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NEWS FROM THE 35TH SPACE SYMPOSIUM

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EXCLUSIVE INTERVIEWS WITH

Gen. John Hyten, USSTRATCOM
Gen. David Goldfein, USAF Chief of Staff
Space Development Agency Director Fred Kennedy
U.S. Air Force Secretary Heather Wilson
Maxar CEO Dan Jablonsky
NASA Administrator Jim Bridenstine said the agency’s approach to moving up a human lunar landing from 2028 to 2024 will focus first on speed and then on sustainability.

In a plenary speech at the 35th Space Symposium April 9, Bridenstine said the new approach the agency is developing in response to the goal of a human lunar landing in five years announced by Vice President Mike Pence two weeks ago will involve many of the same elements of NASA’s original plans, but in a revised order. “All of those elements that were necessary to getting humans to the surface of the moon in 2028, all those elements still exist. The plan is still the same,” he said. That includes, he said, development of the Space Launch System and Orion spacecraft, a lunar Gateway in orbit around the moon, and lunar landers.

What will change, he said, is the schedule for developing some of those elements, which will be split into two phases. “The first phase is speed. We want to get those boots on the moon as soon as possible,” he said. “Anything that is a distraction from making that happen we’re getting rid of.”

That emphasis on speed includes launching Exploration Mission (EM) 1, an uncrewed Orion test flight, on the first flight of the SLS in 2020, to be followed by the first crewed Orion mission, EM-2, “as soon as possible thereafter.”

That phase will also include the lunar Gateway, although Bridenstine suggested it would initially incorporate only a fraction of the elements previously proposed for it by NASA and international partners. “The first elements of Gateway are focused exclusively on the surface of the moon,” he said, specifically mentioning the Power and Propulsion Element NASA is currently reviewing proposals for.
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as well as a habitation module.

NASA is also changing its approach for developing lunar lander elements. NASA issued a solicitation in February as part of its Next Space Technologies for Exploration Partnerships (NextSTEP) program, seeking concepts for a transfer vehicle and a descent module. At the time, agency officials said they planned to keep studies for the lander's ascent module, which would require human rating, within the agency.

However, on April 8, NASA announced it would soon issue another NextSTEP solicitation for ascent module concepts. That solicitation, which will likely start with study contracts but could soon lead to technology development awards, is designed “to enable rapid development and flight demonstrations of human lunar landers,” the agency said in its procurement filing.

NASA rushed through that new ascent module solicitation in just seven days, Bridenstine said.

“We could have had it out in four days, but I put the brakes on it because I wanted to make sure we were heading in the right direction,” he said. All three elements of the lunar landing system, he said, will be developed as public-private partnerships.

The Commercial Lunar Payload Services (CLPS) program, where NASA awarded contracts to nine companies developing commercial lunar landers that can carry agency payloads, will also factor into this phase.

“We’re focusing those capabilities on projects and science that can help us get humans to the surface of the moon, to the most valuable places on the surface of the moon, as soon as possible,” he said.

A second phase of the lunar return effort would kick in after achieving that first human landing, he said, and would focus on long-term sustainability of the exploration architecture by 2028. He gave few details about that approach, but noted it would involve building out the Gateway and making sure key elements like the lunar landers are reusable.

“We’re building a capability, we’re building an architecture that’s ultimately sustainable for the long run,” he said. “All this was already planned for 2028. We’re just going to accelerate pieces of it.”

Bridenstine said little about the cost of this new approach, but confirmed earlier statements that the agency will provide an amended budget proposal to Congress in the near future.

He hinted that NASA might ask international partners to contribute more or seek additional partners.

“We’re going to be going back to Congress with an increased budget request,” he said. “If we could maybe ask our international partners to step up a little more, that would be great as well.”

A mosaic of small pictures form a larger image of an astronaut and lunar lander at Lockheed Martin's booth April 10 at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado.
The 35th Space Symposium’s commemorative poster was designed by Seattle artist Richard Green. Green has designed several Space Symposium posters over the years.
Space Council advisers seek role evaluating NASA’s lunar plans

The advisory group of the National Space Council wants to take on a role evaluating NASA’s plans to return humans to the moon by 2024, once those plans are developed.

During a meeting of the National Space Council’s User’s Advisory Group (UAG) meeting here April 8 during the 35th Space Symposium, members supported, but did not formally approve, a proposal to establish a task force that could serve as a “red team” to review NASA’s new exploration plans.

That proposal was put forward by Lester Lyles, the retired Air Force general who serves as chairman of the group’s exploration and discovery subcommittee. The task force, he said, would consist of UAG members or subject matter experts they would designate, and could also consider “external assessments, advice or inputs” to support their evaluation.

The goal of the task force, he said, would be to serve as a “value-added red team before a revised architecture by NASA is finalized.” That work, though, would not begin until NASA drafted at least an initial version of its revised plans, which remain under development.

The group was already interested in ways to accelerate NASA’s plans before the March 26 speech by Vice President Mike Pence at the National Space Council meeting in Huntsville, Alabama, where he directed NASA to achieve a human landing at the south pole of the moon within five years. Members of the group had complained about a lack of urgency in NASA’s earlier plans, which called for a human landing by 2028, during their previous meeting in November at NASA Headquarters.

At the time, Lyles said the subcommittee was considering a call for an independent assessment of NASA’s plans. That included, he said, a better understanding of what the goals of the lunar exploration program. “The first thing we addressed and talked about, goals, was literally answered that day in Huntsville with the clear direction” provided in Pence’s speech, he said. “The major goal was to return United States humans to the moon by 2024.”

The proposal got a strong endorsement from another member of the Users’ Advisory Group. “That is an excellent recommendation,” said Tory Bruno, president and chief executive of United Launch Alliance. He added this his company would be willing to provide resources to back that task force.

James Ellis, the chairman of the group, also backed the concept, but offered some words of caution. “We need to consider what our role could be in that in a productive way,” he said of NASA’s changing exploration plans. That included keeping the task force from getting too big: “In my view, smaller and more focused is better.”

Schedule was also a concern to Ellis, who called for “perhaps a faster pace than we have been pursuing” with the group’s other activities, as well as a clear understanding of how the its work would compare to NASA’s own internal reviews as well as likely reviews by the NASA Advisory Council, which Lyles chairs. “The last thing we want to do is create a bureaucratic process without a clear understanding of what are the objectives and the impact of our efforts.”

Ellis ultimately decided to work with Lyles to refine the proposal to establish a task force and create a “terms of reference” for that team. That revised proposal will be considered by the Users’ Advisory Group at a future meeting, yet to be scheduled.

Separately, NASA took a step April 8 toward implementing that lunar landing goal. In an internal memo, NASA Administrator Jim Bridenstine said he had named Mark Sirangelo as a special assistant, advising him on exploration efforts. Sirangelo is a veteran aerospace executive who, until last summer, was executive vice president for Sierra Nevada Space Systems.

Sirangelo “will have broad responsibility to work across the Mission Directorates to further develop the agency’s plans for the Exploration Campaign,” Bridenstine wrote in the memo. “This includes a strategy to meet the Administration’s policy to return astronauts to the lunar surface by 2024.” He will also lead planning for the new Moon to Mars Mission Directorate, which Bridenstine announced at the National Space Council meeting in March to oversee the revamped exploration program.
Crews work on the Harris display April 7 during preparations for the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. (Keith Johnson/SpaceNews)
As NASA develops its plans to accelerate a human return to the surface of the moon, international partners are left wondering what roles, if any, they will have in that effort.

NASA has yet to outline its approach to meeting the goal announced in a March 26 speech by Vice President Mike Pence of landing humans on the south pole of the moon within five years. The agency has been working internally on at least a high-level approach for doing so, and plans to start sharing details with the White House, including the Office of Management and Budget, the week of April 15 to finalize a revised budget request that’s expected to seek several billion dollars more in fiscal year 2020 alone.

However, in comments at the 35th Space Symposium, NASA Administrator Jim Bridenstine said the agency would pursue a two-phase approach that would initially emphasize speed. That approach is expected to use the Space Launch System and Orion, lunar landers and some version of a lunar Gateway.

That lunar Gateway, though, will likely be a scaled-down version of earlier concepts publicized as recently as a month ago that featured a suite of habitation, utilization and other modules provided by NASA and other current International Space Station modules. Some concepts under consideration require only the Power and Propulsion Element, which NASA is in the process of procuring, along with a docking node of some kind that could also serve as a habitation module.

Publicly, potential Gateway partners have said little about how NASA’s accelerated approach would affect their ability or willingness to participate. During an April 10 panel session here on exploration, officials from NASA, the Canadian Space Agency, European Space Agency and Japan Aerospace Exploration Agency largely avoided direct discussion of what NASA’s new plans would mean for international contributions to the Gateway or other elements of the exploration architecture.

“We’re now taking the plans that we have in place and seeing how we can accelerate those,” said Bill Gerstenmaier, NASA associate administrator for human exploration and operations. “The good thing is that we’re going to show and prove that the architecture we’ve laid out, the plans we’ve put in place, are adaptable and we’ll be able to continue to move forward.”

David Parker, director of human and robotic exploration at ESA, emphasized that the Gateway is intended to be “flexible and sustainable” amid any changes. “It’s flexible in the way that it evolves and grows over time.”

Privately, though, international partners expressed concerns about how the accelerated plans could affect their schedule or ability to contribute to the overall exploration effort by delaying or even eliminating contributions like Gateway modules. This is an issue in particular among ESA member states, as the agency works to win approval for its role in the exploration program at a ministerial meeting in November in Spain.

It also raises questions in Canada, where the government of Prime Minister Justin Trudeau announced its plans to invest more than 2 billion Canadian dollars into development of a robotic arm for the Gateway less than a month before Pence announced
Emerging digital technologies and innovative operating models will expand the role of space in multiple economic sectors, according to, “Tech Trends 2019: Space industry perspective,” a report released April 15 by Deloitte.

In the past, space technologies like GPS often disrupted the status quo in other industries. Now, technologies like artificial intelligence, blockchain and augmented reality “can disrupt the status quo of what we currently think of as space technology by advancing it, optimizing it or making it cheaper, faster or more accessible,” said Jeff Matthews, Deloitte specialist leader focused on space innovation, finance and technology.

After 10 years of publishing annual reports on technology trends affecting companies broadly, Deloitte produced a report focused on the space industry because “there is so much happening in space right now that mirrors what we are seeing happening in technology and innovation,” said Brett Loubert, a principal in Deloitte’s federal consulting practice.

Many new space startups are software companies at heart, Matthews told SpaceNews at the 35th Space Symposium. “They are leveraging software to exploit the hardware that has been developed or to push it into new mission sets,” he added.

Companies rely on artificial intelligence, for example, to digest weather and remote sensing data. In the future, artificial intelligence will play a wider role in hiring, human-machine interactions and core business processes, according to the report.

More and more space-related operations, like constellation management and ground networks, are being offered as-a-service, meaning companies can outsource those activities. “If I’m not paying the overhead of managing a piece of infrastructure, especially space infrastructure, that can reduce either a massive cost or burden on my business model that makes me more competitive and sustainable,” Matthews said.

Increasing global connectivity also offers challenges and opportunities. “Plan for the upcoming explosion of bandwidth and spectrum congestion,” Deloitte recommends.

Intelligent interfaces, like computer vision and augmented reality, can speed data delivery, minimize training costs and enhancing mission assurance, the report said. “See beyond the long-established standards to imagine new methods of delivering data to a user,” Deloitte recommends.

Experience re-imagined, is a related trend described in the new report. Space data customers “crave dynamic, relatable engagements and insight,” the report said. “For downstream space applications, use new tools like artificial intelligence to improve customer experience with data.”

Organizations also should focus on cyber security throughout their engineering and information technology groups, Deloitte said. “Don’t test it in at the end,” Deloitte said. “Build it in throughout the system.”

Remarkable changes have occurred in the last decade. No longer the exclusive preserve of government agencies or aerospace and defense companies, “space is drawing from backgrounds that are increasingly diverse and cross-functional,” Loubert said.

“There’s more opportunity for companies or industries that traditionally were not in space to start getting involved in a new industry, a new economy. Likewise, there’s more opportunity for people who are space-focused to build a business case related to space,” SN
Lockheed Martin says it has developed an approach to achieving the goal of landing humans on the south pole of the moon by 2024, but warns that construction of essential hardware would have to start soon to meet that deadline.

In a briefing at the 35th Space Symposium here April 10, company officials said they can make extensive use of existing hardware to develop components like a scaled-down version of the lunar Gateway and a two-stage lunar lander on an accelerated schedule.

While many details have yet to be worked out, the basic elements of the plan, Lockheed argues, demonstrates that the ability to meet the 2024 deadline established March 26 by U.S. Vice President Mike Pence is at least technically feasible, if challenging.

“This isn’t the only way to accomplish this,” said Rob Chambers, director of human spaceflight strategy and business development at Lockheed Martin. He called the approach the company described an “existence proof” that the overall goal is feasible. “The objective here is to lay out an architecture that moves the needle from ‘is this possible’ to ‘OK, how do we do it best?’”

Lockheed’s plan would diverge from...
“We need to be bending metal next year, which means tooling already has to be in-house, and I hope somebody ordered a bunch of aluminum.”

NASA’s old approach after Exploration Mission (EM) 1, an uncrewed test of the Orion spacecraft launched by the Space Launch System in 2020. The company proposes launching a “Phase 1” Gateway in 2022 consisting of just the Power and Propulsion Element (PPE) and a small habitation module with docking ports. NASA expects to issue awards for the PPE in May, while the habitation module could be adapted from ongoing studies that are part of NASA’s Next Space Technologies for Exploration Partnerships, or NextSTEP, program.

That would be followed by EM-2, the first crewed Orion flight. While NASA’s current architecture would have that mission go on a “free return” trajectory around the moon, in this plan the Orion would fly to and dock with the Gateway to check out its systems.

That would require modifying the Orion spacecraft for that mission to incorporate a docking system. “It looks credible and sensible that we could add the docking to EM-2,” Chambers said. “It would allow us to test out operations from the Gateway.”

The Lockheed Martin proposal calls for the development of a two-stage lunar lander with ascent and descent stages. The descent stage would be developed from concepts NASA solicited earlier this year through another part of the NextSTEP program. The ascent stage makes use of Orion components, such as the pressure vessel, and a “built-to-print” version of the propulsion system for the Orion service module.

The two lander stages would launch separately on commercial launch vehicles to the Gateway by early 2024, where they would be mated. Tim Cichan, space exploration architect at Lockheed Martin, said an alternative approach would be to launch them together on a single SLS.

In 2024, NASA would launch EM-3, an Orion carrying four astronauts to the Gateway. Some of all of them would board the lander — Cichan said the company is still studying how many people the lander can support — and go to the lunar surface. Those astronauts would likely spend several days near the lunar south pole before launching on the ascent module back to the Gateway, and then board Orion for the trip home.

While Lockheed Martin discussed the plan just 15 days after Pence’s speech, work on the architecture presented started months ago. “We looked at what’s the fastest we could go,” Cichan said, which found that it could be done by 2024. However, he warned, “It’s going to be a challenge.”

To achieve the 2024 deadline, work on lander hardware would have to start next year, Chambers said. “We need to be bending metal next year, which means tooling already has to be in-house, and I hope somebody ordered a bunch of aluminum,” he said.

He compared its development schedule to the Orion spacecraft for EM-3, which NASA’s schedules currently call for being ready for launch in August 2023. Work on the crew module will start this fall to meet that date, he said. The lander ascent stage, derived from Orion, would need to start production by early 2020 to be ready for launch in early 2024, which would give it enough time to be ready for a mission to the lunar surface before the end of 2024.

“So by the end of this year, there needs to be materials starting to show up and folks on contract to begin building to print what exists today that we can safely leverage,” he said.

The company declined to estimate how much this accelerated approach would cost, in part because it depends on multiple factors. However, Chambers said it would require funding above earlier budget projections.

“We’ve all agreed it’s not free,” he said. “The current program of record can’t be turned into a crewed landing in 2024 without some kind of additional resources for the human exploration activity.”

NASA has also declined to estimate how much an accelerated program, be it like Lockheed’s concept or an alternative architecture, would cost. Industry sources during the symposium estimated NASA would need perhaps $3–5 billion more per year to achieve a landing by 2024, but for now NASA is not offering any figures as it works on an amendment to its fiscal year 2020 budget proposal.

“We need to be ready by next week to have a consensus administration position on that,” NASA Administrator Jim Bridenstine told reporters at the Space Symposium April 9. That work will involve coordination with the Office of Management and Budget and the staff of the National Space Council before delivering a proposal to Congress. “Until we get to that point I don’t want to put any numbers on the table.”
SNC Mission Heritage

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- Gateway Architecture design supports lunar missions & prepares for long-duration missions such as those to Mars
With space heritage spanning three decades, Sierra Nevada Corporation (SNC) has participated in more than 450 successful space missions. From America’s spaceplane, the Dream Chaser® spacecraft, to thousands of mission-centric technologies, SNC is changing the way the world goes to space – now and in the future.
In an April 9 keynote speech at the 35th Space Symposium, Acting Defense Secretary Patrick Shanahan laid out his most forceful case to date for the establishment of a new military branch for space.

Shanahan argued that standing up a Space Force — along with a U.S. Space Command and a Space Development Agency — is what it will take to ensure the United States stays ahead of adversaries that are advancing their space capabilities. He cast the issue as a matter of both national and economic security.

Most of the substance of Shanahan’s remarks were about the Space Development Agency, a new organization stood up March 12 and led by former DARPA official Fred Kennedy. Shanahan has made the new agency one of his signature issues. The work of the SDA is not just important to national security but also to the nation’s space economy, he said.

“In addition to the threat, we also see thousands of satellites going into space in the next few years as the cost of launch continues to come down and space technology rapidly advances,” he said. “This will unlock new opportunities and increase the importance of space for the American economy,” Shanahan said.

“Unfortunately, the department is not moving fast enough to stay ahead,” the Acting SecDef Patrick Shanahan said.

The Space Development Agency is “what I call the pacing element of our plan,” he said. “The SDA will focus on developing and delivering the next generation of space-based communications and Earth observation, while existing organizations continue their current efforts. Further, the SDA will help consolidate space efforts so resources are invested more efficiently, he said. Currently, the U.S. military relies on a patchwork of satellite systems, for example, in addition to spot-market buys of commercial bandwidth. “The result is we have deployed over 130 different types of wideband terminals, in addition to narrowband and protected satcom terminals.”

SDA will “harness the innovation and investment that is taking place in commercial space,” said Shanahan. “DoD must leverage the private sector investment. ... Our space R&D needs to include our own research and development as well as ‘rip off and deploy’ commercial market innovations.”

He said SDA will “judiciously combine commercial innovations with exquisite capabilities unique to DoD.”

On the Space Force, he said it is necessary to “grow our margin of dominance in space to protect our $19 trillion dollar economy and ensure access for our warfighters” The United States, said Shanahan, is in an era of “great power competition, and the next major conflict may be won or lost in space.”

Shanahan mentioned China and Russia as space rivals that are developing powerful anti-satellite weapons that they could aim at U.S. spacecraft. “The PLA [China’s People’s Liberation Army] is also deploying directed energy weapons, and we expect them to field a ground-based laser system aimed at low Earth orbit space sensors by next year.”

A centralized focus on space under a dedicated space branch is necessary, he said. The Pentagon cannot confront the contested space environment with a dozen different organizations, he said. A single senior leader in the Pentagon should be accountable for space.

**SANDRA ERWIN**

**SASC WARM-UP ACT**

Shanahan’s speech was a warm-up act of sorts two days before he is scheduled to testify before the Senate Armed Services Committee. Some lawmakers remain skeptical that a new military service is needed, and expect DoD officials at the April 11 to explain how a Space Force would solve lagging innovation and disjointed management of space programs rather than add bureaucracy.

Shanahan, in his speech, that the solution requires all three legs: a service, a combatant command and a space agency to develop technology faster than current organizations.

U.S. Space Command will focus on space war doctrine and strategies whereas the Space Force will “build a professional development system that recruits technical talent, educates them in space from the beginning, and provides a clear promotion path,” said Shanahan.

He also addressed on the key objections that members of Congress have raised, which is the cost of a new branch and the additional bureaucracy it brings.

“By creating the new service inside the Air Force, the additional cost is less than one-tenth of one percent of the DoD budget,” he said. “The Space Force will cost about $1.50 per American per year.”

**SN**
R2-D2 greets Yuri’s Night revelers April 7 at the Space Foundation Discovery Center in Colorado Springs, Colorado. (Tom Kimmell)
After establishing a foothold in the small launch vehicle market, Rocket Lab is now planning to enter the small satellite field with a bus the company says can get customers to orbit faster.

At the 35th Space Symposium here, Rocket Lab unveiled Photon, a smallsat based on the kick stage the company uses on its Electron rocket. The company is offering Photon as part of an end-to-end service that includes an Electron launch and the option of handling spacecraft operations.

In an interview, Rocket Lab chief executive Peter Beck pitched Photon as a platform that allows customers to integrate a variety of payloads, from Earth observation cameras to communications equipment, and get them into orbit in less time than if companies built their own satellites.

“We see a lot of companies, especially in the NewSpace sector, building their satellites for the first time,” he said. “They’re trying to provide a data service but they have to go through all the learning of developing their own satellite, rather than get straight to revenue.”

Beck argued that Rocket Lab’s integrated approach will be more efficient and less risky for startups. “You can use not only a proven launch vehicle but a proven spacecraft platform, so you’re not taking any development time or risk in getting your idea into orbit,” he said.

The company sees Photon as being particularly well-suited to technology demonstration missions, where customers bring a payload they want to get to space quickly before using it in a larger constellation. Rocket Lab could also provide the payloads in addition to the bus. “If you just have an idea and you don’t want to develop a payload, either through Rocket Lab or a Rocket Lab partnerships we can take care of that as well,” he said.

The Photon spacecraft itself has yet to fly, but it is based on the kick stage that has flown successfully on four of the first six Electron launches. Beck said the company planned from the beginning to turn the kick stage into a satellite bus. “If you can build a launch vehicle,” he said, “you certainly have all the expertise and equipment needed to build a spacecraft.”

Rocket Lab will manufacture the Photon at its Huntington Beach, California, factory where it also produces the Rutherford engine that powers Electron. The company estimates that it can produce and launch a Photon in as little as four months.

Beck didn’t give a specific figure for how many satellites the factory can produce, but said it’s “strongly linked” to the Electron production rate, which the company is working to accelerate to one rocket a week. The company has reserved about half of the space at the Huntington Beach facility for satellite production.

Each Photon can carry up to 170 kilograms of payloads. Beck said the company plans to launch only one Photon at a time, but that each Photon could carry multiple payloads. The first Photon will launch no earlier than 2020 because the company’s 2019 launch manifest is full.

Rocket Lab is working with “a number of customers” interested in using Photon, but Beck said the company isn’t ready yet to announce any of them. He also wasn’t concerned that Photon might dissuade companies developing their own satellites from launching them on Electrons.

“We’re not intending to make people use Photon,” Beck said. “It’s just an addition to our product line to make it easier for people to get things in orbit.”
Space Development Agency aims to issue first RFI this summer

The Pentagon’s brand-new Space Development Agency intends to make a formal request for information from megaconstellation ventures and their vendors this summer.

Space Development Agency Director Fred Kennedy started working with such ventures when he was running Blackjack, a Defense Advanced Research Projects Agency effort to buy small satellites from the same vendors supplying megaconstellations like OneWeb.

His intent today is largely the same as it was back then: find a way for the U.S. military to leverage the industrial capacity that private capital is creating to build and launch hundreds or thousands of small satellites to low Earth orbit on an evolving mix of commercial launch vehicles.

The key difference: as the head of SDA, Kennedy has been invested by the Office of the Secretary of Defense with the authorities he needs to put operational capabilities — not just tech demos — on orbit.

And he intends to move fast. Kennedy wants SDA’s first satellites on orbit in 2022. “This is not DARPA,” he said during a freewheeling 90-minute discussion with reporters here April 10. “I will do demonstrations to make sure that I’m ready to go, but I intend to put real hardware on orbit that does real work.”

Kennedy, a retired U.S. Air Force colonel who earned his PhD at the University of Surrey — home of smallsat pioneers Surrey Satellite — outlined a bold vision this week for using large constellations of small satellites to take over military space missions ranging from missile tracking and reconnaissance to communications and navigation.

But for now, Kennedy has more ambition than budget, or staff. While the Pentagon requested $150 million for fiscal year 2020, he’s counting on Congress to approve a repro- gramming request this year that would allow him to expand SDA beyond its current staff of one detailee and several support contractors.

Kennedy’s singular focus between now and the Oct. 1 start of the new fiscal year is to refine a LEO-based architecture that aligns with the so-called space sensor layer of missile-tracking satellites that Undersecretary of Defense Mike Griffin — his boss and longtime colleague — sees as critical to countering China’s hypersonic missile threat.

