O3b mPower satellite Boeing is producing for SES’s medium-Earth orbit constellation of high-throughput satellites. Boeing combined its legacy 702 small and medium platforms with a newly designed digital payload.

In the weeks since the Euroconsult conference, “we have heard interest expressed from smaller governments,” Jensen said. The use of a digital, reprogrammable payload and the miniaturization of electronics has made it possible to pack the same capability of a 4,000-kilogram satellite into one half that size, he said. Boeing sees Airbus as its closest competitor in this segment of the market.

Jensen declined to name specific countries that have expressed interest in the 702x satellite. Some potential customers, he suggested, could be nations that currently are partners and users of the U.S. government’s Wideband Global Satcom (WGS) military constellation of geosynchronous orbit satellites. WGS partners include Canada, Denmark, Luxembourg, the Netherlands, New Zealand, Norway and the Czech Republic.

“They’re looking at this technology for bite-size versions that nations can use, re-purpose it for different missions,” said Jensen. A country would decide, for example, to split the capacity for government use and for commercial economic stimulus. A fully digital payload that can be reprogrammed makes this type of allocation relatively easy to do, he said. “People are thinking differently about how to use this.”

A spacecraft ordered today would be ready to launch in 2022, Jensen said. Boeing designed the satellite to be compatible with most launch vehicles. “We are working with all providers,” Jensen said.

The 702x can be launched as a primary or secondary payload. Three would fit on United Launch Alliance’s Vulcan Centaur, SpaceX’s Falcon 9 or Arianespace’s Ariane 6.

While there is a lot of marketing buzz about digital re-programmable satellites, every one of these products is different, Jensen said. For the 702x spacecraft, Boeing designed the payload to make it easier for customers to change the satellite’s missions and re-purpose capacity.

Satellite operators, for example, could shift from offering TV broadcast to broadband internet services. They can also reallocate capacity as they see fit. “You can shape and form beams, put a lot of throughput to a given region so you don’t waste energy over places where you don’t have customers,” he said. “Old-school satellites can cover an entire country, but it’s hard to parse and distribute data.”
As companies race to launch hundreds of satellites into low Earth orbit in the coming years, ensuring their systems are protected from cyber threats should not be an afterthought, cybersecurity experts Sam Visner and Scott Kordella argue in a paper to be presented at the 70th International Astronautical Congress.

Visner is the director of the National Cybersecurity Federally Funded Research and Development Center (NCF), which is managed by MITRE, a not-for-profit company that operates federal R&D centers. Kordella is MITRE’s director of outer space systems. The NCF, the nation’s first federally funded center solely dedicated to cybersecurity, supports the Commerce Department’s National Institute of Standards and Technology (NIST).

The center has developed and published cybersecurity “best practices” for industries like financial services and health care. These guidelines can be especially valuable to startups and small businesses that don’t have internal resources to combat cybercrime, Visner told SpaceNews. As the space-based economy grows, he says, cybersecurity is going to be essential to companies’ future. “We’ve been interested in space for a long time because of the importance of space to national security and the national economy.”

The space is unique in some ways “but not so different that we can’t learn from what we did in other sectors for cyber protection,” says Kordella.

The large telecom firms that operate geosynchronous communications satellites have invested and continue to invest in cybersecurity for their satellites and ground systems. But many of the startups that are poised to deploy satellites in low Earth orbit are small and might not be prepared to deal with cyber threats, Kordella argues. For this burgeoning sector of the space economy, any disruption of service caused by hackers or hijackers taking control of their satellites could lead to financial ruin.

Small businesses have a large presence in the space economy either as stand-alone companies or suppliers to larger companies, Kordella says. Even those with limited financial resources, he adds, can still ensure the safety of their operations at relatively low cost by taking advantage of commercially available encryption and other technologies.

The NCF is just starting to develop cybersecurity guidelines for the space industry. Kordella says MITRE expects to have a draft ready sometime in 2020. The draft will be coordinated with NIST, the National Space Council and industry groups.

“We want to develop guidelines that the industry can use with some level of confidence,” says Kordella. The guidelines would recommend, for example, the use of commercially available encryption software for satellite uplinks and ground systems.

NIST is emphatic that cyber protection can be achieved without having to develop customized software or hardware, says Visner. “We’re attempting to make cybersecurity possible and consumable for the broadest number of industries, including space.”

As with other cybersecurity guidelines NIST developed for other industries, their adoption is voluntary. “This is not a heavy-handed approach,” says Kordella. “They’re not requirements but recommendations” that companies can choose to follow.

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Made In Space announced plans Oct. 21 to send a plastic recycling facility to the International Space Station on a Northrop Grumman commercial cargo resupply flight scheduled for early November. The Braskem Recycler is designed to turn plastic waste and 3D printed objects into the type of feedstock that serves as the raw material for the Made in Space Additive Manufacturing Facility on the space station.

“Local manufacturing resources are a crucial capability for space exploration,” Michael Snyder, Made In Space chief engineer, said in a statement. “Demonstrating and validating recycling capabilities on the ISS is an important step toward developing sustainable manufacturing systems that will enable us to venture deeper into the solar system.”

In 2016, Made in Space and Braskem, the Brazilian petrochemical company that produces biopolyethylene from sugarcane, announced the first part printed in the Made In Space Additive Manufacturing Facility out of the material. Since then, the two companies have developed the Braskem Recycler to take in plastic waste and unwanted parts, break them up, apply heat and create spools of feedstock for the Additive Manufacturing Facility. Astronauts will load the material but “the recycling process is automated and requires minimal crew intervention,” according to the Made In Space news release.

Made In Space developed the Recycler through its partnership with Braskem.
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