“I need to refine the architecture...and I need to do that in a way that I can show it to Dr. Griffin and the acting [Secretary of Defense Patrick Shanahan] and say, ‘this is what I intend to acquire and I intend to put capability up in orbit in 2022, so I need people now and I need resources now.’ And the good news is they get it and this is a priority for them. So I think one way or the other, its going to happen.’

Assuming SDA gets its funding, Kennedy intends to hit the ground running come October. To do that, SDA plans to issue a request for information, or RFI, this summer, probably in July, followed by a draft solicitation by Sept. 30.

“One I do one or two spins on the architecture, and that’ll probably happen this summer, I would like to get an RFI out because I want to be able to calibrate, sanity check, what we’ve come up with against what commercial thinks is feasible,” Kennedy said.

“And then at some point later on, we’ll want to make sure that we get a draft RFP out, or equivalent solicitation — probably near the end of the fiscal year — or at least be ready to do it, depending on where the budget is, and where Congress is.”

Kennedy declined to discuss the specific focus or details of the planned RFI.

“We’re well aware of the capabilities of all the major megas,” he said, referring to large constellations of the sort OneWeb, SpaceX, Amazon and others are developing for global broadband and other uses. “[E]xactly how they fit, exactly how we fit, we don’t quite know yet. In fact, that’s part of the refinement of the architecture activity.”

Kennedy said SDA is also paying close attention to the smallsat capabilities put forward by traditional contractors such as Lockheed Martin, currently building the bulk of U.S. military satellites. “We are working with all of our legacy providers as well,” he said.

Wanted: cheap phased array antennas

To realize Kennedy’s vision, SDA will need more than just mass-produced spacecraft platforms, or buses. “It’s not just about bus hardware, right? It’s about payload hardware. It’s about user terminals. Can anyone find me somebody who can build me a phased array antenna cheap?”

When a reporter noted that OneWeb founder Greg Wyler recently claimed one of his self-funded side projects has developed an antenna module that costs $15 and paves the way for user terminals priced between $200 and $300, Kennedy expressed skepticism.

“Everybody else says it’s pretty expensive,” he said. “I would love to have that [cheap] phased array antenna. I’d love to be able to mount that thing on a Humvee. I’d love to have it on every dismount’s backpack.

“I don’t believe we’re there, but I do believe that if you, if you push forward in a way that you put capability out every couple of years and you collaborate with commercial [pro- viders], you will get there more quickly than if you establish a government program and say, ‘Oh, you know, maybe 10 or 12 years from now, will we get a phased array antenna.”

BRIAN BERGER

SN | NEWS FROM SPACE SYMPOSIUM | 14
The Space Development Agency is only a month old and its staff has yet to be hired, but the SDA already has a bold agenda. It plans to change how the military develops and acquires space systems, the agency’s director Fred Kennedy told SpaceNews in his first media interview since taking the job.

SDA will do business in a way that is radically different from the way the military currently develops and acquires space systems, Kennedy said. “I wanted to call it the Space Disruption Agency,” he quipped in an April 8 interview.

Disruption, in Kennedy’s view, is overdue. While DoD officials are fond of pointing out that “space is no longer a sanctuary,” for many milspace programs it’s still business as usual. “Some of us may have to be dragged kicking and screaming into the 21st century,” he said. “How we do things in space has to change.”

To prod the Defense Department in that direction, Kennedy is drafting an architecture that leverages commercial capabilities coming online to churn out the hundreds and thousands of satellites venture-backed companies like OneWeb and SpaceX need for the broadband megaconstellations they’re beginning to deploy in low Earth orbit (LEO).

While the current wave of LEO constellations are mostly focused on internet connectivity and remote sensing, Kennedy sees applicability across the gamut of DoD mission areas. “The first thing I’m going to do is refine my architecture by the end of this fiscal year,” he said. “I have an architecture in mind and it’s comprehensive. It’s not just one mission area. It’s the whole thing. How do you do a next-generation space architecture?”

SDA wants to identify commercial vendors building thousands or hundreds of satellites and figure out a contracting mechanism for DoD to buy a couple of hundred off the assembly line. “Then, I want to craft my capabilities on those satellites and fly them so they can work with those networks,” Kennedy explained. “I’ll take those satellites. I’ll put payloads on them. I’ll fly them. And I hope to tunnel through their networks to get data to the tactical edge, to soldiers, sailors, airmen, marines. That’s what I’m trying to do. That’s the idea. And I think I can do that.”

Unlike traditional DoD satellite programs that cost billions of dollars and take decades to develop, the SDA architecture will be low cost and will accelerate the development of capabilities, Kennedy said. “We have an incredible amount of commercial investment just pouring in,” he noted. “A couple of years ago, I would’ve told you I was not confident that was going to continue, that it was a fad.”

But that is no longer the case. “People are excited,” Kennedy said. “Venture capitalists are excited. I think the commercial sector is going to go push hard. They’re going to build small satellites on production lines. I think you’re going to see a Henry Ford for small satellites emerge in the next two to five years. I don’t know which one is going to be that Henry Ford, but I believe that’s what’s going to happen.”

As soon as companies start putting up hundreds or thousands of satellites in low Earth orbit, the stage will be set for DoD to rethink how it develops systems, Kennedy said. “Until now, everything has been pushing us towards ‘more expensive, more review, take your time, it’s got to work,’” he said. “But if I can build spacecraft for a million dollars or less, if I can pull them off the production lines and use them, I can now afford to lose things. I’m not scared anymore. I can put up several hundred satellites and know that maybe 75 percent of them will work and that would be just fine.

“That is not the exquisite mindset. That’s the commodity mindset. I put it up, I see if it works and then I try something again. That encourages innovation. That’s happening on the commercial side and is not happening on the national security side. I need to ride that wave. This is the time to go do it with the massive amounts of money pouring in. This is the time to stand up something like an SDA to take advantage of that synergy with the commercial sector.”

SDA’s approach applies to more than just satellites, Kennedy said. “If I can buy payloads, if I can buy ground command and control software, hardware, user equipment, if we could get user terminals from the commercial side,
then I can maybe do minimal ruggedization and put [it] on ships, planes, Humvees, you name it. That’s big,” Kennedy said.

In DoD, every program builds its own terminals. “I think we have 130 or 140 different kinds of wideband communications terminals alone. If we could just wipe the slate clean and commercially procure all of that into DoD, that would be huge,” he said.

The U.S. will advance in space, “when we figure out how to be agile and responsive,” Kennedy said. “We have to anticipate threats and we’re not going to be able to do that by building exquisite, expensive systems that take a decade or two.”

Military space acquisitions culture emphasizes “hyper reliability and ultimate performance at the expense of everything else,” he said. “So it takes $20 billion and 20 years to finish a constellation…The overarching culture is one of mission assurance, making sure it works. Don’t launch until it’s ready. Spend whatever it takes.”

The SDA will have special authorities to “go off and procure,” said Kennedy. “I am not bound by the requirements or by the JCIDS system. I’m not bound by the DoD 5000,” he said. All DoD procurements must comply with the Joint Capabilities Integration and Development System. DoD 5000 is the massive compendium of regulations governing all DoD acquisitions.

The motto of the new agency is to move “ever faster, and we’re going to make that happen,” said Kennedy. “So the minute I get done with the architecture, I start procuring that architecture.” Critics, he said, will probably say that approach “seems a little crazy” and that more rigorous analysis is needed. Kennedy is ready for it.

SDA wants to “put up capability on a timeline that is threat driven, not requirements driven,” Kennedy said. “I don’t want to be told that I have to meet a certain threshold requirement. I want you to tell me what the threat is and let our team go and address that threat before the requirements are even validated.”

**SDA not a threat to SMC**

Since plans for the SDA were first announced, questions surfaced about what that might mean for the Air Force Space and Missile Systems Center that oversees most DoD space acquisitions.

Kennedy said some of those are “fair questions” but it’s premature to try to predict whether the SDA could replace SMC. “I think that’s a discussion for 2030 or 2040, not for today,” Kennedy insisted. “We’re certainly not trying to steal anybody’s jobs. What we’re trying to do is sort of graduate to the next level of what’s needed so we can actually build the next generation space architecture.”

SDA will work with the current “community of providers” including SMC, as well as the Army’s and Navy’s space procurement offices. Their programs are not at risk today. At some point, however, “we’ll have a discussion about whether this system continues or whether we graduate to something new…Maybe in the next five to seven years if we put up better and better capability, we should have that discussion. If it’s less expensive, if we get better
capability out the door quicker, I don’t know why you wouldn’t want that. So I think it’s ... a debate to have, but we don’t have the data yet. I think it’s premature to essentially declare victory before we’ve even started.”

Kennedy said it is conceivable that SDA could come up with LEO-based alternatives to traditional constellations in higher orbits.

SDA will test new capabilities in incremental “tranches,” Kennedy said. Could SDA figure out alternatives to GPS or to current missile warning satellites? Possibly in five or 10 years, “we will have to have a conversation about what the architecture should look like. And maybe that does mean that you start standing down legacy [systems],” Kennedy said. “But I don’t think that’s a conversation that’s easily had yet because I think we need to get our first tranche of capability up.”

**Space Sensor Layer**

An early test will be an effort to develop a layer of sensors in LEO to detect and track hypersonic weapons. It’s likely that one of the first capabilities that the SDA will pursue will include a “tracking layer that will go after hypersonic weapons because the current legacy systems don’t detect them very well and they certainly don’t do it in real time.”

Defenses against hypersonic weapons are an urgent need, he said. “We believe that a proliferated LEO layer is the right way to go about it. When we’re much closer to the threat, sensitivities will be higher.”

A large constellation would provide global coverage, he said. “So we think we are in a place to go do that. ... The question is, can we build the payload at cadence? The bus builders can provide me with 200 vehicles, but will the payload builders be able to provide me with 200 infrared cameras? We’ll have to see. It’s certainly not in their DNA to go do that.”

But this is the type of rapid and responsive production that SDA is asking companies to do. “So we’ll see if it’s possible.”

If the SDA successfully develops an architecture and proves out new capabilities, the next challenge will be to turn them into operational systems that get funded by the military services.

“That will be the trick,” said Kennedy. The thinking now is that if the Space Force is stood up, it will help move SDA programs forward. “In the absence of a Space Force we would have to discuss exactly what it means to operationalize that capability. But the truth is, most of it will be commercially derived.”

**Staffing SDA**

Kennedy envisions SDA will have about 112 government civilian and military staff, and a comparable number of support contractors. This fiscal year, it will only hire about 20 people. “I’m looking for technically sophisticated space folks.”

Kennedy compared recruiting people for the SDA to the task faced by Adm. Hyman Rickover, the father of the nuclear navy who in the 1950s directed the development of naval nuclear propulsion.

“He was looking for very sharp engineers who could do their job, who understood they had to do, technically sophisticated and it could just go off and run,” he said. “That’s what I need here. I need people who understand the business. I need people who know how to build buses and payloads and components who’ve been through assembly integration and test, who know what it takes to go out and build. And frankly, I need help from industry, especially the new space industry because I’m trying to figure out how I can bring the flavor of mass production, commoditization productization into our story. And so I can’t necessarily rely just on legacy. I need the new thought processes to come in.”

SDA needs a mix of talent, Kennedy said. “I’m open to anybody who wants to play, but they’ve got to bring their ‘A game’ and they’ve got to really know space.”

To be successful, SDA must stay small, Kennedy said. “I really believe that to be effective it has to be a small disruptive activity. Beyond that, you start building subcultures and pretty soon everything gets out of control.”
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Air Force Secretary Heather Wilson on April 9 shot back at the Space Development Agency and its director Fred Kennedy, who is laying out a plan to disrupt the military space business by bringing more commercial technology into space systems to speed up innovation in the face of competition from China and Russia.

The SDA was created only a month ago and its first project will be to design a constellation of low-cost satellites in low Earth orbit that would leverage commercial spacecraft adapted for military missions.

In a keynote speech at the 35th Space Symposium, Wilson challenged that vision, arguing that the military’s current constellations of satellites in higher orbits are “the best in the world” and that shifting to LEO systems would put U.S. forces at risk.

Wilson cited a 90-day “Space Strategy Study” recently completed by the Air Force and the intelligence community that concludes that LEO-based systems would be vulnerable during military conflicts and that DoD should not be taking that risk.

Kennedy told SpaceNews April 8 that the SDA’s proposal to leverage investments in commercial LEO constellations — and the manufacturing capacity behind them — is aimed at reducing the vulnerability of current U.S. systems. “If I can build spacecraft for a million dollars or less, if I can pull them off the production lines and use them, I can now afford to lose things. I’m not scared anymore. I can put up several hundred satellites and know that maybe 75 percent of them will work and that would be just fine,” he said.

Wilson argued that such a plan might work for some scenarios but would be reckless to apply across the board in military space systems.

“Different missions will require different solutions,” she said. “One size does not fit all.”

The Air Force’s 90-day study was kicked off in late 2018, just as the Pentagon was putting final touches on a plan to stand up the SDA. Acting Defense Secretary Patrick Shanahan has been a strong proponent of the new agency and decided to place it under the authority of Undersecretary of Defense Mike Griffin, who like Kennedy, is a staunch believer that military space acquisitions must change radically and that commercial LEO systems should be leveraged as soon as possible.

Wilson said the study will not be publicly released for some time but she provided a few nuggets from the findings, which she said were the result of “thousands of war games and simulations.”

“Increasing the number of satellites helps, but numbers alone are not enough,” she said. The Air Force already has moved to transition to commercial systems in areas like satellite communications, she said. This would drive all the services toward low-cost multiband satellite communications terminals, a change that Kennedy also advocates.

Wilson said the study found that space missions “that are not well aligned with commercial LEO satellites are better off staying where they are, or making changes to protect themselves.” Kennedy, in contrast, thinks LEO constellations have a role to play in all military missions.

The Air Force for the past two years has been studying ways to make systems more resilient and has asked for bigger budgets to support that, Wilson said. She is not against using LEO systems but she warned that “launching hundreds of cheap satellites a year as a substitute to the complex architectures we provide to the warfighter will result in failure on America’s worst day if we rely upon them alone.”

SANDRA ERWIN

“Increasing the number of satellites helps, but numbers alone are not enough,” U.S. Air Force Secretary Heather Wilson said April 9 during a keynote address at the 35th Space Symposium.
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Max Young (left) and Stephen Tucker set up an audio visual display at the KBRwyle booth April 7 during preparations for the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado Springs. (Keith Johnson/SpaceNews)
With EGS, Air Force aims to run software problems to ground

U.S. Air Force Space Command is finalizing a plan to revamp ground control systems for military satellite constellations. Current systems suffer from problems such as user-unfriendly software, outdated cybersecurity standards and difficulties sharing information within the military’s space enterprise.

The problems are well documented but the Air Force has struggled to come up with solutions. Air Force Space Command last year decided that the answer is a universal command-and-control architecture called Enterprise Ground Services (EGS). A memo signed in August by AFSC Commander Gen. John Raymond declares EGS the “common platform to execute satellite operations for tactical command and control of space assets.” To ensure information can be shared, EGS will require “machine to machine exchanges” in all ground systems. They also must use universal messaging standards, according to Raymond’s memo.

The Air Force’s 2020 budget proposal adds a new funding line for EGS, requesting $138 million to develop and test software. Legacy ground systems will have to transition to the EGS architecture over the next decade. That includes the ground control for missile warning, satellite communications, space domain awareness and experimental satellites.

“EGS prepares us for tomorrow’s fight by increasing enterprise resiliency and capability,” Col. Jesse Zydallis, Enterprise Ground Services chief at the Air Force Space and Missile Systems Center, said in a statement to SpaceNews. Zydallis said the goal is to have a “common ground platform for commanding and data sharing.” Commonality would save money on software upgrades and expedite the refresh of software applications.

SMC is now developing the EGS Service Catalog to support government and industry software developers, said Zydallis. Vendors will be expected to follow the guidelines provided by the EGS Service Catalog as they become available, he said. The catalog offerings will grow over time. Zydallis’ office is working with each mission area across SMC to help develop individual transition plans for each ground system by November.

What exactly EGS is and how it will affect current space programs are questions still not well understood, however. Contractors are waiting for details that will inform that what they should do now to prepare, industry sources told SpaceNews.

The Air Force has a spotty record with software developments. Space ground systems are especially challenging due to security requirements and mission complexity, said Jon Ludwigson, acting director of contracting and national security acquisitions issues at the U.S. Government Accountability Office.

Ludwigson authored a March report documenting costly space software problems such as OCX, a next-generation ground control system lagging behind the deployment of the Air Force’s GPS 3 satellites. “The congressional defense committees are very concerned,” Ludwigson said in an interview. “In space, software is critical to the execution of the missions.”

GAO concluded that the poor performance of software programs is caused by the government’s failure to involve users early in the development. Program managers don’t get enough feedback from users until it’s too late or too expensive to change the design, Ludwigson said.

The Air Force is now shifting to “agile development” of software to speed things up, “but they should involve the users a lot more,” he said. “That is one of our critical findings.” The Air Force has to put software in the hands of users as frequently as possible, he said.

GAO’s findings echo what many vendors have heard from customers in the military space enterprise, said Michal Anne Rogondino, a former Apple executive and now CEO of Rocket Communications. The San Francisco company received an Air Force contract two years ago to develop a user experience software tool to help developers create apps for EGS-compliant ground control systems. The user experience is critical to the success of EGS, she said.

Rocket Communications set up a demonstration of its user experience tool, called Astro, at the 35th Space Symposium. The product demonstration is aimed at military space operators and contractors looking to develop intuitive applications for DoD space systems.

“Education about user experience in space software is needed at the highest levels,” Rogondino said. “After working with Air Force users, we realized there is a huge need to redesign the user experience.”
Mark Lewis has his photo taken in what appears to be anti-gravity room at the Lockheed Martin booth at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs. (Keith Johnson/SpaceNews)
Air Force Chief of Staff Gen. David Goldfein hosted April 11 in Colorado Springs the first-ever conference of international air chiefs focused on space issues.

“A large part of our discussion was on how do we work together in space, because we’re far stronger together than we are individually,” Goldfein told SpaceNews April 12 aboard a military plane flying back from Colorado Springs.

The conference, held at an Aerospace Corporation’s classified facility, included the air chiefs of Australia, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway and the United Kingdom. Goldfein said the idea of a space-focused air chiefs meeting came up during last year’s Space Symposium in Colorado Springs and he expects it to become an annual event.

Every country said they need more intelligence about what is happening in space, he said. “Our No. 1 focus area leaving the conference was space situational awareness.”

Although the United States has significant space surveillance capabilities, space security efforts are more successful when countries work as a coalition, he said. In SSA, one of the problems is the attribution. “If something bad happens and we’re the only ones who see it because we’re the only ones who have exquisite intelligence and we haven’t shared that information, it’s going to be pretty tough for us to communicate and convince the international community that this nefarious activity is occurring.”

Goldfein’s big takeaway after the air chiefs meeting is that “sharing information is foundational to our success in the future.”

Another concern is rules of behavior in space. “We had a robust discussion about norms,” said Goldfein. “As airmen, we believe we need norms of behavior in space as we have for airspace. The United States should play a leading role in this dialogue but it’s important to work with a coalition, he said.

Space is a shared commons and more countries rely on satellites for essential services, he noted. “If a war actually starts in space, everybody loses.”

So how do you deter that? By having norms of behavior, by having communication lines that are established so that you minimize the opportunity for a miscalculation or uncertainty,” Goldfein said. “We want adversaries to always want to deal with the Secretary of State and never want to deal with the Secretary of Defense.”

The air chiefs spoke enthusiastically about their countries’ burgeoning commercial space industries. Goldfein said he was struck by how much space activity is happening everywhere and believes it would benefit the entire group of nations to share technology and intelligence about threats.

Analysts from the Air Force’s National Air and Space Intelligence Center gave the chiefs a classified intelligence briefing of current and anticipated space threats. “That set a foundation for us to talk about what we’re up against,” said Goldfein.

In an unclassified report released in January, NASIC analysts said the U.S. and allies face a common threat as China and Russia develop more sophisticated anti-satellite weapons. For Goldfein, now is the time to figure out how to better share intelligence and prepare for “this transition from space being a benign environment to a more contested environment.”

Goldfein said it was fascinating to learn about what the other air chiefs are doing in space. “Every country talked about their space launch business,” he said. “Every one of them is talking about establishing the ability to do launch, not just vertical but also horizontal launch,” such as Virgin Orbit’s plan to air launch small satellites from a Boeing 747. The United Kingdom and others are building spaceports with runways in addition to launchpads, Goldfein said. “Every country is now looking to increase their competitive market for launch, which I think is a winner for all of us.”

“And the other thing they’re all into is satellites,” he said. “Satellites are smaller, cheaper, you build more of them. Every one of them is in the satellite business;” Goldfein added. “So it was instructive to me to hear how far along every...”
country is in the space business.”

The question now is how to apply this fast-moving innovation to the security challenges that the U.S. and allies face in space, he said. “How do we start, with a sense of urgency, to make military elements of space that we’re responsible for more inter-operable and how do we share information?” Goldfein asked. “And because we’re so early in the discussion, this presents us opportunities to actually become more inter-operable faster,” he said. “We had a lot of discussions on that.”

The details of what specific technologies and data will be shared, and how, have yet to be hashed out, said Goldfein. “We had a good conversation with the air chiefs about using information from a variety of sources and using artificial intelligence technologies,” he said. “We need greater fidelity ... so we can go from looking at a softball to looking at a marble,” he said. If countries work together, “if we’re challenged or threatened, we have more options available,” he added. “We’ve got to build our systems so they’re inter-operable.”

He noted that the Air Force Space Command is expanding the Combined Space Operations Center at Vandenberg Air Force Base, California. The center was stood up a year ago to coordinate space intelligence among allies and commercial space companies. Current participants in the CSPOC include Australia, Canada, France, Germany, New Zealand and the United Kingdom. “I just think we’re going to see it grow over time,” said Goldfein.

Goldfein said he plans to work with the U.S. intelligence community to make it easier for allies to access data. “One of the challenges we have is that we over-classify things and that gets in the way of information sharing.”

What’s next for the U.S. Space Force

While Goldfein hosted the conference of air chiefs, concurrently on Capitol Hill members of the Senate Armed Services Committee grilled Pentagon officials about the Trump administration’s proposal to establish a Space Force as a separate military branch.

Goldfein’s take on the hearing is that there are still details to be refined in the Pentagon’s Space Force proposal but that it’s a good first step. “I agree with chairman Dunford [Joint Chiefs Chairman Gen. Joseph Dunford] that we’re at the 80 percent solution,” he said. “Let’s move out now and there will be plenty of opportunities for Congress to provide oversight going forward.”

Dunford told the committee that, given the importance of space, an 80 percent solution should be enough to start the process of standing up a Space Force and that the plan should be refined as things move along.

“Five years from now it’s going to look different than what it looks like today,” Goldfein said. “I agree with chairman Dunford [Joint Chiefs Chairman Gen. Joseph Dunford] that we’re at the 80 percent solution but that it’s a good first step.”

He agrees with Air Force Secretary Heather Wilson that the Air Force does a good job as the service responsible for space. “But it’s an absolutely appropriate discussion to be having on whether we’re organized for success in the future,” he said. But right now, “we just don’t have the answers to the thousand questions that are absolutely appropriate for Congress to ask.”

The Space Force proposal was put together in a short time and many details have yet to be worked out, he said. “The specifics [that the committees are asking about] don’t exist because we just started planning. And so that’s going to be the challenge for us, to ask Congress that given the planning that’s been done, which is weeks old, is Congress comfortable allowing us to move forward with the 80 percent solution?”

The Air Force quietly for several years has been preparing for space being a contested domain, said Goldfein. “It’s only been really since this president openly declared space as a warfighting domain — stating that it’s not enough for us to just be in space, that we have to be able to dominate the space — that it opened up an opportunity for us to actually talk about what we had been doing rather quietly.”

Goldfein acknowledged that DoD and the Air Force still have some work to do in defining the problems that the Space Force would solve. The issue reminds Goldstein of his favorite Einstein quotes: “If I had an hour to solve a problem, I would use the first 55 minutes to define the proper question to ask, and once I knew the question, I could solve the problem in less than five minutes.”

The challenge in articulating the problem is that there is no immediate crisis that needs to be fixed. “You’ve heard that we are the best in the world at the space, but our adversaries know it, and so they’re investing in capabilities to take that away from us and it’s our job as military leaders just to ensure that can’t happen,” he said. “We are competent and we are in the position we are in because of what primarily the United States Air Force has been doing. But we have to have a discussion on whether we’re organized for success in the future.”

“You’ve heard that we are the best in the world at the space, but our adversaries know it, and so they’re investing in capabilities to take that away from us...”
Virgin Galactic CEO George Whitesides addresses guests at the late-night reception the company hosted April 8 at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado Springs. (Tom Kimmell)
Gen. John Hyten, commander of U.S. Strategic Command and nominated to be the next vice chairman of the Joint Chiefs of Staff, oversees operations involving some of the military’s most sensitive satellites that detect and track enemy missiles.

Hyten insists DoD needs a layer of satellites in lower orbits to track targets much closer to Earth than the existing missile warning constellation that operates from geostationary orbit. “That has to be a piece of the architecture,” Hyten told SpaceNews April 9 in an interview here.

“You can’t defend against something that you can’t see,” he said. DoD needs to build stronger defenses against emerging hypersonic missiles that are launched into space but then glide into the atmosphere and maneuver in unpredictable trajectories, said Hyten. That requires global coverage and the most efficient way to get that is from large constellation of satellites in low Earth orbit, he said. “You have to be very proliferated to have global coverage.”

The Missile Defense Agency has been studying options to deploy a sensor layer in space but there is no official Defense Department requirement to develop or build one. “Nobody is really looking at hypersonic sensing,” said Hyten. It’s been talked about but “nobody’s really looking at how do we do this.”

The job of designing a space sensor layer for hypersonic defense will be assigned to the newly created Space Development Agency, which has special authorities to acquire and test technologies with less red tape than traditional programs.

Hyten agrees with SDA Director Fred Kennedy that DoD should rapidly develop a space sensor constellation in LEO using commercially available technology and test it out before official requirements are written for a system. “Otherwise, you could write a requirement for unobtainium,” he said. “And that’s the last thing we want to do. We want to write simple requirements.”

If Hyten is confirmed by the Senate as vice chairman of the Joint Chiefs of Staff — replacing current Vice Chairman Gen. Paul Selva — he would be taking over as leader of the Joint Requirements Oversight Council, the panel of four-star generals that approves military requirements for new systems.

Hyten often has criticized the requirements process as too rigid and slow to keep up with technological innovations. “We want requirements that give the industry flexibility for meeting them, and gives up multiple solutions,” he said. “That’s what we want to have. And you need to be informed by technology efforts first to do that.”

DoD has been slow to figure out how to leverage commercial space technologies like rockets and satellites, he said. “We really haven’t spent a whole lot of money and time exploring these alternative concepts.”

Hyten believes DoD should take more risks and try new capabilities in LEO, for example. While Air Force Secretary Heather Wilson continues to raise concerns about the vulnerability of LEO satellites, Hyten said it should not be binary choice between risk or innovation. “Somewhere along the way, our country reached the point where risk was somehow bad and all the process that we’ve put in place for acquisitions are put in place to eliminate the opportunity for anything bad to happen. You can’t have a test that fails. You can’t have a program that...
Peraton enhances OS/Comet telemetry, tracking and control

Peraton is enhancing telemetry, tracking and control platform OS/Comet to address challenges and opportunities posed by massive constellations, cloud computing and hosted payloads.

“We’ve been doing mission management, mission planning, command and control of satellites for multiple decades across many different missions,” said Roger Mason, Peraton Space, Intelligence and Cyber sector president. “The interesting thing we are showing at the Space Symposium is our eye toward the future.”

Originally, Herndon, Virginia-based Peraton designed OS/Comet to handle as many as 1,000 satellites. Since companies are proposing even larger constellations, Peraton has made OS/Comet compatible with cloud computing.

“With cloud operations, you can fly any number of satellites by integrating the software as a service containers that are out in the cloud,” said Steve Smith, Peraton advanced programs senior manager.

Overall, Peraton is making OS/Comet less like standalone command and control software and more like a platform customers can augment with specific mission applications, Mason said.

Peraton also is updating OS/Comet for hosted payloads. Peraton supports the roughly 150 to 200 hosted payloads on the Iridium Next constellation including 75 Aireon aircraft-tracking payloads. With OS/Comet, Peraton plans hosted payload missions, performs telemetry, issues commands and records data gathered, Smith said.

As proliferated constellations begin to take shape in low Earth orbit, Peraton expects to see more hosted payloads.

Some satellite constellation developers are building spacecraft with a little extra room for hosted payloads, Mason said. Once the constellation operators establish interface requirements, customers with payloads of the appropriate size, weight and power will pay a premium for the “beach front property,” he added.

Acting Secretary of Defense Patrick Shanahan is talking about SDA “taking risk and moving forward trying new things.” Hyten said. The Air Force also is trying to do things in a different way. “Both are going to be part of the solution in the future and we have to make sure that we allow people to take risks and fail every once in a while.”

Hyten said he has studied LEO constellations for 30 years since he was an engineer. There’s promise in LEO concepts but nobody has proven or demonstrated they work for the military, he said. That could be done, as the SDA proposed, using commercial technology with some additional government investment. “You don’t have to build 500 sats to prove it, you have to prove that it can scale,” said Hyten. “We haven’t invested in those risky programs.”

As to whether hypersonic defense can be improved by a LEO constellation, Hyten said it must be tried and see if it works.

There is merit in what SDA wants to do, he added. “If it works, that would be a game changer, and if it doesn’t work, we will not have risked a huge investment,” he said. “Somebody has to prove these technologies.”
LinQuest’s Dan Smith demonstrates a virtual domain April 9 during the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. (Keith Johnson/SpaceNews)
Air Force Secretary Heather Wilson did not want to directly respond to the jabs lobbed at the service for the slow pace of space acquisitions.

“We’re moving much faster, we’re stripping years out of acquisitions,” she told SpaceNews in an April 9 interview.

Earlier in the day at the 35th Space Symposium, Acting Defense Secretary Patrick Shanahan delivered a keynote speech peppered with criticism about the way space systems are procured today. Shanahan did not mention the Air Force specifically, but he didn’t have to. The service oversees most of the military’s space programs, and his speech included phrases like “we need to move with urgency” ... “the Department is not moving fast enough to stay ahead” ... “the market has shifted and our old business model won’t survive.”

Wilson did not have an explanation for why the Air Force gets a bad rap even though, as she often points out, the U.S. military’s space systems are the world’s best. “If there’s an entity in the Defense Department that has a foot on the accelerator of acquisition, it’s the Air Force,” she said. “Just in the last 10 months, we stripped over 21 years out of our space procurement programs.”

In her final weeks as secretary of the Air Force — Wilson will be stepping down May 31 to become president of the University of Texas El Paso — she continues to defend the Air Force’s record on space procurements even as the Pentagon plans to turn over responsibilities for developing the next generation of space systems to a new agency.

SANDRA ERWIN

“If there’s an entity in the Defense Department that has a foot on the accelerator of acquisition, it’s the Air Force,” U.S. Air Force Secretary Heather Wilson said.
Wilson cited a number of efforts the Air Force is pursuing to speed up innovation. “It’s not enough to say ‘make the system go faster,’” she said. “You have to change something.” The Air Force Space and Missile Systems Center is being reorganized so there are fewer layers of reviews and approvals, she said. SMC started a space industry consortium to work more closely with startups. Wilson has delegated authorities down the chain of command so people can focus on managing programs rather than dealing with the Pentagon.

None of that has stopped a year-long effort led by Shanahan and Undersecretary of Defense for Research and Engineering Mike Griffin to create a new space agency to speed up innovation and develop the next generation of military space systems. The Space Development Agency promises to disrupt the military space business by bringing more commercial technology into military systems, and its first project will be to design a constellation of low-cost satellites in low Earth orbit that would be adapted for military missions.

When the idea of the SDA was first floated last fall, Wilson pushed back to no avail. On Tuesday, in her keynote speech at the Space Symposium, Wilson openly challenged the new agency’s vision to develop commercial LEO constellations for military missions.

In the interview, she continued to voice skepticism about the SDA and about its enthusiasm for low-cost satellites in LEO. “The first project that the Space Development Agency is going to take on is actually an Air Force project that we have funded in our budget and done in partnership with the Defense Advanced Research Projects Agency,” Wilson said, referring to DARPA’s Blackjack project to develop a LEO constellation.

“It’s not about the orbits or the number of satellites in a constellation, Wilson argued. “The mission drives what we need to do in space. And not all missions are the same. And not all phases of conflict are the same. And so that’s why the work that we’re doing, the modeling and simulation of different options is so important,” she said. “We can’t just postulate that we can buy cheap satellites and that buying cheap satellites and using them for everything works.” That would work “if we didn’t have a threat...It is a contested domain.”

Another way Wilson likes to explain it: “I drive a Subaru. I could buy 50 Subarus for the amount of money that I would buy one M1 tank, but I wouldn’t go to war in a Subaru.”

SDA director Fred Kennedy and his boss, Undersecretary of Defense Mike Griffin, have made it clear that the agency will not be deterred by critics, and they believe SDA deserves a chance to prove it can do things faster and better.
Members of the dance crew iLuminate perform during the 35th Space Symposium’s opening ceremony April 8 at the Broadmoor Hotel’s International Center in Colorado Springs, Colorado. (Tom Kimmell)
One of the big headlines of last year’s Space Symposium was Orbital ATK’s unveiling of a new rocket designed to challenge incumbents United Launch Alliance and SpaceX for future U.S. Air Force launch contracts.

Dubbed OmegA, the vehicle had been secretly in the works for three years under the generic name “Next Generation Launch System.” The solid-propulsion OmegA was dreamed up by Orbital ATK before the company was acquired by Northrop Grumman. The reveal at the 34th Space Symposium happened just a few months before the acquisition of Orbital ATK was completed.

OmegA’s chances of becoming a credible player in the National Security Space Launch program (NSSL) — formerly known as the Evolved Expendable Launch Vehicle program — got a boost in October when the Air Force awarded Northrop Grumman a $792 million Launch Service Agreement to share the cost of developing OmegA to carry military satellites.

Launch Service Agreement (LSA) funding — also awarded to competitors United Launch Alliance and Blue Origin — is to be spread over five years to help the companies pay for the infrastructure and vehicle modifications that would be required for Air Force certification to fly national security missions.

In the second phase of LSA, called the Launch Service Procurement, the Air Force plans to select two providers in 2020 to split 60/40 up to 25 launches over five years starting in 2022.

The stakes could not be higher for OmegA as it prepares for two critical static-fire tests of its solid rocket motors this year with the goal to launch its first payload in 2021.

Former NASA astronaut Kent Rominger is Northrop Grumman’s vice president for strategic programs. He spoke with SpaceNews about OmegA and its prospects.
What’s happened since you unveiled OmegA year ago?

We have been defining the details. Four years ago, when we talked to the Air Force about our plans and our schedule, we told them we would do the first static test fire in the second quarter of 2019. It’s on track for late May, and it is going to be exciting. In the solid rocket motor world, that is a qualifying test. OmegA has two solid boost stages and a cryogenic liquid upper stage powered by the Aerojet Rocketdyne RL10C engine. The May test is for the first stage. The static fire of the second stage is scheduled for August. We are pleased that we are holding our schedule.

How is Northrop Grumman preparing for these critical tests?

The completed OmegA first stage, which is more than 3.5 meters in diameter and nearly 24 meters long, is currently in the test stand where technicians are attaching instrumentation gauges and data recorders. During the static test, we will measure key characteristics such as thrust, pressure, strain, temperature, vibration and burn rate to validate expected performance. This stage will demonstrate more than two million pounds of thrust.

Do you still plan to develop a heavy configuration?

Yes. The first OmegA model will be an intermediate-class rocket that will fly payloads that currently use the Atlas 5 or the Falcon 9. Our intermediate variant is on track for first launch in 2021 and the heavy variant in 2024. The Air Force requires NSSL competitors to fly to nine reference orbits. Our intermediate rocket can reach seven of the nine. We need the heavy version to reach the other two.

Does being the only competitor with a solid rocket give you an advantage?

I believe so. The Air Force wants a diverse industrial base. Before the LSA award, Northrop Grumman and the Air Force already had invested more than $300 million in developing OmegA. They don’t want a launch monopoly any more. They also want to ensure they have reliable service to get national security payloads to orbit. OmegA was engineered with simple solid boosters and a proven upper stage with the RL-10 engine. We designed it for national security payloads to give them a benign, gentle ride. We maintain that the ideal rocket equation is solid on boost and a very efficient liquid engine upper stage where you don’t care so much about the thrust levels.

What else do you think might give you an advantage in the NSSL competition?

OmegA is different because of Northrop Grumman. If you look at the field of Launch Service Procurement competitors, we are the only company that isn’t just a rocket company. Our whole focus is national security, and certainly national security space. We are a dedicated government partner. Because of our production base and existing infrastructure, we could go down to a very low rate and still be successful, and we would keep our workforce employed across multiple programs. That is our biggest strength in this competition — being a big aerospace company dedicated to national security, we will be there no matter what.

That said, what happens to OmegA if you don’t win a Launch Service Procurement award?

If we don’t win LSP, we’re evaluating what we would do with OmegA. We’re watching those commercial markets to help determine that. I don’t have a definitive answer for you today. Depending on the outlook and other factors, we could easily decide to press on with OmegA. But there is a chance, too, depending on what we see, that we would decide at the time to not continue, or maybe put it on the shelf.

As a former NASA astronaut and veteran of the space shuttle, how do you feel about efforts by SpaceX and Boeing to bring back human spaceflight to the United States?

If we had had OmegA along sooner, we would have loved to have lifted either one of the capsules. The reliability of our system lends itself to human spacecraft. As a former NASA astronaut, I am pulling for the commercial crew folks to be very successful and get our astronauts into space from U.S. soil as soon as possible.
Launch and Communication Capabilities. L3 Delivers.

L3 Technologies is an established pioneer in space exploration and defense technology, with more than 60 years of exceptional performance. Our world-class expertise in connecting space, airborne, ground and sea-based platforms with secure, real-time data answers the heightened global demand for advanced solutions. Visit us at the 35th Space Symposium, Booth 108.
United Launch Alliance will begin flying Vulcan hardware on Atlas 5 rockets this year in an effort to give the next-generation launcher bona fide flight heritage before its debut in 2021.

ULA's Atlas 5 rocket, with 79 consecutive successful flights, has a track record rivaled only by the European Ariane 5. The only blemish on Atlas 5’s record is a 2007 mission where its upper stage underperformed while carrying a classified satellite into orbit. ULA still considers the NROL-30 mission one of Atlas 5’s 79 successes since the satellite reached its destination using onboard thrusters.

Reliability has been a top selling point for United Launch Alliance, especially as the company fights to preserve its share of U.S government launches while elbowing its way into the commercial market, competing more aggressively with SpaceX, Arianespace, and others.

“The follow-on has to be as good as the previous, the Atlas 5,” said Marco Caceres, a Teal Group analyst who covers launch. “And it has to be cheaper, because otherwise they can’t really compete commercially successfully to any large degree against SpaceX.”

As ULA prepares for Vulcan Centaur, the Boeing-Lockheed Martin joint venture will be starting over with a new vehicle that, while expected to be more price competitive, won’t have Atlas 5’s long string of successes. But that doesn’t mean Vulcan hardware will start from day one without any flight heritage.

For starters, Vulcan will use a Centaur upper stage upgraded with larger fuel tanks and powered by a variant of Aerojet Rocketdyne’s RL10 engines. Both systems have extensive flight heritage in their current configurations.

“We are building this launch vehicle based on our heritage with the Atlas and Delta launch vehicles,” Tiphaine Louradour, ULA’s president of global commercial sales, said in an interview. “We are burning down risk as much as we can in this next-gen launch vehicle.”

In 2015, when ULA selected Orbital ATK (now Northrop Grumman Innovation Systems) to provide GEM-63XL solid rocket boosters for Vulcan, it also decided to phase out Atlas 5’s Aerojet Rocketdyne-supplied solid boosters in favor of the GEM-63.

The first Atlas 5 launch using GEM-63 boosters — which measure two meters shorter than Vulcan’s 22-meter GEM-63XLs — is planned for 2020, according to Northrop Grumman spokeswoman Kay Anderson. She said a September test firing showed the booster would benefit from “nozzle enhancements” that Northrop Grumman chose to implement, delaying the first flight until 2020, though it was originally expected to fly on Atlas 5 this year.

The first Vulcan technology to fly on Atlas 5 will be new payload fairings from Swiss supplier Ruag built using an “out-of-autoclave” production process that enables fairing halves to be produced as one piece, a process Ruag says lowers production time and costs.

“The out-of-autoclave fairings, which are manufactured by Ruag, and now in the U.S. — they are in a factory next to ours in Decatur — that’s going to fly on Atlas 5 this year,” Louradour said.

ULA said it is seeking commercial customers for Vulcan’s early missions, the first of which is scheduled for April 2021 followed by a second mission two to three months later. The company needs to conduct at least two Vulcan missions with commercial customers as a prerequisite for Air Force certification, making commercial success critical to ensuring ULA can continue to launch national security payloads.

Louradour said ULA’s experience evolving Atlas through the 1990s up to today’s Atlas 5 should give customers confidence it can seamlessly transfer that reliability from one launch vehicle to another.

“We know it’s hard, but we know how to do it, and I think early on that is something that will position us well in the early 2020s [with Vulcan],” she said.

Louradour said Vulcan will combine the strengths of Atlas 5 and Delta 4 with the production and launch operations infrastructure the company already has in place.
Attendees enjoy a laser light show April 8 following the 35th Space Symposium’s opening ceremony at the Broadmoor Hotel in Colorado Springs, Colorado. (Tom Kimmell)
Blue Origin wants the U.S. Air Force to wait until 2021 before picking the two companies it intends to use for launching critical military satellites in the decade ahead.

The Air Force, however, aims to solicit proposals this spring and choose its two preferred launch providers in 2020 — perhaps a year or more before the new rockets that the Air Force is fostering at Blue Origin, United Launch Alliance and Northrop Grumman make their first flights.

All three companies were chosen in October by the Air Force Space and Missile Systems Center to share $2.3 billion in so-called Launch Service Agreement (LSA) funding to support development of next-generation rockets capable of meeting the military’s satellite launch needs.

The Air Force said last fall that all three LSA winners plus SpaceX would be required to submit new proposals in 2019 if they want to be among the two providers the Air Force intends to select in 2020 to split up to 25 future launch contracts.

The Air Force intends to call for those proposals in the coming weeks with a solicitation known as the Phase 2 Launch Service Procurement (LSP) that would give Blue Origin its competitors 60 days to submit bids.

Blue Origin says the Air Force’s hurry to select two providers to split 60/40 contracts for up to 25 launches between 2022 and 2026 would forestall competition and give an unfair advantage to United Launch Alliance and SpaceX, the two companies currently launching nearly all U.S. national security satellites.

“We disagree with the Air Force on the timing of Phase 2,” Brett Alexander, Blue Origin vice president of government sales and strategy, told SpaceNews.

Under Blue Origin’s LSA award, the Air Force agreed to give the company up to $500 million between 2019 and 2024 to help cover the costs of getting the reusable New Glenn heavy-lift rocket and its infrastructure ready to support military launches.

That funding, however, would be terminated if Blue Origin is not one of the two companies the Air Force selects to split LSP launch contracts potentially worth billions of dollars.

Alexander said Blue Origin has already invested $2.5 billion in New Glenn’s development, including building factories in Florida and Alabama, but needs the LSA funds for infrastructure investments specific to national security missions.

“We’re doing a commercial heavy-lift vehicle development,” Alexander said. Without LSA funding, the company would not, he said, build a New Glenn vertical integration facility — a requirement for carrying certain military payloads, such as satellites with massive, fragile mirrors. Nor would Blue Origin build a launch site at Vandenberg Air Force Base, California, which due to its location is used for polar launches of little interest to most commercial customers. “Those are things we are not doing commercially,” he said. “We’re doing under LSA what we wouldn’t otherwise do for ourselves.”

ULA and Northrop Grumman are in similar situations, although both won much larger LSA awards than Blue Origin. ULA stands to receive up to $967 million from the Air Force to help with the development of Vulcan Centaur, the successor to Atlas 5, the Air Force’s workhorse rocket. Northrop Grumman is eligible to receive up to $792 million for OmegA, the only solid-fueled rocket in the competition. Blue Origin, ULA and Northrop Grumman all say they are on track to debut their rockets in 2021.

SpaceX, which is privately funding development of a new fully reusable Super Heavy rocket and exploration-class Starship second stage, will presumably compete for LSP contracts with its existing Falcon 9 and Falcon Heavy rockets.

While Blue Origin presses the Air Force to delay the LSP competition, it’s also found allies on Capitol Hill. House Armed Services Committee Chairman Adam Smith (D-Wash.), whose Seattle-area congressional district is home to Blue Origin, asked the Pentagon late last month to put a hold on the release of the so-called Phase 2 LSP solicitation. Air Force officials, however, have said they intend to move ahead.

Blue Origin, despite its objections to what it considers a premature downselect, says it will be ready to submit its proposal even if the Air Force moves ahead as planned.

“When it does come time to submit a bid, we’re 100 percent focused on submitting a winning and compelling proposal,” he said. “We have a commercial vehicle that will be flying 12 times a year and can meet national security requirements.”

Meanwhile, New Glenn checked off an important LSA milestone, completing its preliminary design review in December, according to Steve Knowles, New Glenn’s program manager.
INNOVATION

Aerojet Rocketdyne is leading the industry in designing and building 3-D printed components that are affordable, reliable and meet the stringent requirements of aerospace and defense applications. Most recently, we’ve incorporated this technology into our RL10 rocket engine to reduce cost and extend its demonstrated performance well into the future.
The U.S. Air Force is poised to solicit proposals this month for national security launch services and select two providers in 2020. A call for proposals was expected to be released March 29 but was put on hold amid criticism that the Air Force was narrowing the playing field too soon.

The solicitation known as the Phase 2 Launch Service Procurement (LSP) is now on track to be released this month, Col. Robert Bongiovi, director of the Launch Systems Enterprise Directorate at the Air Force Space and Missile Systems Center, told SpaceNews.

The request for proposals (RFP) will move forward despite objections raised by Blue Origin, a new player in the national security launch market. The company has argued that the Air Force is rushing to select two providers to split national security launches 60/40 between 2022 and 2026 and that the schedule gives an unfair advantage to more established players.

During an interview April 11 at the Space Symposium in Colorado Springs, Bongiovi said the Air Force has listened to companies’ concerns and is ready to move on with the final RFP. “We just did two rounds of draft RFPs. We got 1,500 comments. We met with providers one-on-one to really understand their concerns,” he said.

The field of competitors includes Blue Origin, United Launch Alliance, Northrop Grumman and SpaceX. The first three companies in October were awarded $2.3 billion in so-called Launch Service Agreement (LSA) funding to develop next-generation rockets and the infrastructure to support national security missions. SpaceX did not receive an LSA contract but is still expected to compete for the LSP award — although the company’s congressional supporters have warned that SpaceX might sit out the competition unless it too receives LSA funding.

Bongiovi said the final RFP has been updated to address many of the industry’s concerns. “As with any RFP this size, we went through a couple of independent reviews,” he said. “We’ve got a much better product because of these reviews. I’m really satisfied with where this RFP is,” Bongiovi insisted. “We’re acquisition experts and we work through these things to make sure we get it right before we release it.”

The strategy for this procurement has been carefully crafted, he said. It is “still the same as what we’ve had from day one. It started when we realized that we were no longer going to use the Russian engine,” Bongiovi said. That was in 2015, when Congress passed a law that set a 2022 deadline for the Air Force to phase out ULA’s Atlas 5 rocket which is powered by the Russian RD-180 engine. “The first thing we did was invest in technology maturation. We’re invested in rocket propulsion systems since the beginning of 2016.”

Every competitor has shown progress in developing their systems, Bongiovi said. “We have a solid base of launch systems out there,” he said.

The schedule is not being rushed, he said, and was designed so the Air Force can have new vehicles ready for 2022. “Our original plan had us at one point awarding the procurement of launch services at the same time that we were going to award the LSA,” said Bongiovi. The Air Force later decided to separate the two to “buy us some more time,” he said. The RPF must go out so vendors can be selected next spring.

“By next spring we expect most, if not all, of these systems would have gone through critical design review,” he said. “And I think we have systems that are going to be mature enough that we can make a reasonable determination next spring on who we want to have as our national security space launch providers starting in 2022.”

Blue Origin, ULA and Northrop Grumman are developing new vehicles and none will fly until 2021. But the Air Force must select its two suppliers in 2020 because that will ensure both companies have enough time to get their vehicles ready to start launching payloads in 2022, said Bongiovi. It is not unprecedented for the Air Force to select vehicles that have not yet flown. In the original Evolved Expendable Launch Vehicle program in the 1990s, “we absolutely chose our path forward before the vehicles’ first flight,” Bongiovi said. National security satellites are “large and very complex. Some require at least a two-year timeframe.”

SANDRA ERWIN
< > to integrate and launch,” he added. “If we wait until after the first flight [to select providers] that could mean an additional two years of flying Atlases with the Russian engines.”

**SpaceX concerns**
Despite not winning LSA funds, “I think SpaceX is competitive going forward,” said Bongiovi. “We have a lot of business with them ... but it’s their choice how they respond to the RFP.”

The company has not publicly said whether it will enter the LSP competition and declined to comment for this article. An industry source said SpaceX behind the scenes has pressed the case that it has been put in a competitive disadvantage not only because it didn’t get LSA money but also because the Air Force will not select the two LSP providers based on price alone, something that would give SpaceX an edge. The industry source said the way the Air Force laid out the selection criteria — a combination of technical performance, operational readiness, business case and price — gives the government a lot of discretion to determine who provides the “best value,” a process that commercial players like SpaceX and Blue Origin view as favoring the most established provider, ULA.

Bongiovi said price is one of many factors and sub-factors that will be weighed. “Price is never not part of this decision.” It will be part of a trade-off analysis, he said. “We have to see the proposals and do the evaluation to understand how much of a factor it will be.”

The industry source said SpaceX is weighing its options but is not expected to pursue legal action the way it did in 2014 to compete in the EELV program. It would be shocking if SpaceX chose not to bid for Phase 2 because they have the most mature rockets in the field. Although the company would not have to pay for vehicle development to compete for Phase 2, it would still have to self-fund the infrastructure needed to meet national security launch requirements, such as a vertical payload integration facility on the East Coast. This has been a sore issue for SpaceX as its three competitors are all being subsidized by the Air Force to build that infrastructure.

SpaceX also is challenging the narrative pushed by Blue Origin that the LSP schedule favors both national security launch incumbents, ULA and SpaceX, the source said. “Blue Origin is pushing this narrative forward because they’re trying to make this seem like it’s a competition that’s unfair to them,” the source said, while SpaceX sees itself in an unfair position after the Air Force awarded billions of LSA dollars to its competitors.

**A new way to contract for launches**
One of the more puzzling aspects of the LSP is how the Air Force plans to award launches once the two providers are selected in 2020. Competitors are not bidding for specific missions but instead must propose vehicles that can meet requirements to fly to nine reference orbits and carry different payload classes.

“It’s called a requirements contract,” said Bongiovi. This is different from the previous EELV contracts that were awarded for specific missions. In the National Security Space Launch program, the two providers selected for Phase 2 will be assigned the specific missions on a yearly basis over the five-year period. “I call it a batting order,” Bongiovi said.

After the Air Force picks the two winners, it will decide who gets 60 percent who gets 40 percent of the missions over the five-year period but will assign specific rockets on a yearly basis depending on the required missions. That gives the government more flexibility to manage the manifest, said Bongiovi.

This approach would save the government the cost of making contractual changes if it needs to change the timing of the launches as it often happens when satellites are not ready. In 2020, for instance, the Air Force will look at how many missions will be needed for 2022 and decide which of the providers gets what missions that particular year. And that process will be repeated annually to even out the 60/40 split over the five-year period.

Providers will not know which missions they get until the Air Force issues the contracts on an annual basis, he said. One of the lessons from the EELV program is that the government needs more flexibility, Bongiovi said. “Some satellites were launched pretty close to when we expected them to but some satellites didn’t,” he said. “The last one we ordered in 1998 was launched in 2016. That doesn’t help industry. That doesn’t help us.”

The launch business “is going to be a little bit more dynamic than it was in the past,” said Bongiovi. “We can’t predict exactly what’s going to be ready or how is the department going to prioritize these launches,” he said. The Air Force wants to be able to adjust the manifest...
As far as vendors having enough business predictability and time to prepare that was considered too, said Bongiovi. One of them will know upfront it will get 60 percent of the missions. The other will know it will get 40 percent. And once a plan is decided for each year, the vendors will know the order of the missions.

There is, of course, no guarantee that everything will work out as planned, he cautioned. “No matter what the contract says, you succeed and fail together with your industry partners. In this case, it will require us to be in good communication with both industry partners and work with them,” he said. “A contract is a two-way street, and a requirements contract means that when we have the requirement, we have to follow the terms of the contract.”

The five-year deal is estimated to average about five missions a year but the Air Force is not guaranteeing a specific number of launches, said Bongiovi. Budgets are revised year to year and priorities can change, he said. The president puts out a five-year budget plan “but I don’t think that’s necessarily an accurate forecast of what we’re going to end up launching in the five-year period.”

Contract awards will be made so that vendors have sufficient time to prepare, said Bongiovi. “They have a supply chain that they have to manage. There are components that have long leads,” he said. The five-year commitment they get from the Air Force should allow them to have a ‘fairly stable base,’ he said. “That is certainty. It may not be as much certainty as if I say I’m going to buy five launches a year every year,” he added. “That’s how we constructed this whole program so the government doesn’t have to manage the ins and outs of hardware. So they [the vendors] can handle that through their business processes, through their logistics processes.” Launch providers must deal with the ups and downs of commercial sales and the LSP gives them stability “even without giving them a number, in my opinion.”

Mixed views from the industry
The forthcoming release of the Air Force RFP for launch services was a hot topic last week at the Space Symposium, where senior executives weighed in on the competition.

Much of the attention was on Blue Origin’ CEO Bob Smith. During a news conference April 8, Smith said the company looks forward to the competition but expressed concern that the schedule might not allow enough time to mature its New Glenn rocket. Downselecting vendors in 2020 “just seems premature,” he said. “We can probably delay and still have the same level of competition, perhaps even better insight,” Smith said. “These are big one-way door decisions that we have for the nation and what infrastructure will be put down and how we put that down is important,” he said. “And so you’d think more time would actually be beneficial ... and would be better for the country.” If the Air Force sticks with the schedule, however, “We’ll be glad to compete in LSP,” he said. The Air Force requires all three companies that received LSA funds to bid for the Phase 2 award. The losers of Phase 2 will have their LSA agreements terminated.

United Launch Alliance CEO Tory Bruno said he agrees with the Air Force that postponing the release of the RFP or the downselect would risk not being able to meet the 2022 congressional deadline to stop buying Atlas 5 launches. ULA is developing the Vulcan Centaur, powered by Blue Origin’s BE-4 engine.

The government started co-investing with industry in new propulsion systems and rockets five years ago, Bruno said. “We are very confident that we will be flying [Vulcan Centaur] in 2021,” he said. The schedule the Air Force laid out was “very thoughtfully put together and is the fastest path to end the U.S. dependency on the Russian rocket engine so let’s get on with it, let’s get it done,” Bruno said. “That’s where I’m at.”

Kent Rominger, Northrop Grumman’s vice president of OmegA capture, said April 8 at the Space Symposium that company completely agrees with the schedule put forth by the Air Force and in fact would not mind if it were accelerated.

He said Northrop can “compete with these new space companies that are really leaning forward and have changed the world when it comes to affordability.” Although the solid-fuel OmegA is a brand-new design, it uses existing hardware and avionics that Northrop Grumman grabbed from its other vehicles.

“By 2022, the Air Force has got to have systems to replace what they’re relying on today,” he said. On whether the schedule favors some players versus others, Rominger said, “honestly, that’s competition.” If anything, “I want to see it accelerate rather than delayed,” he added. The December 2022 deadline to stop buying the RD-180 is “rapidly approaching,” he said, “so we’re big proponents of keeping the program on schedule.”

"[L]et’s get on with it, let’s get it done," United Launch Alliance CEO Tory Bruno said during an April 8 media briefing at the 55th Space Symposium.
POLSA helping Poland’s fledgling space industry find its niche

It has been a little more than six years since Poland joined the European Space Agency and just over four years since the Central European nation of 38 million formally established its national space agency.

On April 2, the Polish Space Agency (POLSA) announced that its president for the past year, Grzegorz Brona, had resigned March 29 and would be replaced by Michał Szaniawski as acting POLSA president for a three-month period before a new president is appointed by the prime minister. Before taking the helm of POLSA, Szaniawski served, among others, as the vice president of the state-run Industrial Development Agency, and, since November 2018, a member of POLSA’s Council.

SpaceNews spoke with Brona in early March about the prospects for Polish space industry players and the solutions they offer on the global market, their participation in European Union-led projects and other international industry initiatives, and how POLSA hopes to tighten its cooperation with NASA in the coming months.

What types of companies operate in Poland’s space sector, and who are the people behind them?
The Polish space industry is a highly diversified sector which is experiencing rapid development, and it consists of several groups of companies. One group of businesses encompass small companies with up to 50 employees got started around 2012 when Poland became a member of the European Space Agency. This event marks an important date for the industry, and, as its result, about 20 to 30 companies began their operations in Poland. They were predominantly set up by scientists and researchers, and the Space Research Center of the Polish Academy of Sciences played a vital role in their development. Many of these businesses are startups that supply satellite subsystems.

The second group of Polish space companies consists of entities that enter the market on a continuous basis. They act as classic startups, offering a solution, then testing and improving it.

The third group includes local offshoots of large international companies such as Airbus, Thales, Sener and many others. Their role in Poland is to provide the technical support for the companies’ operations abroad.

The third group includes local offshoots of large international companies such as Airbus, Thales, Sener and many others. Their role in Poland is to provide the technical support for the companies’ operations abroad.

I would also distinguish a fourth group of companies which specialize in satellite data processing and analysis. There’s more than a dozen such businesses in the Polish market, many of them founded by cartographers from local universities. The Polish Armed Forces are showing increased interest in their services, but they’re also able to secure customers from abroad.

Our estimate is that there are about 50 Polish companies that have been involved in at least two projects for ESA. They can be considered stable businesses with a proven track record. In total, there are about 100 companies in Poland that have worked on at least one project based on a contract awarded by the European agency.

What kind of products can the Polish space industry offer the global market?
Polish space companies should aim to offer competitive solutions in defined niche markets. Last year, POLSA carried out a review of the Polish sector, and we identified four promising segments that could become the industry’s specializations. The first is space robotics, and Polish businesses are already supplying such solutions which are used in missions conducted by ESA and NASA. The second segment comprises small satellites, specifically larger nanosatellites and microsatellites. Polish companies have the potential to effectively compete against other international players within this field. Satellite data processing and analysis is the third prospective space market segment, and such services are provided by Polish companies. Finally, the fourth segment is related to the suborbital rockets designed for testing products and solutions, among others electronics, in the space environment. We have two companies in Poland that share this market, and their rivalry is a positive factor that stimulates competition. POLSA plans to focus its support on these four areas,
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Five years after POLSA was launched, how do you define the agency’s key priorities?

POLSA was established to support growth of Poland’s space sector, and in doing so, the agency combines in its activities the needs and demands of four groups of stakeholders: science and R&D, administration and government, defense and security, and the space industry. We support companies from the Polish space sector in parallel with ESA. Since 2014, when POLSA was set up, we have been gradually increasing our support for local industry players.

It is important for us to work in close cooperation with industry representatives. We developed the National Space Program after consultations with the Polish Space Industry Association and other entities involved in the Polish space sector. This document is a product of yearlong workshops, and it puts emphasis on providing support for the development of new space technologies in Poland.

Due to the small size of most Polish space businesses, POLSA focuses on support for small businesses. One of the means of such support is matching them with venture capital firms, both Polish and foreign, that are willing to invest in this sector. Together with the National Center for Research and Development, we want to develop a program to commission space solutions and technologies from Polish companies to enable them to develop the Technical Readiness Level of their products to make them more competitive in open ESA bids.

The Czech Republic, Estonia and Hungary have already landed ESA Business Incubation Centers (BIC). Poland is soon to join the list. What’s the status?

We’re backing the project to launch a new ESA BIC in Poland this autumn. This project is led by another government body, the Industrial Development Agency, with our support. What is important here, the Polish ESA BIC won’t have a single operator, but it will be run by a group of operators under the auspices of the Industrial Development Agency. It will have local branches in Warsaw, Gdańsk, Rzeszów, and other locations across the country, fostering the industry’s growth in various parts of Poland.

What is the state of POLSA’s efforts to expand its ties with other space agencies?

There are projects in which we’re cooperating to secure new opportunities for Polish space industry companies. As part of our cooperation with ESA, we’ve joined its optional Space Situational Awareness program. The coming months will bring new tenders, and entities that offer optical data or laser-ranging services will be able to compete for contracts. Last December, Poland joined the EU’s Space Surveillance and Tracking consortium, and we’re currently in the process of preparing applications for grants under this program. We’re also very much interested in the European Geostationary Navigation Overlay Service (EGNOS) program.

Other EU-backed programs in which we are active include the Peraspera space robotics technologies cluster, and the GoyaSatcom initiative in which Poland is to be one of the leading partners.

In addition to multinational projects, the agency is also determined to boost its bilateral ties with key partners. Beyond Europe, cooperation with NASA is very high on POLSA’s international affairs agenda. The agency has performed a review of the global space market, asking itself which markets had the highest potential to absorb Polish technologies. We believe that Poland’s space industry with the industries in neighboring Central-Eastern European countries, such as the Czech Republic, Hungary and Romania, complement each other. The U.S. industry is a natural partner for us, and we want to facilitate the participation of Polish space businesses in NASA missions. The experience of countries such as the Netherlands and Denmark proves that companies from our region could also successfully break into this demanding market. The U.S. spending on space equals that of the rest of the world combined, so it is vital that Polish companies can present themselves in this highly competitive market. Our role is to facilitate their expansion.

We have ongoing contact with NASA which includes regular meetings and discussions on areas of potential cooperation and industry synergies. Our ambition is to sign a framework agreement with NASA in 2020.

You were president of Creotech Instruments before becoming president of POLSA. What’s the biggest difference between running a private space company and running an agency?

There are many differences, but one of the capacities that I needed to develop as POLSA president was how to navigate between the political interests of the numerous stakeholders in the space sector, and how to balance them. There are at least four government ministries with a deep interest in space. These include the Ministry of Defense, the Ministry of Digital Affairs, the Ministry of Entrepreneurship and Technology, and the Ministry of Science and Higher Education. It is often the case that, to solve one of the issues that limit the development of the space industry, POLSA needs to collaborate with multiple partners and reconcile their approaches. But we get along well. This is how we’re able to move things forward.

POLSA AT A GLANCE

Headquarters: Gdańsk, on the Polish Baltic Sea shore.


Mission statement: POLSA participates in fulfilling Poland’s strategic goals by supporting the use of satellite systems and the development of space technologies.

National Space Program Budget: 248.5 million złoty ($65 million) for 2019-2021

Portfolio: Some 54 projects are planned for 2019-2021 to support the development of the Polish space industry. These include the development of the Polish space scientific mission, the national space situational awareness program, a suborbital rockets program, and infrastructure for the use of the national space sector. The program is also designed to foster partnerships between Polish space industry players and foreign partners to develop new technologies. To date, the agency has signed bilateral agreements with its counterparts in France, Italy, China, Mexico, Israel, Brazil, Romania, and Ukraine, among others.
An “astronaut” in a spacesuit carries an American flag across the stage during the 35th Space Symposium’s opening ceremony April 8. (Tom Kimmell)
Three companies selected for DARPA Launch Challenge

Three launch vehicle developers, one of which is still in stealth mode, have qualified to compete in the DARPA competition in early 2020 to demonstrate responsive launch capabilities.

In a briefing at the 35th Space Symposium here April 10, DARPA announced that Vector, Vox Space and a stealth-mode company have qualified to participate in the DARPA Launch Challenge. Vox Space is the U.S.-incorporated subsidiary of Virgin Orbit, which is developing the LauncherOne air-launch system.

Todd Master, the manager of the competition at DARPA, said the unnamed company will identify itself closer to the dates of the competition. “At this time they’re not ready to do that,” he said.

Industry sources believe that the stealth company is most likely Astra Space, a company developing a small launch vehicle that suffered two failed test launches last year from Pacific Spaceport Complex-Alaska. Master said that two companies are using ground launch systems and that none of the companies have yet to put payloads into orbit, characteristics consistent with Astra Space.

As part of the competition, the three companies will first attempt to launch payloads into orbit in January or February 2020. The exact launch window and location, which will be selected from a set of spaceports announced last November, will be revealed to the companies about 30 days in advance.

Each company that can place a payload into orbit will receive $2 million and then perform a second launch from a second site, also on short notice. The companies will that perform the second launch will be eligible for a $10 million first prize, $9 million second prize and $8 million third prize.

The companies will be ranked on several factors, with an emphasis on speed to launch, Master said, although DARPA is still developing the scoring algorithm. Other factors, he said, may include orbital insertion accuracy and mass to orbit.

The qualifying companies, which each received $400,000, came from an initial pool of 55 companies that attended an industry day last May in Los Angeles. More than 30 teams submitted their launch concepts through a “pre-qualification” process. DARPA then selected 18 teams to continue into the full qualification process, which required companies to offer more technical details while also going through the commercial launch license application process with the FAA.

Master said the winnowing process from 55 interested companies to three qualified teams involved several factors. “In the initial phase, I think there were just a lot of people who wanted to find out what we were doing,” he said. “I think you had some natural drop off from that.”

The selection of 18 companies from more than 30 who entered the pre-qualification process, he said, was based on which companies were offering a feasible concept within the
Exolaunch and Virgin Orbit sign memorandum of understanding

German launch services provider Exolaunch announced a memorandum of understanding April 11 with Virgin Orbit to send satellites into space as early as 2020 on LauncherOne dedicated and rideshare missions.

“Virgin Orbit and EXOLAUNCH share a core belief in customer experience and viable launch services,” Jeanne Medvedeva, Exolaunch Launch Services Commercial Director, said in a statement. “For our small satellite customers predominantly from Europe, Virgin Orbit will provide frequent and easy access to … a wide range of orbits. We will provide diverse smallsat clusters adapted through our separation systems to the upcoming missions of LauncherOne.”

Exolaunch, a spin-off of the Technical University of Berlin formerly called ECM-Space, has arranged launches, managed missions and integrated small satellite rideshare clusters for customers in Europe and North America. Exolaunch customers include startups, universities, scientific institutions and space agencies. In 2019, Exolaunch is under contract to send more than 60 small satellites into orbit. Forty of those satellites are scheduled to fly together on a Russian Soyuz rocket this spring or summer.

DEBRA WERNER

Virgin Orbit’s LauncherOne is designed to send payloads of up to 500 kilograms into orbit from rockets air-launched from a modified Boeing 747 carrier aircraft. The company performed its first LauncherOne captive carry flight in November. At the time, company officials said they planned to send satellites into orbit in early 2019.

“Virgin Orbit and Exolaunch are naturally aligned in our ambitions to launch the global small satellite revolution, which necessitates low-cost, high-frequency access to space,” Dan Hart, Virgin Orbit CEO, said in a statement. “Europe is on the cutting edge of science and technology when it comes to small satellites. We’re very motivated to provide our unique launch capabilities to this rapidly growing market.”

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< > time frame of the competition. “We saw a lot of interesting ideas, but in a lot of cases there was no actual hardware development to date, or no software development to date, or no safety considerations for licensing,” he said.

That companies went into the full qualification process got more rigorous technical analyses to see if they would be ready to launch in time for the competition. Some companies also stumbled into problems with the FAA licensing process. “The FAA process is an extremely rigorous process,” he said. “A lot of companies, I think, are still focused on building a rocket engine and building tanks and building avionics, and probably don’t spend as much time as they need to figuring out how that’s going to be licensed by a federal safety authority.”

Master defended the decision to hold the competition now despite the limited number of companies qualified to compete. “We very specifically chose the time frame of this challenge when it was,” he said. The intent was to get companies in the early stages of vehicle development “prioritizing responsiveness and flexibility such that it could still be enacted” before their designs became too mature.

Another issue yet to be addressed is how any prize-winning companies might transition to contracts with U.S. government agencies to provide launches for them. Air Force Gen. Jay Raymond, head of Air Force Space Command, was “extremely interested” in the results of the competition after a briefing about it last year, Master said. There’s also interest from the Defense Innovation Unit.

“But we don’t have a specific procurement plan yet or a direct contracting mechanism” for the winning companies, he added. SN
Space Symposium attendees socialize April 10 at a cocktail reception in the “Orbit Lounge” that Zoic Labs, Slingshot Aerospace and Rocket Communications sponsored in the Broadmoor West Tower Lobby. (Tom Kimmell)
Canada's road map for the country's future direction in space was released with much fanfare in February and March in two separate announcements that were heavy on feel-good public relations but lacking in the specifics that industry needs.

Canadian Prime Minister Justin Trudeau announced Feb. 28 that Canada would be partnering with NASA and contributing 2 billion Canadian dollars ($1.4 billion) over 24 years on the Lunar Orbital Platform Gateway program, a human-tended facility in orbit around the moon, as well as other space programs. “Canada is going to the moon,” Trudeau said with dramatic flair to cheers from the audience at the Canadian Space Agency headquarters in Saint-Hubert, Quebec.

The announcement also included funding of 150 million Canadian dollars over five years for a new Lunar Exploration Accelerator Program to help small and medium-sized businesses develop new technologies to be used and tested in lunar orbit and on the moon’s surface in fields that include artificial intelligence, robotics and health.

That announcement was followed by the March 6 release of the Canadian government’s national space strategy, which included the Gateway commitment and Lunar Exploration Accelerator as its main platform.

But much of the rest of the strategy was a replay of previously announced programs. The 22-page document repeated a 2018 initiative to support the development of low earth satellites to bring internet services to rural parts of the country. For that, Trudeau’s Liberal Party government will commit 100 million Canadian dollars for research until 2023 and would use the money on projects that are directly related to LEO satellites and next generation rural broadband.

The space strategy also re-announced the 2016 commitment of 379 million Canadian dollars to continue Canada’s participation in the International Space Station and a 2017 program to add new recruits for the country’s astronaut program. In addition, it touted a 125 million-Canadian-dollar program for artificial intelligence research but that spending was originally announced in 2017. At that time the same government positioned the research funding differently, noting that such work would “improve transportation and lead to better and more efficient health care and social services.” Space was not listed.

In some cases, the strategy appeared to stretch the link of existing and unrelated federal government programs to the realm of space. For instance, the document listed one of its strategy’s goals as “enhancing access to nutritious food” and noted that growing such food in remote regions with harsh environments could lead to technology that might be used on the moon. “The Government will work with provincial and territorial partners to explore how to help improve the accessibility of food across Canada, including the North, with the aim of, one day, taking these lessons learned to help astronauts grow food off Earth,” the strategy noted, but with no additional details.

The Canadian government’s annual budget, released March 19, largely repeated much of what was in the space strategy, although it did have some new details about what would generally be spent in each year for the next five years. However, it did not outline a full costing of the proposed plan.

The budget did include one new promise to add more funding to the 2018 LEO satellite initiative for rural broadband communications but again it provided no specific details on how much or how that money would be accessed by industry.

Navdeep Bains, Canada’s minister of innovation, science and economic development, acknowledged that the country’s commitment to Gateway was the cornerstone of the space strategy.

Industry representatives reacted with polite optimism. Jim Quick, president of the Aerospace Industries Association of Canada, said he was pleased with the government’s announcement but pointed out some elements of the strategy had already been announced and others included in the document required more details about funding and timelines. “The timely release of a fully costed and funded plan is a necessary next step,” Quick said.

Christyn Cianfarani, president of the Canadian Association of Defence and Security Industries, told SpaceNews that the government needs to get one or two solid projects underway to send a sign to industry it is serious about the strategy. It will be up to industry representatives to continue to put pressure on the federal government to deliver on its commitments.
government to provide specifics about strategy projects and then push to move those forward, said Cianfarani, whose association includes key space industry players. "We're not going to let off the gas," she explained. "It's up to us to not sit back and congratulate ourselves (about the strategy) but actually continue to put pressure on the government to roll out connected pieces."

The lack of specifics is particularly puzzling since the value of Canada's space sector isn't lost on the federal government. The strategy noted that the sector contributes $2.3 billion Canadian dollars to Canada's gross domestic product, directly employs almost 10,000 Canadians, and is one of the most research and development intensive sectors in the Canadian economy. Small- and medium-sized businesses account for over 90 percent of all Canadian space firms and nearly 30 percent of employment in that industry.

Even still, just getting Canada to release a strategy has been a multiyear ordeal involving both the previous Conservative Party government and the current Liberal Party administration of Prime Minister Trudeau.

First there was an extensive examination released in November 2011 of Canada's space sector by David Emerson, a former Conservative government cabinet minister.

Emerson's report called on the government to recognize the importance of space to national security and economic prosperity and recommended the country's Industry Minister produce annual, 5-year and 10-year plans for the Canadian space program. Those plans would be brought to a cabinet committee for discussion and approval each spring. That, however, was never done.

Then in February 2014, the Conservative government issued a 13-page document, Canada's Space Policy Framework. But that provided only broad-brush strokes of the direction the country wanted to go in space and had few specific details. National sovereignty, security and the creation of domestic jobs were to be the key drivers behind Canada’s future space activities, the government of the day noted. The document also called for continuation of the Canadian astronaut program, further investments in the development of Canadian contributions of advanced systems and scientific instruments as part of major international missions and increased support for technology development, especially in areas of proven strength among domestic firms, such as robotics, optics, satellite communications and space-based radar.

That policy framework was supposed to be followed by the release at the end of 2014 of a long-term space plan. That never happened and specific programs supporting the Conservative policy initiatives failed to materialize.

"The Conservatives dragged out the process for years while in the meantime, very few concrete measures were taken," explained Steve Staples, who analyzed the space sector for the union representing Canada’s aerospace workers. With the election of the Liberal government in the fall of 2015 it was back to square one on defining a role for Canada in space. In late 2016 the Liberal government announced it was going to develop a new space strategy, with a focus on advanced technology that could contribute to growing the country’s economy. The strategy was to be released in June 2017. Bains, Canada’s minister of innovation, science and economic development, noted that the Canadian government saw the space strategy as a “research and innovation” plan to fuel growth in the sector. The June 2017 date came and went, with promises by Bains the strategy would be released sometime soon. But it took a major push in the fall of 2018 from the country’s space industry to prompt the Liberal government to act. That campaign, known as #Don'tLetGoCanada, was a lobbying and public relations strategy to raise awareness of Canada’s accomplishments in space as well as the major economic benefits to the country that come from the space sector. The group behind the campaign included more than 20 organizations and companies such as MDA, Honeywell, the Canadian Astronomical Society, the Aerospace Industries Association of Canada, the Canadian Space Society, IMP Aerospace and Magellan Aerospace. The initiative was designed to put pressure on the Canadian government to sign on to the Lunar Gateway program and to release the new space strategy. MDA, which will build a new Canadarm for the Gateway, was particularly concerned that foot-dragging by the federal government would see the country missing its opportunity to join the NASA project. "There's been this trend in declining investment in space in Canada," Mike Greenley, group president of MDA, and one of the #Don'tLetGoCanada coalition partners, told SpaceNews. "The international community is looking for a commitment from Canada to participate in [Lunar Gateway] so it's a key time for Canada to determine whether it will commit."

NASA Administrator Jim Bridenstine also lent support to having Canada come on board to Lunar Gateway, noting at a Sept. 7 forum in Washington that a Canadian-built robotic arm would be a welcome addition to the project.

While industry’s campaign had a successful outcome in convincing the Liberal government to sign on to Lunar Gateway and to release the space strategy that doesn’t mean there is clear public support take a hit, a situation that does not bode well for the party as it heads into a general election in October.

If the Liberals lose to the opposition Conservative Party, it is highly unlikely that Conservative leader Andrew Scheer will continue with the Liberal government’s space strategy. While a Lunar Gateway commitment would likely continue, there could be delays or changes as a space strategy is reworked by a new government.

If the Liberals are re-elected, then industry could be still waiting for more details on how federal money will be allotted to specific space initiatives. SN
Launch, Payloads, Communications, Protection. L3 Delivers. L3 Technologies offers the most comprehensive space mission solutions. With more than 60 years of exceptional performance, we provide reliable, technologically advanced subsystems that contribute to our nation’s security. Visit us at the 35th Space Symposium, Booth 108.
Despite the rhetoric of a space race between the United States and China, experts say there are opportunities for the countries to expand cooperation in space that could have broader benefits.

Civil space cooperation between NASA and Chinese organizations is sharply restricted by language commonly known as the Wolf Amendment, first placed in an appropriations bill in 2011 by then-U.S. Rep. Frank Wolf (R-Va.) Similar language has been included in subsequent appropriations bills, including the fiscal year 2019 appropriations bill enacted in February.

The Wolf Amendment, though, doesn’t bar cooperation between the two countries in civil spaceflight. “A lot of people think that the Wolf Amendment is a prohibition on working with the Chinese. It’s not,” said Mike Gold, chairman of the Commercial Space Transportation Advisory Committee, during a March 29 panel discussion on U.S.-China cooperation by the Secure World Foundation.

The provision, he noted, allows for cooperation if there is certification from the FBI that such efforts don’t pose a national security risk and if Congress has been notified of the plan. “To me, those are two commonsense steps,” he said. That has allowed some limited cooperation in areas like science and aeronautics.

However, many still see the amendment as a barrier to more significant cooperation. “I absolutely agree that the Wolf Amendment does not prohibit cooperation, but the effect of it has been to prohibit it,” said Brian Weeden, director of program planning at the Secure World Foundation.

The restriction, coupled with political rhetoric critical of working with China, has resulted in what he called a “stifling effect” for any plans for enhanced partnerships between the two countries.

Weeden said that restriction should be revisited. “While it’s probably a bridge too far to completely get rid of the Wolf Amendment,” he said, “it’s probably time to think about how to relax it, or at least prescribe areas where we might want to think about having cooperation with China in space.” Doing so, he added, “could lead to benefits for this whole engagement process” between the two countries that go beyond civil space.

This year could provide the best opportunity for modifying or eliminating the amendment. Wolf retired from Congress after the 2014 elections and Rep. John Culberson (R-Texas), who succeeded Wolf as chairman of the appropriations subcommittee that funds NASA and who also supported the amendment, lost re-election in 2018 as Democrats regained the majority. House appropriators, though, have yet to bring up the Wolf Amendment as they start planning for fiscal year 2020 spending bills.

Speaking at the International Astronautical Congress in Bremen, Germany, in October, NASA Administrator Jim Bridenstine showed interest in enhanced cooperation with China, including a meeting with Zhang Kejian, administrator of the China National Space Administration. “I look forward to exploring more opportunities to do that,” he said at the event.

Bridenstine, though, was not nearly as eager when discussing the issue in a media roundtable in February. “I’m not going to close that door,” he said of potential bilateral or multilateral cooperation in space exploration involving China, “but certainly it’s not a door I’m opening wide.”

There has been recent, if limited, cooperation between NASA and China on China’s lunar exploration program. Patrick Besha, senior policy adviser for strategic engagement and assessment at NASA, said at the Secure World Foundation panel there was coordination with the Chinese government regarding plans by NASA’s Lunar Reconnaissance Orbiter to take images of the landing site of the Chang’e-4 spacecraft shown above that China landed on the far side of the moon in January.

“Earlier this year, there was coordination with the Chinese government regarding plans for NASA’s Lunar Reconnaissance Orbiter to take images of the landing site of the Chang’e-4, the robotic spacecraft shown above that China landed on the far side of the moon in January.”
U.S. Air Force airmen use virtual reality to race across the Mars surface in the exhibit hall April 9 at the 35th Space Symposium. (Tom Kimmell)
Aerojet Rocketdyne proves 3D-printed RL10C-X thrust chamber performance

One year after unveiling 3D-printed injectors for the latest version of the venerable RL10 rocket engine, Aerojet Rocketdyne announced April 8 successful testing of an entire 3D-printed thrust chamber.

“This was a full-up, closed-loop engine with the turbopump, controls and valves,” said James Maus, senior director and general manager of Aerojet Rocketdyne’s West Palm Beach facility, where the company designs, manufactures and tests propulsion systems. “In our view, the testing has been a home run.”

In June 2018, the Air Force Space and Missile Systems Center expanded an agreement with Aerojet Rocketdyne focused on development of the AR1 booster engine to include work on the RL10C-X, the latest version of the RL-10 upper stage engine. Aerojet Rocketdyne began testing its new 3D-printed RL10C-X thrust chamber in January. The thrust chamber, composed of a copper alloy, includes a 3D-printed nickel alloy main injector.

To date, Aerojet Rocketdyne has tested the new 3D-printed thrust chamber to simulate three times the burn required for a typical mission and approximately half its qualification life. The hardware remains “in excellent condition,” Maus said. “It has a lot of life left in it, which gives us confidence to move forward on the program.”

Aerojet Rocketdyne is revising thrust chamber manufacturing processes to reduce costs and speed up production. “We predict this will reduce our engine cost by 25 to 35 percent and reduce the manufacturing lead time by 35 to 50 percent,” Maus said.

Aerojet Rocketdyne RL-10C engines power the Centaur upper stage for United Launch Alliance’s Atlas 5 and Delta 4 rockets. NASA also plans to fly updated RL-10 upper stages on the Space Launch System, Northrop Grumman Innovation Systems picked it for the OmegA rocket and United Launch Alliance chose it for its Vulcan rocket. “We are currently flying on two rockets and preparing to fly on five,” Maus said.
Attendees explore Peraton’s 360-degree experience in the exhibit hall at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. (Keith Johnson/SpaceNews)
The Brazilian government is planning to purchase a second satellite for military and civil communications. Brazilian Air Force Executive Vice President Maj. Gen. José Vagner Vital said the nation’s military wants to have a backup for the Geostationary Defense and Strategic Communications Satellite, SGDC-1.

“We need always to have some kind of redundancy in X-band,” Vital said, referring to the SGDC-1’s military payload. “This means that sometimes we can buy some more capability to have some redundancy, and we are planning to launch a second satellite, hopefully in 2022. It will be SGDC-2.”

SGDC-1 launched in May 2017 on an Ariane 5 rocket. The satellite carries seven X-band transponders for military communications, and 50 Ka-band transponders for broadband services to schools, hospitals and other facilities in remote parts of Brazil.

Vital, in an interview at the 35th Space Symposium, said SGDC-2 would also have a Ka-band payload and depending on the Brazilian budget, an ultra-high-frequency payload. He said current plans for SGDC-2 include feeder links in Q- and V-band, two types of spectrum satellite operators are beginning to utilize.

Vital said SGDC-2 will have an open procurement for the world’s satellite manufacturers to submit their bids, but preference will be given to proposals that include Brazilian components.

“We are always looking for increasing local content, because we want to have our industry inside the market,” he said. “But it doesn’t mean we want to have an only Brazilian satellite. The idea is to have partnerships and go to the market with international partners.”

Thales Alenia Space of France and Italy built the first SGDC satellite with Visiona Tecnologia Espacial, a joint venture of Brazilian companies Embraer and Telebras. Vital said Visiona will likely be involved in building SGDC-2, since Visiona was created to establish a domestic geostationary satellite manufacturing capability in Brazil.

**CALEB HENRY**

**IN BRIEF**

**Slingshot Aerospace** won a $6 million contract from the U.S. Air Force to demonstrate it can use artificial intelligence to improve space surveillance. The contract awarded April 5 covers customization of the company’s Orbital Atlas predictive space situational awareness software for possible military use. The company says its tool will allow the Air Force to shift from routine catalog maintenance of objects in orbit to “a more tactical, predictive solution.” The decision to try out a commercial system like Orbital Atlas for space control activities comes as the Air Force seeks to augment government-developed technology to detect and characterize space threats.

**LinQuest Corp.** won a $9.2 million contract April 8 to assist in the establishment of U.S. Space Command, by providing support Gen. John “Jay” Raymond, who is the Joint Force Space Component Commander and has been nominated as commander of U.S. Space Command.
Maxar’s path to growth runs through Worldview Legion

Dan Jablonsky, the former DigitalGlobe president, took the helm at Maxar Technologies on Jan. 13, six days after the company announced the loss of its Worldview-4 satellite. Immediately, Jablonsky set to work evaluating the corporation’s structure and components, including satellite manufacturer Space Systems Loral. Maxar’s decision in February to retain that business and rename it Maxar Space Solutions was followed by layoff and reorganization to turn Maxar into a single operating company except for MDA of Canada, which remains vertically integrated.

Nearly three months into the job, Jablonsky, an attorney and former U.S. Navy officer, told SpaceNews Maxar has a strategy to return to growth. The firm’s Worldview Legion constellation is a key part of the plan as is the recent reorganization. Contrary to rumors Maxar was struggling to pay for Worldview Legion, the company is “fully able to fund” the constellation and investigating launching the first group earlier than scheduled, Jablonsky said at the 35th Space Symposium in Colorado Springs.

It seems to be you’re stepping into a challenging job.
Yes. But if it wasn’t challenging, they wouldn’t need me. Ships are built to go to sea and I’m built for an environment that is not completely safe and inside the harbor. I’m very comfortable with where we’re headed. I’ve got an amazing team. We’ve got the right strategy. We need to fix our capital structure as part of this. But I’m very bullish about the prospects for Maxar. Any good business starts with good customers and we have amazing customers — customers on the commercial side, the government side and in the international realm. We have amazing products and capabilities, including some things no one else on the planet can replicate right now. We’ve got amazing people. Now, we need to make that economic model work across the entire chain. We’ve got the right strategy to do that. I’m excited about that.

Why did you reorganize Maxar?
We are designing the organization to operate at high velocity and to react to market conditions and customer needs much more nimbly and quickly. Instead of being in the more siloed business unit structure with different strategies, we adopted a one Maxar operating model. It’s much faster. It also took out a lot of cost. We can retain the capabilities we have and be more efficient with them. We’re saving $60 million this year. We want to be good stewards of shareholder’s capital and $60 million is a lot of money.

Why has Maxar decided to retain the business formerly called SSL?
The day I took over, I conducted my own assessment of what it was worth to others, what...
it was worth to us and also what I thought the future that business was in terms of the end-to-end solutions we could provide as a Maxar portfolio. I went on a customer listening tour. I came to the conclusion, fully supported by the board that SSL, now Space Solutions, as an integrated product line with GEO, MEO and LEO assets for both commercial and government customers running on two main product lines, a 1300-class and a Legion-class bus, was a very healthy business. They could play off each other on a smaller footprint and be much more robust inside that framework.

We have some work to do to change market perceptions about us being around and we’re underway on that. But the pipeline is very good especially for the smaller class buses and for government work. That will help us to recover from the Worldview-4 loss and to put us back on the path to growth. Also, since we’re building the satellites, we can add more to the constellation if the market demand signals are there. We don’t have those plans right now. We’re putting our money into the technology aspects of it within the original budget, more so than just more satellites on the chain. Right now, the technology is advancing faster so that we’re able to get the additional capacity without building more satellites. It’s very capital efficient for us.

**What impact is the loss having on your business?**

Our Earth observation, Earth intelligence business is very resilient. Even with the loss of Worldview-4, which was an important asset to us that business will be flat this year. It’s not stepping down 15 or 20 percent or whatever, which you would normally think would happen with the loss of an asset like that. We’re able to keep it flat because we’ve built a resilient business. It didn’t impact the U.S. government. And a large portion of our business has been moving toward subscription and other products, which we are able to fill in a multi-constellation design.

**When do the first Worldview Legion satellites launch?**

Right now, the publicly released schedule is first quarter of 2021. We’re under contract with SpaceX for two launches. This is the first block of a multisatellite constellation. We’re looking at ways to possibly pull that into the back end of 2020. We’ve been having meetings with others here today to see if we can pull those back to the left. Right now, we’re still on a path to get to first quarter of 2021, but we’re seeing if there are things we can do pull to the left, into 2020.

**I’ve heard rumors that you don’t have enough money for Worldview Legion.**

That is completely and utterly false. We’re building it on our own. We have more debt than we want to right now, which we’re working on in terms of getting our capital structure into a different place that would be better for our shareowners on the equity side. But we are fully able to fund the Worldview Legion constellation. This is the highest capex year for it. Raytheon is providing the instrument, a highly designed advanced instrument per our specifications. SpaceX is under contract for launches. We’re building the satellites on our own. I’m absolutely certain we’re going to do. Our credit facilities and other things provide us way more latitude than we need with this program.

**Are you having trouble paying Raytheon for those instruments?**

Absolutely not.
Did you respond to the Chilean Air Force Request for Information for an Earth observation satellite?

We typically don’t say when we respond to an RFI. What I would say is if you’ve read the RFI, it looks tailor-made for a Legion-X type program. We’re very bullish on the prospects of Legion-X. We’re able to use the heritage from the Legion satellites, our ability to monetize outside the region of interest, our ability to quickly provide these assets on orbit and then pull it into the ecosystem of what we do: flying satellites, operating them, maintenance of them, data handling, propagation of data and what you can tell from the data. Getting you a bunch of data is just one step. And that’s probably not the step you’re most interested in. Having that data make sense to you is the thing that you’re most interested in. And that’s where we can be very helpful to anybody that comes into that program as well.

What is the Legion-X business model?

We’re pretty flexible. We ask, “What problem are you trying to solve?” Depending on who you are, the Legion-X model could be a satellite you buy and operate yourself. We’ve got an entire commercial business built on that premise. But that’s usually not what people want. They’re trying to answer questions. If you buy one satellite, you have to operate it. You have to move the data around the world. We’re very good at that. If you want to enter in that ecosystem, we can fly the satellite for you.

Also, you can buy into an entire ecosystem of Earth observation assets. One satellite might pass with a certain periodicity. But if I have lots of satellites, I can guarantee the sort of refresh you want. I can help you analyze and move data into the decision-making phase. We’ve built the platforms and the tools and the analytics to help you make sense of the data fast. And, I can help you get the data to the people that need to make decisions. Then, it’s not sitting in a national intelligence center or an air force headquarters. We can provide that sort of end-to-end solution for the customer.

A lot of people looking at Legion-X right now have a defined region of interest. We’re a global company with customers around the globe, serving global needs. If you’re highly interested in this particular grid on the earth, we can certainly help you with that. But if you’ve bought into the system and you don’t need intelligence about other areas of the globe, we can help monetize and underwrite the core assets.

That seems like a new model.

We thought it up ourselves. It was designed to align more closely with customer needs and budgets. How do we help them? Is there a way to meet their budget needs and their data and information needs in a way that is still accretive to our shareholders but that solves their problems? It’s innovative and we’re very pleased about the prospects for it. I’m sure others will copy it at some point. We have the worldwide reach, data handling capabilities and all the rest to make us very efficient. So, we will just keep innovating.

What do you see in terms of opportunities for robotics?

We have one of the richest heritages for on-orbit and planetary robotics programs. There are five robot arms on Mars right now. We built all five through the Jet Propulsion Laboratory and Space Solutions. One of the key missions we’re working with NASA right now is Restore-L for satellite servicing in low Earth orbit. If you think about space becoming much more like other places we’ve done human development, it will become an entire ecosystem. But space is very inhospitable to humans. So, robotics will play a large part. If you can service assets on orbit that becomes a way to do more work in space, extend asset lives and make it more economical for things to happen.

The other piece of our robotics program is on-orbit assembly. Right now, a lot of what gets put into space is limited to the fairing design of the rocket. With in-orbit construction, you’re not limited to a five-meter fairing or what you can unfurl in a very complex fashion. You can actually build it in space. We’re working closely with NASA and others and some of our own programs to do that kind of work. We think that’ll be a key enabler for the entire ecosystem to be able to do more, more economically and more efficiently in space.

Anything else you want to say?

I would like to say a big thank you to the Maxar team. They’re not only innovative, hardworking and some of the brightest people on the planet, but they’re working around the clock to help solve some of the world’s most critical sustainable development, intelligence and defense issues around the world. It’s a real privilege to work with this group of teams.
A model of KhalifaSat, an Earth observation satellite built in the United Arab Emirates, on display in the exhibit center at the 35th Space Symposium in Colorado Springs, Colorado. (Keith Johnson/SpaceNews)
NASA awarded Planet a $6.7 million contract to provide Earth imagery for climate research. Under the award Planet revealed in an April 11 blog, NASA will supply Planet data to 35 researchers to evaluate its utility alongside data provided by government Earth observation sensors, including NASA’s Moderate Resolution Imaging Spectroradiometer, Global Ecosystem Dynamics Investigation, and the second Ice, Cloud and land Elevation Satellite.

Planet gathers global Earth imagery daily with a constellation of about 140 satellites, including Dove cubesats and larger RapidEye and SkySat satellites. The contract “is a signal of NASA’s interest in understanding what commercial imagery can bring to their scientific missions and how it coexists with other datasets,” Jen Marcus, vice president of Planet Federal Operations, told SpaceNews.

For Planet, the NASA contract also represents a homecoming of sorts. Planet co-founders Robbie Schingler, Will Marshall and Chris Boshuizen worked on NASA small satellite projects before establishing the company. In addition, Planet’s commitment to Earth monitoring is revealed in its motto, See Change, Change the World, Marcus said.

“Getting our data into the hands of renowned climate scientists to help measure essential climate variables furthers our mission of providing timely, global imagery and analytics to empower informed, deliberate and meaningful stewardship of our planet,” Schingler, currently Planet’s chief strategist, said in a statement.

Under the new contract, NASA will gain access to Planet’s daily imagery and its 10-year imagery archive, Joseph Mascaro, Planet academic programs director, said in the April 11 blog. NASA “has broad interests in land use and land cover change, forest and ocean science, and polar and cryosphere applications,” Mascaro added.

Thomas Zurbuchen, NASA associate administrator for science, announced in August the space agency’s plan to spend $100 million a year on a series of small satellite projects. As NASA and the National Oceanic and Atmospheric Administration begin purchasing Earth observation data gathered by private companies, some researchers have expressed concern they will be required to pay to obtain the data. NASA is purchasing the Planet data under a license that allows the space agency to share it with anyone conducting NASA-sponsored research, Marcus said.
The National Geospatial-Intelligence Agency has exercised a $5.9 million contract option to acquire current and archival Earth imagery from Planet’s small satellite constellation through mid-September.

Under the contract, NGA continues to obtain access to Planet’s daily global imagery to monitor locations of interest, freeing up the government’s own intelligence, surveillance and reconnaissance capabilities for different jobs, Jonas Skinner, NGA’s Planet program manager, told SpaceNews. “We can look back over the last few years and see what’s happening over time,” he added.

In addition to imagery, NGA draws on Planet’s automated data processing “to augment and facilitate NGA analysis processes,” NGA said in a March 21 news release. Planet trains machine learning algorithms to identify objects including roads, buildings, ships and planes. “We can see very quickly how things are progressing at a particular site,” Skinner said.

Planet data is proving useful for monitoring ports and airfields as well as identifying illegal mining and deforestation in Central and South America, Skinner said.

For Planet, it was gratifying to learn combatant commanders and other units NGA supports see value in the company’s products, Jen Marcus, Planet vice president of U.S. federal operations, told SpaceNews. “It was a call from the customers to continue the contract,” she added.

Planet also sees the NGA contract extension as a signal of continuity under the agency’s new director, Navy Vice Adm. Robert Sharp. Robert Cardillo, the NGA director who retired in February when Sharp took the reins, helped push the agency to explore the value of commercial partnerships and small satellites.

“We’ve had a good relationship with Robert Cardillo, supporting his vision for the agency,” Marcus said. Cardillo had recently retired when NGA officials were deciding whether to award Planet an option to continue providing imagery and automated processing. “We felt positive about being able to continue serving the agency in that transition and begin able to support Adm. Sharp’s vision,” Marcus said.

NGA obtains high-resolution imagery and other types of geospatial data, which it analyzes and supplies to Defense Department and intelligence agencies.

In August, the National Reconnaissance Office took over NGA’s EnhancedView contract and announced a $300 million one-year award for continued access to updated and archival Earth imagery from satellites operated by DigitalGlobe, a Maxar Technologies company. NRO can extend the EnhancedView contract through one-year options.

In addition to working with Planet, NGA is watching the evolution of the small satellite industry. “We’re constantly evaluating our changing mission versus the changing environment of the market to make decisions strategically,” Skinner said. “Planet has been a leader for the last few years, but there are quite a few other companies coming online that we will have to closely monitor and evaluate to see what they’re bringing to the table.”

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VISIT BOOTH #528

Discover how a.i. solutions handles all of your space mission engineering needs and see why our space software applications like FreeFlyer and Meridian Ground Systems are crucial components of any successful mission.
Industries such as aviation, financial services and energy have organized what are known as Information Sharing and Analysis Centers, or ISACs.

ISACs have been around since the late 1990s and were created by the U.S. government to collect, analyze and disseminate information about security threats that affect specific sectors.

On April 8, executives and government officials met in a classified session at the Space Symposium where it was announced that the space industry would have its own ISAC, with Kratos Defense & Security Solutions as its first founding member.

As the founding member, Kratos provides the initial funding and support to set up the organization. Phil Carrai, president of Kratos Technology & Training Solutions Division, said the Space ISAC is being created to support the White House National Cyber Strategy, published in September, which calls for the government to work with industry to “strengthen the cyber resilience of existing and future space systems.”

Kratos will pay $75,000 per year in dues as a founding member. There are 10 founding member slots, and each gets a seat on the board of directors. The dues can be paid in cash or with in-kind services.

Carrai told SpaceNews he expects at least 200 companies — including satellite and launch vehicle manufacturers, and their supply chains — to join the group. Platinum membership costs $50,000 a year, gold $25,000 and silver $10,000.

The Space ISAC is being organized as a 501(c)(6) nonprofit, and government officials can participate in advisory roles, not as members. The 501(c)(6) status allows the ISAC to work directly with the government to help define security standards, for example.

The Space ISAC’s unclassified analysis center will be based at the National Cybersecurity Center in Colorado Springs. Member companies can do analysis work at their own facilities.

Frank Backes, senior vice president of Kratos SATCOM products and federal space solutions, will serve as the acting president of the Space ISAC.

Backes said the company was asked by the government last year to lead the standup of the ISAC because of its experience developing space systems, especially ground infrastructure.

Space architectures are said to be increasingly vulnerable to electronic and cyber threats. Member companies would provide information to the ISAC about potential security threats. That data would be analyzed and the ISAC then would share the information through a secure portal so companies can figure out how to combat those threats as they develop and build new satellites or other space systems. SN

SANDRA ERWIN

The Space ISAC’s unclassified analysis center will be based at the National Cybersecurity Center.
Propulsion hardware on display at the Firefly Aerospace booth April 11 during the 35th Space Symposium in Colorado Springs, Colorado. (Keith Johnson/Space-News)
Astroscale raises $30 million, opens U.S. office in Denver

Astroscale, the Japanese company developing technologies to remove orbital debris, announced April 10 that it has raised an additional $30 million and will open an office in the United States that the company hopes will lead to new business opportunities.

The Tokyo-based company announced at the 35th Space Symposium that it added $30 million to an earlier $50 million Series D round the company raised in October 2018. Several Japanese funds participated in the round, including some who previously invested in Astroscale. The new funding brings the total raised by the company to date to $132 million.

“The biggest thing is that it gives us more runway,” Chris Blackerby, chief operating officer of Astroscale, said of the new funding in an interview. “This is still an uncertain business market and the best way to make sure we can remain viable until that market gets viable is to have as much runway as we can.”

Astroscale is currently working on technologies that would enable active debris removal as well as end-of-life disposal of satellites. Its next satellite, called End-of-Life Service by Astroscale demonstration (ELSA-d), is scheduled for launch in 2020 to test technologies to identify, approach and capture objects in orbit, using a larger “servicer” satellite that will track and dock with a smaller client spacecraft.

ELSA-d would lead to later operational spacecraft, although Blackerby said the specific missions and scheduled have to be worked out. One issue is uncertainty about who the customers of that service would be, which could include government agencies and companies operating satellite constellations. The additional funding, he said, gives the company more time to see how those potential markets develop.

“There’s interest out, but it’s always going to be tough to close the business case and get people to pay for it,” he said. “We are finding that the interest is growing on both the government side and the commercial side.”

Astroscale will also use the new funding to open a U.S. office in Colorado. That office will be led by Ron Lopez, who previously led defense and space sales in the Asia Pacific region for Honeywell Aerospace.

The company chose the Denver area for the office because of the region’s existing space industry base and access to both financial and educational institutions. The area also won out over alternatives like Seattle and Silicon Valley because of support from local economic development offices and lower costs.

Blackerby said the new office will help it win U.S. government and commercial customers, while also being able to weigh in on regulations and standards. “We’re not going to have a long-term sustainable business in this market without having a U.S. presence,” he said. “Having the U.S. footprint is really vital for us.”

A drawback, he acknowledged, is the complications that export control regulations introduce for an international company like Astroscale, which also has offices in Singapore and the United Kingdom.

“ITAR will make it tough to do too much in terms of exchanging information,” he said, a reference to the International Traffic in Arms Regulations, which strictly regulate the export of many space-related technologies. “We’ll find a way to take advantage of the benefits of the U.S. industry without running afoul of those regulations.”

Astroscale is taking a long-term approach that is enabled by its latest funding round. “Once we prove the technology and once we continue to push forward on some of these regulatory issues, we’re confident that the market is going to start to show up,” he said. “But it takes time and it takes effort.”

Jeff Foust

A model of the ELSA-d satellite on display at the Astroscale booth April 10 at the 35th Space Symposium.
Elias Rodriguez puts the finishing touches on the Lockheed Martin full-scale lunar habitat April 8 before its unveiling at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado. (Keith Johnson/SpaceNews)
Morpheus Space plans future electric propulsion tests

**Morpheus Space** is meeting with potential customers and raising money for electric propulsion technology the German startup recently demonstrated in orbit.

On Feb. 26, engineers fired Morpheus’ 160-gram Nano Field Effect Electric Propulsion (NanoFEEP) thruster for the first time on the University Würzburg Experimental-4 (UWE-4) cubesat.

Now, Morpheus is preparing for additional tests. The company delivered a NanoFEEP thruster to GomSpace, István Lőrincz, Morpheus co-founder, told SpaceNews. GomSpace, a firm based in Denmark with a propulsion center in Sweden, is beginning large-scale manufacturing of nanosatellites and establishing facilities to produce as many as 350 per year, according to the firm’s 2018 annual report released March 29.

In addition, ZfT, the Center for Telematics in Würzburg, is evaluating NanoFEEP as a candidate to propel satellites for CloudCT, a German and Israeli mission focused on climate research. With 14 million euros ($15.7 million) from the European Research Council, the CloudCT mission is focused on gathering detailed images of cloud structures and properties with 10 miniature satellites flying in formation.

“We are currently evaluating potential candidates for the propulsion system,” Klaus Schilling, president of the Center for Telematics, said by email. “The Morpheus electric propulsion system is certainly a candidate in this evaluation after our good experiences with the electric propulsion system from Dresden used in the UWE-4 mission.”

The primary mission for UWE-4, a 10-centimeter-square cubesat launched in December 2018, is demonstration and characterization of the NanoFEEP thruster as part of the University of Würzburg’s overall campaign to develop technologies for formation flight of cubesats.

The late February demonstration “was the first time electric propulsion on a one-unit cubesat was successfully turned on in orbit,” Lőrincz said. “It was quite awesome.”

The University of Würzburg and Morpheus, a spin-off of the Institute of Aerospace Engineering of the Technical University of Dresden, plan to continue testing NanoFEEP, which combines a liquid gallium propellant with a chip-based neutralizer. Four Morpheus NanoFEEP thrusters are housed in the rails of the UWE-4 cubesat.

In future tests, the UWE-4 operations team plans to fire the Morpheus thruster to change the attitude and orbit of the satellite, Lőrincz said.

Morpheus focuses on technologies to help emerging space companies build, what Lőrincz calls, “agile constellations.” Cubesats equipped with Morpheus thrusters, for example, will be able to dodge collisions and deorbit when their missions conclude, he said.

“With NanoFEEP, a small cubesat could be propelled back into the atmosphere within two years,” Lőrincz said. “With MultiFEEP, one could even dispose of a six-unit cubesat within two years.”

The growing popularity of small satellites has prompted several startups, including Boston-based Accion Systems, Enpulsion of Austria and Orbion Space Technology of Houghton, Michigan, to focus on electric propulsion for miniature satellites.

In addition to NanoFEEP, Morpheus is developing MultiFEEP, a thruster that combines seven NanoFEEP thrusters with additional features for thrust vectoring. MultiFEEP thrusters are designed for three-unit cubesats and larger satellites, Lőrincz said.

**DEBRA WERNER**

German startup Morpheus Space is raising money to continue development of its NanoFEEP thruster, a 160-gram propulsion system tested in February on the University Würzburg Experimental-4 cubesat, shown above.
Indian anti-satellite test provides early trial for Space Fence

Still in testing mode, the U.S. Air Force Space Fence on Kwajalein Atoll detected India’s March 27 anti-satellite test and issued a breakup alert.

“We happened to be up during an endurance test and we were very excited to see that the system performed nominally,” Matthew Hughes, Lockheed Martin Space Fence and Space Surveillance programs business development manager, told SpaceNews.

“Space fence is all about the ability to identify breakups, maneuvers, closely spaced objects, proximity operations, new foreign launches.”

Lockheed Martin completed construction of Space Fence and is conducting testing and evaluation of its capabilities. The Air Force is scheduled to begin initial operation of the ground-based radar, which sends out a curtain of radio frequency energy wider than the continental United States, in the fourth quarter of this year.

The Space Fence is designed to detect unusual activity in orbit, like multiple objects in orbit that do not correlate to objects in the Space Surveillance Network catalog. When new objects are detected, it issues alerts and begins tracking them to determine their orbits, he added.

Lockheed Martin also completed surveying a location for a second Space Fence in Western Australia. The Air Force authorized Lockheed Martin to survey the site but did not request funding to build a second Space Fence in its 2020 budget.

Having a second site, particularly one in the Southern Hemisphere “would significantly increases the accuracy and timeliness” of unusual orbital activity by allowing the radar to observe objects more frequently, Hughes said.

Since most Space Surveillance radars are in the Northern Hemisphere, “a site in the Southern Hemisphere adds a lot of value,” he added.
Intelsat-29e drifting in GEO orbit after suffering crippling fuel leak

Intelsat’s first Epic-series high-throughput satellite, Intelsat-29e, is drifting in orbit after back-to-back anomalies, forcing the company to shift customers to other spacecraft.

Intelsat said April 10 that the propulsion system on the three-year-old satellite “experienced damage” — the cause of which it did not identify — resulting in a fuel leak.

While attempting to restore services from the satellite, Intelsat said it lost communications with the satellite due to a second problem.

Intelsat said its connection with Intelsat-29e has been intermittent, and that it is working with Boeing, the manufacturer of the satellite, on restoring uninterrupted communications. The fuel leak occurred April 7, Intelsat said.

ExoAnalytic Solutions, a commercial space situational awareness company, said its network of ground-based telescopes identified debris around Intelsat-29e on April 8.

Doug Hendrix, ExoAnalytic’s chief executive, told SpaceNews two prominent objects were identified April 10, but that the company can’t determine if they are frozen fuel or something else.

“What we’re confident in saying is they’ve had an anomaly; they have announced an anomaly. We believe that we have seen debris come off of the satellite,” he said at the 35th Space Symposium.

Intelsat said it “will not make a determination of financial impact until the conclusion of the recovery mission.”

In a statement, ExoAnalytic said Intelsat-29e was “in a geostationary orbit at 50 [west] longitude until April 8, when it began tumbling and drifting to the east” along the geostationary arc where most telecom satellites reside. Intelsat-29e is the second Intelsat Epic satellite to experience a propulsion anomaly.

In 2016, Intelsat-33e suffered a thruster issue that insurers estimated could shave 18 months off its design life.

Boeing built five of the six Intelsat Epic satellites, and supplied the payload for Intelsat-32e, which used a bus from Airbus Defence and Space.

IN BRIEF

Analytical Graphics Inc. (AGI) says some debris from India’s anti-satellite test could remain in orbit more than a year. Researching the debris created by the March 27 ASAT test, AGI found some objects were in orbits with apogees as high as 2,200 kilometers. In such orbits, the objects may take one to two years to reenter. Some debris has already reentered, while much of the rest will deorbit within a month or two. AGI data showed that multiple Russian Kanopus remote sensing satellites and Dove satellites operated by commercial company Planet were among 25 spacecraft most at risk of intersecting with debris paths from the ASAT test. — Caleb Henry
People inside the full-scale lunar habitat mock-up Lockheed Martin brought to the 35th Space Symposium in Colorado Springs, Colorado. (Tom Kimmell)
Vector isn’t eager for legal fight with Lockheed Martin over patents

Even though Vector Launch filed a patent infringement lawsuit against Lockheed Martin, the Arizona startup is not eager to spend millions of dollars fighting the aerospace giant.

“We don’t want to be in lengthy litigation with Lockheed Martin,” Shaun Coleman, Vector co-founder, told SpaceNews. “We were forced into this situation and would love to resolve it.”

Vector filed a complaint April 5 in the U.S. District Court for the Central District of California, alleging Lockheed Martin infringed on three patents related to GalacticSky, Vector’s software-defined satellite technology.

Lockheed Martin declined to comment on the pending litigation.

Vector is widely known as a launch vehicle developer but it is actually a “space access company,” said Coleman, who is also GalacticSky chief marketing officer and general manager. Coleman also authored the patents that are the subject of Vector’s claim against Lockheed. Before joining Vector, Coleman, an angel investor and serial entrepreneur, founded three startups including Cloud-Volumes, a software company acquired in 2014 by VMware.

Coleman, who met Jim Cantrell, Vector chief executive and co-founder, through their shared love of car racing, leads a team of 20 people at GalacticSky. Based in San Jose, California, GalacticSky focuses on the firm’s software-defined satellites, sales and marketing.

With GalacticSky, “you can skip satellite development and launch and upload your applications to a satellite,” Coleman said. Vector plans to launch its first GalacticSky prototype later this year. Production versions “are nominally scheduled to go up in 2020,” Coleman said.

Vector has filed more than 30 patents and has many more in the works, Coleman said. As of April 9, the U.S. Patent and Trademark Office had awarded Vector 12 patents related to GalacticSky and one for its rocket engine.

Vector was not aware of Lockheed Martin’s SmartSat software-defined satellite project until it was announced March 20, Coleman said.

In the wake of the Lockheed Martin announcement, Vector sent letters to the aerospace giant. Lockheed Martin acknowledged receipt of the letters but did not respond to Vector’s concerns regarding patent infringement, Coleman said.

As a result, Vector felt forced to file a lawsuit to protect its intellectual property, Coleman said. “We are a small innovative company. We came up with this idea first but Lockheed Martin can out-execute me every day of the week. We would much rather work with them,” he added.

Vector also took offense when Lockheed Martin pulled an April Fools’ Day prank, announcing it developed a fragrance called Vector. Many publications including SpaceNews published April 1 articles about the fragrance.

“Not only did they use our name, but the logo/wordmark of their prank product was stylized almost identically to our own wordmark,” Kim Jennet, Vector senior marketing director, said by email. “Intimidation comes in many forms, but this appears to us to be an attempt to diminish our brand and our status in the small launch vehicle and new space market.”

Meanwhile, Vector is plowing ahead with its campaign to begin sending satellites into orbit with Vector-R, its first launch vehicle scheduled to fly for the first time this year. The company also is developing a larger rocket, Vector-H.

Vector announced in October it raised $70 million in a Series B funding round led by Kodem Growth Partners in conjunction with Morgan Stanley Alternative Investment Partners.

DEBRA WERNER
Murali Krishnan, Harris Corp. vice president and general manager of intelligence, surveillance, and reconnaissance, at the Harris booth April 9 at the 35th Space Symposium. (Keith Johnson/SpaceNews)
SAIC increases space startup collaboration

Defense contractor SAIC, fresh off its $2.5 billion acquisition of Engility, plans to increase its collaboration with startups to further grow its presence in the space sector. SAIC completed its Engility purchase in January, growing its portfolio of software-intensive space services.

Josh Jackson, executive vice president and general manager of SAIC’s Solutions and Technology Group, said SAIC is working with around a dozen space startups through accelerators in Austin, Texas, and Colorado Springs, Colorado, to make their technology more available to U.S. government customers.

Within the next six months, SAIC plans to choose a third location where it will team with more startups, he said.

“We are looking at where else should we tap,” Jackson said in an interview at the 35th Space Symposium. “It’s a geography thing. We are tapping into geographies where it makes sense from a customer as well as a capability standpoint.”

Jackson cited Austin’s strength in analytics, machine learning and augmented and virtual reality as reasons for SAIC’s interest in that location. SAIC’s Austin partner is Capital Factory, an organization that works to pair startups with investors, customers and mentors. In Colorado Springs, SAIC partnered with Catalyst Campus, being drawn in by the region’s space activity, Jackson said.

“These are one and two person companies that have some niche technology,” he said. “That’s the value that the government is seeking now: how to tap into that true entrepreneurial spirit that exists across the country.”

SAIC is evaluating Los Angeles, Boston, and the Silicon Valley area as prospects for its third startup hub, Jackson said. He declined to name any of the startups SAIC is working with.

“Our goal is to understand the landscape of emerging technologies that could be applied to government missions, and then help be that bridge between those government mission challenges and the emerging technologies that are starting up,” he said.

Jackson said SAIC is increasingly focused on digital engineering, creating “virtual representations of systems,” such as satellites and their corresponding ground infrastructure, to shorten development times and improve sustainability when in use. That includes designing with an awareness of cybersecurity risks from the beginning, rather than retroactively introducing cyber features when threats become apparent, he said.

“When you think about the proliferation of smallsats and cubesats, the number of nodes in space is going to increase exponentially,” he said. “We need to think about how to protect those from the very beginning.”

Jackson said 97 percent of SAIC’s revenue comes from federal government customers, such as NASA, the National Reconnaissance Office and the Missile Defense Agency. He said that revenue mix is unlikely to change in the near future, since SAIC intends to stay focused mainly on federal government customers.

“We’ll stay close to our roots and who we are as a company,” he said.
Symposium attendees enjoying the weather April 8 on one of the lakeside patios at the Broadmoor Hotel in Colorado Springs, Colorado. (Tom Kimmell)
Space investment hits record high in 2018

Investment into space companies hit a record high in 2018, exceeding $3 billion with no sign of an imminent downturn, according to a new report by a consulting firm.

The “Start-Up Space” report, published April 9 by Bryce Space and Technology, found that various types of investment into space companies, from venture capital to debt financing, totaled $3.23 billion in 2018. That tops the $3.03 billion invested in space companies in 2016, and $680 million more than in 2017.

That total came without a single deal larger than $1 billion. The Bryce report estimates the largest single deal last year was $750 million invested in Blue Origin by its founder, billionaire Jeff Bezos. There were also three separate late-stage investments in SpaceX that the report estimates to be worth more than $200 million each.

“2018 was the biggest year yet, and it’s really interesting because there were no billion-dollar deals,” said Carissa Christensen, chief executive of Bryce, in an interview. “This was a lot of more diversified investment.”

Venture capital investment alone grew by 22 percent in 2018 to $2 billion, she noted. “Those are the investors that are looking for financial return,” she said, as opposed to those who invest for broader strategic reasons or have other non-financial motivations.

That growth is a positive sign for the industry, she said, because these investors are convinced by the business cases of these startups despite the limited number of companies in the sector that have provided a return to their investors. “There are a lot more VCs in the game, including many new investors to space,” she said.

Another significant trend, she said, is the growth in the number of investors from outside the United States. While the majority of seed and venture funding in 2018 came from American investors, nearly half of the investors are from outside the United States, led by Britain and China.

The was little in the way of acquisitions of space companies in 2018. The Bryce report found eight such acquisitions with a total value of roughly $100 million. The lack of such deals, or other exits for investors, have led some to worry that the space industry is in a bubble that could burst in the near future, drying up investment.

Christensen said current investors are far more risk tolerant than those of two decades ago who stopped investing in the industry after companies like Globalstar and Iridium filed for bankruptcy protection, wiping out their stakes.

“The risk now is similar to the risk that Iridium faced” in terms of market uncertainty around new markets, she said. “But the investors now are aligned with that risk, whereas the corporate and equity investors in Iridium were not.”

Current investors, she believes, won’t panic when startups inevitably fail. “When we start seeing failures, which we will, the venture and the advocacy-oriented billionaire ecosystem will not react in the same way,” she said.

The Bryce report, while not giving specific estimates for projected investment in 2019, concluded that investment will continue to grow in 2019, driven in large part by the development of so-called megaconstellations of broadband satellites by companies like OneWeb, SpaceX and Telesat. OneWeb announced March 18 it closed a $1.25 billion funding round, increasing the total it has raised to date to $3.4 billion.

Recent reports that Amazon is planning its own satellite constellation may also drive investment. “Those business cases are not yet proven,” she said of megaconstellations, “but you look at them through a different lens when a company like Amazon enters the playing field.”

Blue Origin comprised over 20 percent of all investment in start-up space companies in 2018.

“2018 was the biggest year yet, and it’s really interesting because there were no billion-dollar deals,”

Carissa Christensen, chief executive of Bryce Space and Technology

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McDaniel declined to reveal the value of the award pending a Defense Department announcement but called the 12-month prototyping contract “a steppingstone to bringing an advanced multisatellite capable antenna system to market both for larger-scale government adoption as well as commercial adoption.”

Atlas began operating Freedom, a cloud-based ground station network, in January 2016. The company plans to operate 31 ground sites by the end of 2020 “to meet the demands of our current customer base and the coming expansion into low Earth orbit constellation management,” McDaniel said April 9 at the 35th Space Symposium.

SMC’s Range and Network Division solicited information on multiband, multimission antennas citing the “need to increase capacity, flexibility, interoperability, automation and resiliency of space operations and spacelift,” according to a 2017 post in FedBizOpps. “There is an increasing number of satellites and launches projected in the foreseeable future, and with that comes an increased demand on the Air Force Satellite Control Network and the Launch and Test Range System. A multiband, multimission system is one conceptual solution to the growing number of U.S. government satellites and may augment or replace the current Air Force Space Control Network and Launch and Test Range System infrastructure by providing the ability to perform key Telemetry, Tracking and Control capabilities and radar functions.”

Atlas’ Freedom network began supporting FalconSat-6, the U.S. Air Force Academy’s 169-kilogram satellite packed with research experiments, in December. FalconSat-6 was Atlas first Defense Department customer.

The latest Air Force contract is important to Atlas because it “will increase our business opportunities within the U.S. government on the whole,” potentially leading to contracts with NASA, the National Oceanic and Atmospheric Administration and “perhaps intelligence community when the time comes because of the scalable nature of the antenna array,” McDaniel said. “We can adapt the technology to meet the demands of a given customer within the U.S. government or commercial industry.”

While expanding its government business, Atlas also is establishing relationships with commercial partners. In March, Atlas signed a memorandum of understanding with satellite network operator Speedcast. The agreement covers the integration of teleports for low Earth orbit satellites at Speedcast facilities worldwide, McDaniel said.

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Pictured above: MTM’s newly retrofitted DSI 5-axis Mill-Turn Gantry Mill (65FT in X, 30FT in Y, and 9.8FT in W). Capabilities include a 100hp live spindle and turning up to 21FT diameter/15FT in Z.

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Where people make the Major difference.
Winners of Defense Department small business innovation research (SBIR) contracts will have a chance to compete for up to $40 million the Air Force will award this fall in a live pitch event in Los Angeles focused on space technology.

“What the Air Force wants is for companies who are innovating in space to come to us first because we’ll be able to get you paid quickly,” Assistant Secretary of the Air Force for Acquisition, Technology and Logistics told Space News April 10 at the 35th Space Symposium.

The upcoming “Space Pitch Day” would be the Air Force’s second live pitch event following the inaugural event last month in New York where, in a single day, 51 small businesses were awarded $8 million worth for contracts and were paid instantly by swiping a government credit card.

Now the Air Force wants to narrow the focus to space, and it is especially interested in technologies “that we didn’t even know we needed,” Roper said. A company can deliver a winning pitch “and 15 minutes later they’re not just on contract, they actually have money in their accounts,” he said. “And we’re not going to ask for equity in their company. So, we hope we can be part of this space innovation ecosystem in the commercial sector.”

Unlike the New York event, the businesses that will be invited to the Space Pitch Day are only those that submitted proposals under the SBIR 19.2 Broad Area Announcement that closed Feb. 6 and won SBIR Phase 1 contracts. They will present their ideas live to a team of Air Force experts, commercial investors and defense executives for an opportunity to compete for Phase 2 awards and get paid on the spot.

By contrast, the average timeline to award an SBIR contract is 180 days. The Air Force awards about $660 million a year in SBIR contracts.

For the Space Pitch Day, candidates will be matched up with military space operators and they will deliver a joint presentation to Air Force program executive officers. The idea is to give PEOs a chance to hear about the military utility of the technologies.

“I think the Space Pitch Day will likely be similar in scale to the one in New York,” Roper said. “We’ll have $30 to $40 million available.”

Air Force officials find live pitches can be more effective than evaluating someone’s proposal on paper. “You understand their idea, you want to buy their idea, you want to buy the team that’s producing it,” Roper said. “That was a big lesson that we learned. In the world of investment, which is new for us in the Air Force, you can’t buy it just on paper. You’ve got to believe in their expertise, their determination and energy,” said Roper. “We want them to have at a minimum a viable product that we can put in an operator’s hands,” he said. “We’ll have money available to put them on contract immediately.”

Live pitches may not work for everything, Roper said, but “early on in the idea phase, I’m absolutely convinced this is the way we need to do business.”

The Air Force is hoping candidates cover a wide range of space technologies, including satellites and small rockets. Cheaper, more responsive launch vehicles are “really exciting,” Roper said. “I think that it’s going to really change the game for us in low Earth orbit. We want satellite makers that are working on new things, new technologies. We want people that are working in digital technologies, artificial intelligence,” he said. “What are we going to do with all of the data coming off of all those satellites? We need to plan for that.”

Space is an environment where artificial intelligence “should do really well,” Roper said. “It’s a very predictable environment and we want algorithms to tell us if something changes. So I think this is going to be a great area to get AI companies in and help our operators looking at things when they’ve changed.”

Companies also are encouraged to pitch unconventional space technologies and ideas that the Air Force may not have thought about. “Maybe even companies that don’t think of their technology as applying to space. We want you to take a risk and come tell us about it,” Roper said. “I would like a company that has a great idea to think I’m going to definitely pitch it to the Air Force first because I’ve got nothing to lose and a whole lot to gain.”

SANDRA ERWIN
United Launch Alliance CEO Tony Bruno, right, and representatives of ULA’s Vulcan supplier team, brief reporters April 8 on the status of ULA’s next-generation rocket during the 35th Space Symposium. (Keith Johnson/SpaceNews).
Compared to traditional U.S. Defense Department agencies, the Air Force Space Enterprise Consortium (SpEC) moves at an extraordinary pace.

Exhibit A: Navigation Satellite Technology-3, an Air Force program focused on augmenting GPS with small satellites in geosynchronous orbit. Harris Corp. submitted a white paper in June and won an $80.4 million contract in December.

“It truly was remarkable,” said Jen Moore, director of Rapid Capabilities for Harris Space Superiority and Global Positioning Systems programs.

For smaller contracts, decisions are even faster. Three weeks after submitting a proposal through SpEC, the Air Force selected Blue Canyon Technologies to work on Tetra, a program aimed at exploring missions, tactics, techniques and procedures for microsatellites in geosynchronous orbit.

“We were on contract a couple weeks after that,” said Dan Hegel, Blue Canyon advanced development director. SpEC is “streamlining the acquisition process for small satellites, in particular.”

SpEC is an Air Force initiative focused on rapid prototyping of spacecraft, sensors, propulsion systems, ground stations and other space-related technology and services. Since early 2017, SpEC has awarded 37 prototype projects with a total value of $206 million.

Ten of those awards went to companies, nonprofits or academic institutions that don’t traditionally work with the Defense Department and 86 percent of the projects include significant contributions from groups other than traditional defense contractors, said Brian Delamater, SpEC executive director. Delamater is a senior program manager for Advanced Technology International, the company based in Summerville, South Carolina, that manages SpEC for the Air Force Space and Missile Systems Center in Los Angeles.

To date, SpEC programs have focused on satellites in low Earth and geostationary orbit as well as military satellite communications network studies, cybersecurity for military payloads flying on commercial or international spacecraft, ground stations for missile warning systems, missile warning data processing and concepts aimed at producing resilient GPS constellations.

“In my opinion, the SpEC is the one beautiful flower blooming in El Segundo,” said retired Air Force Col. David Anhault, president of Blue Residuum Space Alliances, a consulting firm based in Centreville, Virginia. “In the past 12 months, the SpEC has proved itself to be the most prolific and effective DoD agency in promoting rapid prototyping and acquisition reform.”

Instead of following traditional procurement, with a lengthy process of defining military requirements and soliciting proposals, SpEC relies on Other Transaction Authority (OTA) to award contracts. OTA is an acquisition process designed specifically for prototype projects.

“It’s about taking these new ideas and acting on them to get new capability to the warfighter as soon as possible,” said Moore, who spent 24 years in the Air Force and directed space forces for U.S. Central Command before joining Harris. “We are not locked into architectures intended to live for 10 or 15 years. We are looking at getting technology and capability into the warfighter’s hands soonest and then continue to evolve much more quickly than we used to.”

OTA rules allow government agencies to move from prototypes into production without holding a competition. Unlike traditional government procurement programs, OTAs also encourage government agencies and their suppliers to collaborate at various points in the solicitation process.

“Through this collaboration, SpEC’s members gain a deeper understanding of the government’s technology needs, while the government can learn about and leverage existing industry capabilities,” Delamater said in written response to questions. “The government ultimately receives better technology solutions.”

Frank Backes, senior vice president for Kratos Federal Space, said the dialogue is extremely helpful. Usually, as soon as a federal agency asks for proposals, “things go dark and you can’t talk to them,” Backes said.

After SpEC solicits proposals,
communication continues. Companies can ask questions and get answers, making sure they understand their customer, Backes said. “If you were buying a car or a house, can you imagine not being able to talk to the people trying to sell it,” he asked.

As of April 1, SpEC had 277 members including 65 large companies, 202 small companies and 10 not-for-profit or academic institutions. Seventy-nine percent of SpEC members are not traditional defense contractors, Delamater said by email.

Annual dues for SpEC members range from $7,500 for large companies to $500 for small businesses, academic institutions and nonprofits. When a company wins a SpEC award, it must either show significant contribution from partners who are not traditional defense contractors or cover one-third of the cost of a program.

In 2019, the Air Force increased SpEC’s budget fivefold to $500 million. In the first three months of 2019, SpEC released eight solicitations. One is looking for ways to give military units quick access to national space systems to assist in decision making through a program called Tactical Exploitation of National Capabilities.

Another seven prototypes are in the early phase of solicitation and 10 more are expected in 2019. Upcoming SpEC projects focus on satellite servicing, protected tactical satellite communications, commercial space situational awareness, and small satellite constellations that can be updated with new technology every year or two.

What surprised SpEC members most was its speed. SpEC routinely awards contracts within 90 days of receiving proposals.

“I’ve been impressed,” said Chris Pearson, chief executive for Roccor, a small satellite component supplier based in Longmont, Colorado. Roccor is contributing a deployable antenna for a SpEC project led by another company.

The first inquiry from the prime contractor, who Pearson declined to name, came in late October. The prime contractor won the award in February and immediately held a kickoff meeting with its suppliers and government customer. “That is really quick for a space program,” Pearson said.

Speedy contracting is particularly helpful for small businesses because they can hire employees without worrying whether they will remain busy, Pearson said. “When programs take longer than you think they will, you can’t be as efficient,” Pearson said.

SpEC also is spurring new teaming arrangements. Kratos, a defense company based in San Diego that specializes in spacecraft ground systems, is already working on several SpEC projects while bidding on others.

“SpEC gives the Air Force an opportunity to start programs that would have otherwise lagged,” Backes said. “Big programs take a very long time to get on contract and narrow the field of potential suppliers. Whereas initial SpEC awards are smaller and can be awarded to more than one company. It allows [the Air Force] to engage a broad community of potential suppliers.”

As a result of SpEC, Kratos is teaming with companies it hasn’t worked with before. SpEC proposals might be 50 pages with 15 pages of technical information compared with major defense programs often requiring 1,000-page proposals. “If the technical volume is 15 pages, I can afford to be on more than one team,” Backes said.

Initial SpEC awards tend to be small, “but that’s the whole point,” Backes said. “The Air Force can do small awards and prototypes, then pick the best design and continue to move forward with that company.”

SpEC’s speedy contracting is impressive but “changing the way you put something on contract is not the end all be all,” Moore said. “We have to learn both on the government side and on the industry side how to change our processes to then take advantage of that. We are on contract. Now let’s get that capability out.”
RELIABILITY

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Sierra Nevada Corp. is preparing to ship a prototype of an inflatable space habitat designed for lunar orbit and Mars missions to NASA’s Johnson Space Center in Houston.

SNC built the habitat prototype for NASA’s Next Space Technologies for Exploration Partnerships (NextSTEP) program. The habitat is designed for stowage in the rocket fairing of NASA’s Space Launch System or a large commercial rocket. Once in orbit, it would inflate to become an 8.2-meter-wide habitat where astronauts would live and work.

“With an inflatable, you get a lot more volume and a lot more usable space for the crew to do their mission,” said Steve Lindsey, SNC Space Exploration Systems vice president and former NASA astronaut. “It’s designed for the Gateway but it’s also designed for an 1,100-day mission to Mars.”

SNC designed the habitat interior with three floors. Astronaut crews would live and work primarily on the top floor. The main floor is devoted to research with science and robotic workstations. The crew galley and toilets would be housed on the bottom floor.

In late April, SNC plans to ship the habitat to NASA Johnson for testing. There, NASA officials will send astronauts inside the habitat “to simulate several mission days to see how things work,” said Lindsey, who served as a pilot or mission commander on five space-flight missions.

ILC Dover, a firm known for producing flexible materials for aerospace applications like spacesuits, worked with SNC to produce the habitat’s durable fabric. The SNC design is reminiscent of TransHab, an inflatable module ILC Dover developed in the early 2000s for International Space Station crew quarters. It was never flown.

SNC has conducted extensive testing of a one-third scale model of its inflatable habitat, subjecting it to extremely high pressure to ensure the material and design can meet human spaceflight certification requirements.

High strength fabrics form the habitat’s pressurized interior bladder, which is surrounded by webbing to support structural loads. The habitat’s exterior is covered by layers of material strong enough to withstand the impact of micrometeorites and orbital debris, Lindsey said.

The habitat inflates around a circular core that houses its avionics and Astro Garden, a modular system for growing vegetables. SNC subsidiary Orbital Technologies Corp. built Veggie, the International Space Station produce garden.

SNC also has a partner, who it is not yet ready to name, helping with the habitat’s artificial intelligence. “The tricky part about AI is you never know where it’s going to go in the future,” Lindsey said. Preliminarily, SNC would like the voice-activated AI system to control lights, facilitate long-distance communications, offer schedule reminders and provide instructions for scientific experiments and repairs, meaning astronauts would not need to rely on computer screens for step-by-step instructions.

SNC is one of six companies working under NASA NextSTEP contracts to produce habitat designs or prototypes. The others are Bigelow Aerospace, Boeing, Lockheed Martin, NanoRacks and Northrop Grumman.
The SpaceNews editorial team hard at work April 11 in the makeshift newsroom at the 35th Space Symposium in Colorado Springs, Colorado. Clockwise from left: SpaceNews Editor-in-Chief Brian Berger, national security reporter Sandra Erwin, telecom reporter Caleb Henry, and senior staff writer Jeff Foust. Not pictured: San Francisco correspondent Debra Werner. (Keith Johnson/SpaceNews)
The U.S. Air Force plans to test the performance of a small microwave sensor developed by NASA’s Jet Propulsion Laboratory on the International Space Station in 2021.

The conical microwave sensor, called Compact Ocean Wind Vector Radiometer (COWVR), is designed to reduce the cost, mass and power consumption of instruments capable of making global observations of wind, temperature and precipitation near Earth’s surface.

What’s unique about COWVR is that its aluminum reflector rotates while its feed horn and other electronics remain stationary, making it far smaller, less power hungry and easier to accommodate on a spacecraft than sensors that spin the entire radiometer, said Shannon Brown, COWVR principal investigator in JPL’s Microwave Instrument Science Group.

If the on-orbit demonstration is successful, “we could see a shift in the way we design and build conical microwave sensors,” Brown said. For example, several small sensors could be deployed for the cost of a single large sensor, reducing revisit time and improving weather forecast models, Brown said.

In 2016, the Air Force announced plans to send COWVR into a 600-kilometer sun-synchronous orbit on a 300-kilogram satellite as part of a mission dubbed Operationally Responsive Space-6. Last year, after JPL delivered the sensor to the Air Force Space Rapid Capabilities Office, which was previously known as the Operationally Responsive Space Office, the Air Force canceled launch plans to launch ORS-6 due to problems with the satellite bus.

Now, the Air Force plans to send COWVR to the space station in 2021 for one to three years as part of a group of instruments and experiments known as Space Test Program-Houston 8. The Defense Department has long coordinated with NASA to fly instruments and experiments on ISS or other crewed spacecraft through its Space Test Program office in Houston.

“Debra Werner

“The purpose of the COWVR technology demonstration is to mature the new microwave design and prove its functionality on-orbit,” the Air Force Space and Missile Systems Center (SMC) said in written responses to questions. “A successful demonstration could reduce overall development and launch costs for future microwave programs, which track and forecast hurricanes and typhoons as well as deliver sea surface wind direction and speed data.”

Last year, the Air Force began reorganizing SMC in an effort to speed up development and production of space systems. The reorganized agency is known as SMC 2.0.

Air Force and NASA cooperation on the COWVR program “is a prime example of the Air Force SMC 2.0 focus to enable potential space acquisition using interagency partnerships, where it makes sense,” SMC said.

COWVR is designed to measure ocean surface vector winds as well as the WindSat microwave radiometer launched in 2003 on the Naval Research Laboratory’s Coriolis satellite except in heavy rain cells. A future sensor could add lower-frequency channels to obtain measurements through rain cells, Brown said.

Ocean wind monitoring is a high priority for the Defense Department. While the Air Force conducts the COWVR technology demonstration on the space station, Ball Aerospace & Technologies Corp. is building Weather System Follow-on Microwave, an operational satellite equipped with passive microwave imaging radiometers to monitor ocean winds and cyclone intensity as well as an energetic charged particle sensor.
AFTER four years of stealth mode, LyteLoop, a startup planning to store massive amounts of data by moving it continuously between satellites, is coming out of the shadows.

Since 2015, LyteLoop of Great Neck, New York, has been assembling a team and obtaining patents for its plan to move data in an endless loop with ultrahigh bandwidth lasers. The goal is to meet the growing demand for secure data storage without building large, energy-intensive, ground-based centers. LyteLoop plans to store many hundreds of petabytes of data in space, an amount equivalent to a data center containing thousands of servers.

“The amount of data is growing exponentially,” said Ohad Harlev, LyteLoop chief executive. “We can’t build enough data centers to keep up.”

LyteLoop’s network is designed for cybersecurity. Data moving through space at the speed of light is less vulnerable to hackers than data stored on the ground.

“Once you are in space, your operation costs are in the single-digit millions a year,” he said. In contrast, terrestrial data centers require “tens of employees, electricity, maintenance and taxes.” Over a 10-year period, Harlev estimates LyteLoop’s total cost of owning its data constellation, including the cost of the building, launching and operating it, will be about 30 percent lower than the cost of terrestrial data center.

To date, LyteLoop has not sought external investment. Soon, the company plans to begin raising money, publicizing the venture and meeting with prospective partners, Harlev said.

“Within 20 months, we will have vacuum-worthy prototypes of six optical communications subsystems,” Harlev said. In 2020, LyteLoop plans to issue a request for proposals for satellites.

Before founding LyteLoop, Harlev was president of RRsat America, a communications company renamed RR Media and MX1. SES acquired the firm in 2016. Charles Palanzo, LyteLoop’s lead digital engineer is a technology management and engineering consultant. Paul McManamon, former chief scientist for the U.S. Air Force Research Laboratory’s Sensor Directorate, is LyteLoop’s chief technology officer. Alan Willner, a University of Southern California engineering professor whose research focuses on optical-fiber and free-space communications, leads the firm’s laser communications design work.

LyteLoop’s patents and research papers highlight both space and terrestrial applications for its data-in-motion storage concept.

“We have set up a gigabyte storage loop using 1,000 kilometers of optical fiber as a demonstration vehicle, and we are looking at more advanced concepts that explore the ‘art of the possible,’ with goals of significantly reducing required power and footprint,” according to the abstract of a paper LyteLoop executives presented in February at a San Francisco conference held by SPIE, the international professional society focused on optics and photonics.
When a small asteroid exploded in the Earth’s atmosphere in December off the coast of Siberia, the event went largely unnoticed despite releasing 10 times the energy of the atomic bomb the United States dropped at World War II.

As researchers would eventually discover, Japan’s Himawari weather satellite actually witnessed December’s fireball using sensors that Harris Corp. designed for the U.S. National Oceanic and Atmospheric Administration’s Geostationary Operational Environmental Satellite-R series constellation.

“That is the type of technology that is very relevant to missile warning,” says Rob Mitrevski, vice president and general manager of Harris Environmental Solutions.

The company has a long history developing satellite weather sensors and now is looking to parlay that experience into the multibillion-dollar missile warning business.

“We’ve been asking our U.S. government and international customers: ‘What problems can we help with?’” Mitrevski told SpaceNews. “The common theme we hear in the United States and abroad is that there is a need for missile warning capabilities.” This is not surprising since missile technology is becoming more widely available, spurring demand for space-based early warning and surveillance capabilities, he said.

Harris sees missile defense as a major business opportunity where it can combine its sensor and satellite know-how. “The thermal detection capabilities we employ in our core weather missions can also be employed in other missions,” he said.

The company’s weather payloads are used for wildfire detection, for example. Thermal detectors can identify very small and closely spaced wildfires, locate fire and smoke plumes, and detect volcanic eruptions. Harris is looking to package its sensors with low-cost satellites and offer “affordable constellations,” he said.

In the coming years, Harris — which is in the process of merging with L3 Technologies to form the sixth-largest U.S. defense contractor — could conceivably challenge incumbents Lockheed Martin and Northrop Grumman to produce future missile warning satellites for the U.S. Air Force under a program known as next-generation Overhead Persistent Infrared, or next-gen OPIR.

Next-gen OPIR is “very capable,” said Mitrevski, but there could be ways to make lower-cost systems using smallsat with modular designs to augment next-gen OPIR.

Missile warning is one of the Pentagon’s most expensive satellite programs. The Air Force is seeking $1.4 billion for 2020, including $817 million for the development of three Block 0 geosynchronous missile-warning satellites being built by Lockheed Martin and two polar-orbiting satellites to be made by Northrop Grumman. The Air Force foresees spending more than $11 billion over the next five years to accelerate both the space and ground segments.

For competitors like Harris, the opportunity will come when the Air Force solicits bids for Block 1 of next-gen OPIR. It is still unclear when that will happen. The first Block 0 geostationary satellite will be fielded in 2025 and the first polar satellite by 2027.

“Block 1 is the long-term solution,” says Mitrevski. “We see a lot of alignment in our capability with the requirements that are coming out for the Block 1 system.”

Harris also intends to compete for future Pentagon investments in space-based missile defense sensors in low Earth orbit to detect hypersonic weapons. The Missile Defense Agency is requesting $157 million for 2020 to continue to study a space architecture for hypersonic missile defense. That work is expected to transition to the Pentagon’s newly created Space Development Agency, or SDA.

“What we hear about SDA is that they need producible, quick-to-deployment solutions using mature technology,” Mitrevski said. “We are very invested to see if we can align to some of those areas.”

Sandra Erwin
U.S. Air Force Gen. John "Jay" Raymond, commander of Air Force Space Command and President Trump’s nominee to lead a re-established U.S. Space Command, surprised the audience during his April 9 keynote with a live video feed from the International Space Station. (Tom Kimmell)
Ruag, Mitsubishi sign contract for H3 payload fairings, structures

Ruag Space signed a contract April 9 to supply Mitsubishi Heavy Industries with payload fairings and payload supporting structures for MHI’s H3 launch vehicle.

Mitsubishi Heavy Industries and the Japan Aerospace Exploration Agency are developing the H3 rocket to replace the H-2A and H-2B rockets. In December, British satellite fleet operator Inmarsat signed on as the H3’s first commercial customer. The rocket, standing 63 meters high with a 5.2-meter diameter, is expected to debut in 2020.

Ruag has agreed to supply fairings and supporting structures for three International Space Station resupply missions MHI intends to fly starting in 2021 using the H3 rocket and HTV-X, the planned successor to the HTV Transport Vehicle that Japan has used since 2009 for ISS cargo runs.

“We are delighted to receive support of RUAG, a highly experienced and trusted supplier of space products. We have enjoyed working with a Japanese partner for standard types of fairings and supporting structures for our families of launch vehicles for many years. We will build up trusted partnership with RUAG to help us transport critical cargos to the ISS,” Masahiro Atsumi, MHI vice president and senior general manager for space systems said in a statement. SN

Blue Canyon extends its hiring spree

Blue Canyon Technologies doubled its workforce in 2018 and is on track to double it again in 2019, George Stafford, BCT president and chief executive, told SpaceNews.

The company established in 2008 in Boulder, Colorado, as a satellite component supplier, is expanding rapidly to meet demand for spacecraft components, complete spacecraft and mission operations.

To make room for its 140-person staff, BCT acquired additional office space in February. The company plans to double its manufacturing space in 2020 when it moves into an 80,000-square foot facility.

Stafford attributes the firm’s growth to expertise and lean processes. The engineers from Ball Aerospace and the University of Colorado’s Laboratory for Atmospheric and Space Physics who founded BCT had “decades of experience,” Stafford said.

BCT applies that expertise to a wide variety of small satellite missions. The two Mars Cube One cubesats that served as communications relays for NASA’s Mars InSight mission relied on BCT attitude control systems.

BCT is building seven identical three-unit cubesats for the NASA and Massachusetts Institute of Technologies TROPICS constellation, a mission focused on temperature and humidity observations related to tropical cyclones. BCT also is defining bus and payload requirements for Blackjack, a DARPA program focused on small satellite constellations.

While the missions have different objectives, BCT applies common hardware and software to many of them.

“The star tracker that flies on 3u cubesats is the same star tracker that would fly on a 300-kilogram spacecraft,” Stafford said. Blue Canyon also developed a line of reaction wheels for spacecraft ranging from miniature cubesats to 1,000-kilogram satellites. “We can plug and play whatever size we need,” Stafford said. “The software stays the same.”

Increasingly, customers turn to BCT for entire missions rather than individual components. “We currently operate five spacecraft,” Stafford said. “By the end of the year, it will be closer to 15.”

At the same time, BCT’s component business remains strong. To date, the firm has sold 52 star trackers, 153 reaction wheels and 25 attitude determination and control modules, says Johannes Loschnigg, BCT consultant and Loschnigg Consulting principal. SN
Chemical equations written on a glass wall at the Maxar booth at the 35th Space Symposium at the Broadmoor Hotel in Colorado Springs, Colorado.
The nonprofit International Association for the Advancement of Space Safety (IAASS) issued a new report in March calling for the establishment of an independent Space Safety Institute to speed development of commercial space flight safety standards and certification processes.

The 60-page report, which the Noordwijk, Netherlands-based IAASS and its Houston-based sister nonprofit the International Space Safety Foundation sent to NASA, the Federal Aviation Administration, the U.S. General Accounting Office and several aerospace industry groups, said an independent body is needed to help the commercial spaceflight industry grow and gain public trust.

The Space Safety Institute (SSI) concept, which dates back to 2013, envisions systems safety experts from the industry working together with government officials on binding fault-tolerance requirements similar to those that are in place for government-funded spaceflight operations.

"Today in the U.S. if you want to sell an electronic product, like a toaster or a microwave, you need to get a UL sticker because that means that an independent organization looked at your electronic design and made sure that it is not going to hurt people," said Ed Mango, former NASA Commercial Crew Program manager and one of the experts behind the proposal.

"In commercial spaceflight right now, there is nothing that says a system is safe except the company itself," Mango said. "That might work for the early space tourism operations but that’s not how you create a thriving industry with point-to-point transportation and commercial operations in low Earth orbit."

The Space Safety Institute (SSI) could take over from the Commercial Spaceflight Federation (CSF), a Washington-based industry association of leading businesses in the field, which has been pushing a voluntary consensus approach to safety standards.

IAASS Executive Director Tommaso Gobba, the former head of the European Space Agency’s Independent Safety Office, said the IAASS was concerned about the slow progress of CSF’s consensus-based approach and was hoping to offer an alternative to move the industry forward.

According to Gobba, the SSI, which would be partially government funded, would have more authority than an industry group such as CSF, which he said might be prone to put forward only lowest common denominator safety requirements due to the group’s competing interests.

"There is in the world no safety-critical system which is certified on the basis of a voluntary standard," said Gobba. "In the case of a standard, there always needs to be some form of enforcement. What we are proposing is similar to what was implemented in the 1970s in the nuclear industry and in the oil industry following the Gulf of Mexico disaster."

Gobba pointed out that following the devastating 2010 oil spill in the Gulf of Mexico, a national commission on the BP Deepwater Horizon disaster found the American Petroleum Institute, the trade body representing the U.S. oil and natural gas industry, “culturally ill-suited to drive a safety revolution in the industry” due to its position as a leading industry lobbyist. He warned the CSF might find itself in a similar position.

Mango agreed: “The CSF is a good organization but it’s an organization that’s there to fundamentally push commercial space. If you want the people who are pushing it to also regulate it then you are going to get to the lowest common denominator.”

The Commercial Spaceflight Federation says the concerns expressed by the IAASS are based on outdated and inaccurate information.

"Originally, CSF attempted a standards drafting process on our own, with some success, but quickly realized it was necessary to open up the process to ensure truly consensus standards and a potential basis for future licensing or regulation," said Jane Kinney, CSF’s director of business operations.

CSF joined forces with ASTM International in 2016 to stand up a committee on commercial spaceflight, dubbed F47, to develop consensus standards with input from non-CSF companies, such as Boeing and United Launch Alliance, as well as academia and government. “[W]e are one representative in a committee of multiple voices and votes,” Kinney said. “We are advocates and supporters of the work being conducted, but are not ‘leading the establishment of safety standards.’”

Kinney said IAASS is welcome to join F47 but
NASA boss seeks legal, regulatory certainty for commercial space

Before NASA can take full advantage of lunar resources or in-orbit satellite servicing, a U.S. government agency must assume responsibility for authorizing and supervising commercial space activities, NASA Administrator Jim Bridenstine said at the 35th Space Symposium’s Space Law Workshop.

The most daunting challenges facing the global space community are not technical, Bridenstine said, adding, “Don’t get me wrong, the technical problems are not always easy.” It’s the legal and regulatory challenges that concern him most. Overcoming those is “absolutely critical to the future of our country, the future of NASA but also the future of the world,” he said April 8.

The Trump administration’s first Space Policy Directive signed in December 2017 directs the U.S. to lead a campaign to send humans to the moon with the assistance of commercial and international partners. It also directs NASA “to utilize the resources of the moon,” Bridenstine said.

The lunar poles hold “hundreds of millions of tons of water ice,” Bridenstine said. While NASA will lead the way in early extraction of ice to produce air and water for human life support, the agency wants companies to eventually take over that work.

Similarly, NASA intends to develop the technologies required for satellite servicing through programs like Restore-L, a robotic spacecraft Maxar Technologies is building to refuel the Landsat 7 Earth imaging satellite.

“As cool as that is, our goal is not to refuel Landsat 7 but to demonstrate the technology, license the technology, commercialize the technology and then have companies do rendezvous and proximity operations and the servicing of satellites in orbit,” Bridenstine said. “That’s the goal. Now, who in the U.S. government is going to authorize and continually supervise all of that activity?”

Article 6 of the 1967 Outer Space Treaty says nations must authorize and continually supervise “activities of nongovernmental entities in outer space.” However, the regulatory framework required for these commercial activities does not exist in the international community or in the United States, Bridenstine said. “We’ve got to figure this out,” he added.

Until the national regulatory framework and international legal framework is established, companies will have trouble raising money for activities like lunar resource extraction and satellite servicing, Bridenstine said. “That’s why I’m here to talk to you. These are critical capabilities that ultimately need to be capitalized. If we don’t have certainty in the regulatory environment, the legal environment and the international legal environment, that capital will not form and those activities will not take place,” he added.

Bridenstine said commercial satellite servicing ventures are particularly important because they can help to slow down the creation of space debris. “We can reduce the number of objects in space by servicing satellites that currently exists rather than just having them become orbital debris at the end of their useful life,” he said.
The Russian space agency’s first official reaction to the successful March 3 docking of SpaceX’s Crew Dragon spacecraft with the International Space Station congratulated NASA but didn’t mention SpaceX or its founder, Elon Musk.

On the one hand, a little petulance is understandable considering Crew Dragon — and Boeing’s CST-100 — will soon end the monopoly Roscosmos has held on ISS crew access since the U.S. space shuttle retired in 2011. But on the other hand, Roscosmos, its director Dmitry Rogozin and Russians at large appear to crave Musk’s approval.

Four days after Crew Dragon’s successful docking, Musk shared with his 25 million Twitter followers an Ars Technica story headlined “Russia’s passive-aggressive reaction to SpaceX may mask a deeper truth.” The story noted that in addition to leaving SpaceX out of its congratulatory tweet, Roscosmos had also been “throwing small bits of shade here and there” such as when it shared photos of Cosmonaut Oleg Kononenko, NASA’s Anne McClain, and Canadian astronaut David Saint-Jacques wearing protective masks as a precaution against unexpected off-gassing from the new visiting vehicle. “For the first time in the history of the station, the crew worked in Russia-made IPK gas masks,” Roscosmos tweeted.

Perhaps to ease the sting, Musk praised Russia’s space know-how when he tweeted the Ars Technica article: “Russia has excellent rocket engineering & best engine currently flying. Reusable version of their new Angara rocket would be great.” Rogozin, quick to boast, retweeted Musk: “Well you can’t argue with Elon here :’)”

A day later, Rogozin finally tweeted his congratulations at Musk, setting off a new round of Twitter absurdity. Rogozin recently made his Twitter account private, so Roscosmos has taken to reposting Rogozin’s tweets from the agency’s main account. Musk, who doesn’t appear to follow Rogozin on Twitter, finally responded once Roscosmos reposted the director’s tweet.

“Thank you on behalf of SpaceX! We have always admired your rocket/spacecraft technology,” Musk said in reply. “[The] NK-33 & RD 170/180 are exceptional,” he said in another. Both were re-tweeted by Rogozin. Had this ended here, it could have been chalked up to friendly platitudes between space industry leaders. But it didn’t end here.

Rather, Russian state media swung into action, running headlines such as “Elon Musk says Russian rocket science is first class.” Figures including Russia Today chief Margarita Simonyan tweeted screen shots of Musk’s praise and invoked a popular, mostly tongue-in-cheek Russian meme: “How do you like that, Elon Musk,” which is typically reserved for videos showing Russian genius for “innovation” (i.e. finding creative ways to keep decrepit machines like Soviet-made cars in service).

The Musk obsession is part of a larger trend in the modern U.S.-Russia online dialogue. For the past five years, Russian officials, pundits and ordinary social media users have expended significant energy denouncing the West, only to rejoice in near unison when a prominent Western figure says something positive about Russian technology or nuclear weapons. Especially nuclear weapons.

Musk is arguably the second most common object of this phenomenon, though it works a little differently in his case. Much ink is spilled reassuring Russians that their space technology is indeed first class, and Russian officials often deride SpaceX and Musk. But when Musk himself says that Russia has the best rocket engines in the world, state media treat it as front page news — confirmation of their propaganda lines.

Sometimes this phenomenon doesn’t even require Musk’s direct involvement. Russian media can come up with some strange story lines. For example, after last year’s successful Falcon Heavy test flight, several Russian commentators and journalists claimed the vehicle’s 27 engines vindicated Soviet rocket designer Sergei Korolev, whose use of 30 engines in the first stage of his doomed N1 moon rocket is often derided as a critical design flaw.

They also note the grid fins on reusable Falcon rockets are a Soviet innovation.

Ultimately, however, this all has very little to do with space and everything to do with modern Russia. And headlines denouncing SpaceX, reveling in Musk’s attention, or claiming ultimate superiority will not save a struggling Russian space program.
William Gattle, left, and Wayne Lucernoni look 1/3 scale model of Harris Corp.'s NTS-3 satellite at the 35th Space Symposium April 9 (Keith Johnson/SpaceNews)
Commentary | Sid-Ahmed Boukabara

AI for Earth observation and numerical weather prediction

After substantial investments to build and launch sensors designed to observe the atmosphere, numerical weather and climate prediction have benefited greatly from the assimilation of satellite data. The overall improvement in forecasts include advances in modeling, computer power and observations. Satellite observations have also enabled fantastic advances in situational awareness for forecasters. Combined with modern model guidance and the expertise of the operational forecasters, we’ve made great strides in saving lives, protecting property and enhancing our economy. It therefore seems counterintuitive that only 3-5 percent of satellite observations are actually used in preparing numerical weather forecasts. Machine learning and other artificial intelligence techniques could help forecasters get more out of these data by improving accuracy and speed in almost every step of turning satellite observations into actionable forecasts.

Why don’t we use all the data now? First, there are strict time limits for completing weather forecasts and the computer power requirements to process the ever-increasing volume of satellite data are prohibitive within those constraints. Second, there are significant scientific challenges to properly interpret and exploit the most interesting and potentially most valuable satellite data—these are the satellite data in stormy situations where rain or complex cloud conditions are common. However, overcoming these obstacles will very likely lead to more accurate weather forecasts—including forecasts of extreme events such as hurricanes and tropical storms.

How can AI help exploit satellite data? Let’s start with the complicated numerical weather prediction applications (NWP apps for short) that work together to produce almost all weather forecasts longer than a few hours. One of the most important apps mixes all kinds of data to make a full picture of current weather conditions. Temperature, wind, and humidity data from all around the are put together in what we call data assimilation, or DA for short. The data include observations and six-hour forecasts, but none of these data are perfect—they all have errors. During DA, data with small errors are given higher weighting than data with large errors. An accurate DA analysis is critical for an accurate forecast. To get the most out of the observations collected, scientists need to give the DA app a perfect understanding of the data errors. Scientists also need to leverage all environmental observations to maximize both spatial and temporal coverages to avoid gaps. The DA app isn’t perfect as scientists use different short cuts to make it work, such as using only some of the observations (to “thin” the observations), or combining observations close together into what are called “superobservations”. These considerations along with the large computational cost of the DA for the huge volume of satellite observations explain why so few satellite observations are actually used.

AI and machine learning techniques have advanced considerably across areas as diverse as medicine, self-driving cars, social media and the finance industry. Meteorology and oceanography have also seen its share of AI advances. However, until recently, far fewer AI applications were developed for exploitation of environmental satellite data, high-level information extraction in the area of numerical weather prediction, data assimilation and forecasting, as well as for extreme weather prediction and nowcasting.

There have been encouraging signs that AI is increasingly considered for these applications, with promising results—including predictive skills—and this trend is expected to continue with the ever-increasing volume of satellite data and the increased societal reliance on improved forecasting accuracy. The increased data volume comes from higher resolution satellites and sensors, from a growing list of new sensors and from an explosion of virtual observing systems made possible by the Internet of Things. Exploiting all these data sources is expected to present major challenges. AI is a potentially transformational technology, especially because of the potential of what might be called meta-Transfer Learning—the transfer of knowledge and expertise from fields in which AI has been firmly established to NWP and related environmental sciences.

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The 1st NOAA Workshop on Leveraging AI in the Exploitation of Satellite Earth Observations & Numerical Weather Prediction will be held April 23–25 in College Park, Maryland. The workshop is intended for scientists, program managers, and leaders interested in identifying innovative ways to use satellite and other environmental data. Details: https://www.star.nesdis.noaa.gov/star/meeting_2019AIWorkshop.php
Commentary | Brian Weeden and Victoria Samson

India’s ASAT test is wake-up call for norms of behavior in space

On March 27, Indian Prime Minister Narendra Modi announced that his country had successfully conducted an anti-satellite (ASAT) test from a launch site on Abdul Kalam Island in the Bay of Bengal. Hailed by Modi as a moment of “utmost pride” and with “a historic impact on generations to come,” Mission Shakti was seen domestically as proof India was a space power on par with the United States, Russia, and China. Yet internationally, the test is further evidence of the more complex space domain, the lack of progress on developing norms of behavior for space, and the challenges of ensuring its long-term sustainability.

The likelihood that India would conduct an ASAT test was apparent to most India watchers. Ever since China destroyed one of its own weather satellites, the FengYun-1C (FY-1C), in January 2007, Indian space and security officials have debated internally the value of a possible Indian response to demonstrate that they too were a force to be reckoned with. India sees itself as locked in a regional competition with China for power and prestige, along with occasional military skirmishes along an unsettled border that risk escalating tensions between the two nuclear powers. India also was concerned about a repeat of history with it being one of the ASAT “have-nots” if there was ever a future ban on direct-ascent ASAT testing, as India had not tested a nuclear weapon before the Nuclear Non-Proliferation Treaty and thus is not considered to be a nuclear weapon state, per treaty language.

After Modi’s announcement, evidence emerged that India had attempted an ASAT test weeks earlier but failed. The Indian government had released, and then canceled, a Notice to Airmen for a missile launch from Abdul Kalam Island between Feb. 10–12, and there were Indian press reports of a missile test against an “electronic target” Feb. 12. However, anonymous U.S. government officials told The Diplomat they detected a rocket launch that failed about 30 seconds into flight. Outside experts confirmed that the date and time of the Feb. 12 test corresponded with a pass of Microsat-R, the eventual target destroyed March 27, strongly suggesting the Feb. 12 launch was intended to be an intercept.

The dynamics of Mission Shakti resembled America’s interception of its own USA 193 spy satellite in February 2008 more than China’s destruction of the FY-1C, as shown in the table above right. The American and Indian tests used modified missile defense interceptors, a Standard Missile 3 and a Prithvi Defense Vehicle Mark II, respectively, while the Chinese test used a modified medium-range ballistic missile, the Dong Feng 21. Although each of the three tests created thousands of pieces of debris, the low altitude of both the Indian and American tests meant relatively few pieces stayed in orbit, albeit with some fraction of those being thrown to much higher orbits. In the case of the American test all the orbital debris re-entered within 18 months, even those pieces of USA 193 thrown as high as 2,600 kilometers. The much higher altitude of the Chinese ASAT test resulted in more than 3,000 pieces of long-lived orbital debris that will be on orbit for decades to come.

India also appears to have learned from both the Chinese and American tests about how to portray the test as having been done in a responsible manner. The Chinese government was silent for more than a week after its 2007 test, while international outrage and demands for answers built. By contrast, the United States conducted international briefings weeks ahead of February 2008 to argue why the destruction of USA 193 was necessary from a safety standpoint and highlight the steps it was taking to minimize any resulting orbital debris. Within hours of its test, the Indian government released a “Frequently Asked Questions” web page that explained why it had done an actual intercept instead of less destructive tests. The FAQ also went to great lengths to rationalize how the test did not change India’s position on preventing an arms race in outer space or opposition to the weaponization of outer space.

Although the orbital debris from Mission Shakti is likely to be short-lived, it still could pose a significant hazard. According to April 1 comments by NASA Administrator Jim Bridenstine, Mission Shakti created at least 400 pieces of debris and about 24 of those were thrown into orbits with apogees above the International Space Station. The U.S. government estimates that the debris impact risk to the ISS of small-debris impact has risen by 44 percent as a result of the test. This prompted Bridenstine to call the test “unacceptable” and to term it a “terrible, terrible thing, to create an event that sends debris into an apogee that goes above the International Space Station.”

The political repercussions from Mission Shakti are likely to last much longer than any orbital debris it created. Other countries with ballistic missile and hit-to-kill technologies may decide that they too need to ‘join the club’ with a similar show of force. India may claim that Mission Shakti doesn’t change its commitment to peaceful uses of outer space, but nonetheless their actions may spur others to follow in their footsteps. A share of...
The dynamics of India’s ‘Mission Shakti’ resembled America’s intercept of its own USA 193 spy satellite in February 2008 more than China’s destruction of the FY-1C in January 2007.

One of these ASAT tests is not like the other

The UN has limited in scope and results. The UN actions in the space domain, but they have

OK to test kinetic ASAT weapons against satellites, as long as you try and minimize

because U.S. officials want to maximize their

Continued is that it is

A failure to establish norms

India’s ASAT test also lays bare the failure of U.S. efforts to establish norms of behavior in space. This has been something much talked about by both the Obama and Trump administrations as an important part of their space policies and strategies, but with very little actual progress to speak of. Establishing norms of responsible behavior in space is indeed important, but so far the U.S. has failed to articulate what exactly it means by that, make any concrete proposals, or take meaningful actions to call out irresponsible behavior in space by others. While the U.S. continues to raise concerns about the 2007 Chinese ASAT test, it refrained from calling for a norm against such testing, most likely because U.S. officials want to maximize their own freedom of action for missile defense or ASAT testing. The only norm the U.S. seems to have successfully established is that it is OK to test kinetic ASAT weapons against satellites, as long as you try and minimize the resulting orbital debris.

There have been some attempts in international fora to discuss destabilizing actions in the space domain, but they have been limited in scope and results. The UN Committee on the Peaceful Uses of Outer Space agreed in June to 21 guidelines for the long-term sustainability of outer space, but these were broadly conceived and worded and very specifically were not intended to provide guidance on ASAT development, testing or usage. There were discussions in Geneva over the last year of a UN-supported Group of Governmental Experts (GGE), which included the United States, Russia, China and India among others that attempted to create a report on the on further practical measures for the prevention of an arms race in outer space. The GGE finished last month without reaching consensus and so there is no clear multilateral path to a solution at this time.

A big obstacle to progress is that there is a fundamental difference in approach toward space security and stability between the U.S. and its allies on the one hand and Russia, China, India, and most of the rest of the world on the other. The U.S. and its allies argue for the need to regulate/modify behavior on orbit, pointing out that due to the dual-use nature of space technology, it does not make sense to try to limit hardware. By contrast, Russia, China, and India argue for a more classic arms control approach that focuses on banning technology or hardware in space and excludes ground-based ASAT weapons.

The good news is that more countries than ever are concerned about this issue and engaged in trying to develop solutions. Recognizing that the actions of one can negatively affect the ability of all to use space, irresponsible actions have become the business of all space users, not just those states who may have the technical capacity to hold an ASAT test. Ironically, Mission Shakti may also mean India is more willing to now consider some sort of ASAT test ban that may help break the deadlock, although the international community should also consider whether it’s appropriate to reward India for their behavior with some sort of special status.

The other good news is that we don’t need to rely on countries alone to call out irresponsible behavior in space or help enforce norms. The recent commercial space boom means private companies are increasingly powerful players in the space domain and can leverage their brand, customers, and checkbooks to support their values and the economic viability of the domain they operate in. That viability rests on the long-term sustainability of the space environment itself and minimizing the costs and risks to commercial investment and space activities, which could be jeopardized by military activities such as debris-causing ASAT tests.

Thus, an opportunity exists for companies to pair their own internal commitments to responsible operating practices with efforts to influence responsible action elsewhere in the supply chain, a common corporate social responsibility outcome. The Indian ASAT test showed this dynamic may already be at work: while governments were largely silent about Mission Shakti, several companies issued public statements criticizing or condemning the test.

SWF plans to raise these issues and more during our first Summit for Space Sustainability, which will be held June 25-26 in Washington. The Summit will be open to the public and will convene experts from around the world to discuss multiple aspects of space sustainability. The focus will be developing recommendations for norms of responsible behavior across civil, commercial, and national security space activities that promote the long-term sustainability of space. We invite all interested members of the space community to attend and help us forge solutions to help prevent future irresponsible activities that endanger that sustainability for all.

Brian Weeden is Director of Program Planning at The Secure World Foundation. Victoria Samson is the Washington Office Director at The Secure World Foundation.
The development of standards may seem like a dry topic, but it is also crucial for any industry that wants to be safe and effective as it matures.

Before the railroad industry implemented gauge standards, cargo traveling between regions would have to be unloaded and moved to different trains when they entered a new area because the distance between rails no longer matched the size of the wheels of the train. From steel, to clothing, to cars, to pharmaceuticals, standards are a vital part of the growth and development of industries across the globe. This is already true for the burgeoning industry of commercial space.

For many years, the Commercial Spaceflight Federation (CSF) and the Commercial Space Transportation Advisory Committee (COMSTAC) have recognized the importance of developing industry voluntary consensus standards. A particular focus of standards and recommended practices was, and still is, human spaceflight safety.

Voluntary consensus standards are developed or adopted by a voluntary consensus standards body. A voluntary consensus standards body is a domestic or international organization that plans, develops, establishes, or coordinates voluntary consensus standards using agreed-upon procedures. Such a body is defined by openness, balance of interest, due process, an appeals process and consensus. Moreover, such standards comply with U.S. Office of Management and Budget Circular 119-A and National Technology Transfer Advancement Act guidelines and are the Federal Aviation Administration’s preferred means of compliance for the streamlining of existing or enacting new regulations.

Originally, CSF attempted to draft these documents on our own, with some success, but quickly realized that we needed to open up the process to make them truly consensus standards and a potential basis for future licensing or regulation. We also wanted to ensure participation from government stakeholders and entities outside of CSF.

After several attempts to produce these standards, first in-house, and then with external entities called Standards Development Organizations (SDOs) that professionally facilitate the standard writing process, in late 2016 CSF joined forces with ASTM International to stand up its Committee on Commercial Spaceflight F47. With over 12,000 standards in effect, as well as successful committees in areas touching commercial space (e.g., Additive Manufacturing, Aerospace & Aircraft) industry participants saw ASTM as the optimal SDO for such an endeavor. The collaboration was solidified, and the first official meeting of the technical committee was held in April 2017.

As of today, the committee has active participation and support from multiple industry voices, including non-CSF companies (e.g., Boeing, United Launch Alliance, academia (e.g., FAA’s Center of Excellence on Commercial Space Transportation and several universities), and government (e.g., FAA, NASA). Industry members include operators, spaceports, suppliers, general interest groups and consumers. Together, we consistently discuss how to better inform our ranks and expand F47’s membership to ensure that all relevant players are part of the conversation and standards development effort.

F47 has four industry-specific subcommittees that address various sub-sectors of the commercial space business: unmanned vehicles, spaceports, and human suborbital and orbital spaceflight. Work within the subcommittees is currently focusing on seven specific topics that are in various states of development. Four are still in the “Task Group” phase, meaning the topic area is being researched and discussed to better identify how to move forward to produce a relevant standard. Three are in draft standard form and continue to evolve in both content and form in preparation for the balloting process.

In February 2019, F47 published its first standard, Standard Guide for Storage, Use, and Handling of Liquid Rocket Propellants. The standard was developed by the subcommittee on spaceports.

The choice of topics is driven by multiple factors. Within F47 there is a committee on road mapping that aims to develop the best path forward and the areas of most urgent need for standards. To form a task group, a member of F47 must be willing to take the reins and lead the effort. As the committee continues to grow in membership and participation, so will the road-mapping efforts and the breadth of topics that we are able to address.

Competing efforts
It is a sign of commercial space’s success that there are multiple standards efforts popping up. Among these are qualified Standards Development Organizations compliant with the Office Management and Budget and National Technology Transfer Advancement Act guidance, notably SAE International, the American Institute for Aeronautics and Astronautics, the National Fire Protection Association, and others.

And there are organizations such as the International Association for the Advancement of Space Safety, who do not necessarily follow established voluntary consensus standards process necessary to be used as an FAA means of compliance. CSF and ASTM are currently in the process of compiling a global directory of SDOs, and will hold a summit to bring the relevant players together to discuss what has already been accomplished, what is currently being worked, and the best way to move forward efficiently and effectively.

Safety is of the utmost importance to the CSF, COMSTAC, and the members of ASTM F47. We are all working on standards to ensure that our industry is as safe as possible, even as we undertake inherently risky activities.
For that reason, we have some concern about the risks of too many fragmented and potentially conflicting standards development efforts.

First, multiple, disjointed efforts could result in conflicting approaches, as well as duplication and attendant increased workload for all parties. We believe it is best to bring all players around one table to have an inclusive discussion so that everyone’s expertise and actual experience can be considered together.

Second, not all SDOs are in agreement about general standards parameters. We strongly believe that standards developed should be focused on creating the safest environment possible, need to be performance-based, and must represent an industry consensus.

Most entities are in agreement that safety is of the utmost importance when developing standards, but these last two considerations—that standards be performance-based and use industry consensus processes—are not always agreed upon.

Many historical standards provide requirements on what levels of safety need to be incorporated, but these last two considerations—that standards be performance-based and use industry consensus processes—are not always agreed upon.

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Commentary | Brian Weeden

Time for a compromise on space traffic management

Over the last several years, space traffic management (STM) has gone from an obscure topic debated mainly by academics and policy wonks (like myself) to one at the forefront of U.S. national policy. This is thanks largely to the efforts of Scott Pace and his staff at the National Space Council, who led the interagency efforts that resulted in the first-ever national policy on STM signed by President Trump last June. However, implementation of that policy has stalled, mainly due to disagreements between Congress and the White House over which agency should be in charge. I believe that these disagreements can be overcome and there is enough common ground on which to build a compromise that will yield real benefits for national security, the commercial space industry, and ultimately the American people.

Space Policy Directive 3 (SPD-3), signed by President Trump on June 18, 2018, lays out an excellent set of policy goals and directives for STM and provides a solid roadmap of how to put in place the roles, authorities and responsibilities to get there. This should be no surprise, as it leveraged the more than six years of studies, preparatory work done by many departments and agencies, and interagency discussions on this topic conducted during the Obama administration since 2011. The biggest policy change directed by SPD-3 is giving a civil government agency the authority to provide space situational awareness (SSA) data and services to support safety of space activities, and refocus the Department of Defense on developing national security SSA capabilities and protecting against threats. The policy also mandates better use of private sector SSA capabilities and modernizing government oversight mechanisms to enable commercial innovation while protecting the long-term sustainability of space.

The main difference between the Obama and Trump administrations, and the current sticking point, is who that lead civil agency should be. The Obama administration, and congressional Democrats in general, felt that the mission was best suited for the Department of Transportation (DOT), and specifically the Federal Aviation Administration’s Office of Commercial Space Transportation (FAA/AST), as they have significant experience with promoting safety and efficiency in the aviation world while also enabling a strong commercial market to develop. The Trump Administration, and Republicans leading the House space subcommittee in the previous Congress, felt that the Department of Commerce (DOC) was a better fit to assuage concerns that too much regulation would stifle commercial innovation. This issue is not strictly partisan though: lawmakers of both parties on the House Transportation and Infrastructure Committee and Senate
Commerce, Science, and Transportation Committee are also concerned about expanding the authorities and size of the Office of Space Commerce (OSC) when there is already significant capacity and a more proven track record of success within FAA/AST.

Thus, in June 2018 the House Committee on Science, Space and Technology introduced the American Space SAFE Management Act that would elevate OSC to create the Bureau of Space Commerce and give it broader authorities over SSA and licensing of commercial space, while in July the Senate Committee on Commerce, Science and Transportation introduced the Space Frontier Act that would reinforce the role of FAA/AST in oversight of new and emerging space activities via a concept called mission authorization. The Senate was silent on SSA authorities, reportedly out of a desire to not go against White House policy, but there are indications they favored that mission going to FAA/AST as well.

As a result of this impasse, there has not been much progress to fully implement SPD-3. Over the final two years of the Obama administration, FAA/AST laid significant groundwork for taking on civil SSA and STM, primarily focusing on minimizing the impact of space traffic on air traffic, and was weeks away from launching a Congressionally appropriated pilot civil SSA program before being forced to stop work when the Trump Administration came into office. Since his appointment last year, the new director of OSC, Kevin O’Connell, has done an outstanding job marshalling what resources DOC has to better promote commercial space and lay the groundwork for future SSA and STM services. But his efforts have been hampered by a lack of authority and funding, due to the inability of the 115th Congress to pass legislation on this issue. Another two years of delay and the uncertainty of another presidential election and Congress should be avoided if at all possible.

The good news is that there is room for a compromise that incorporates the best parts of both sides’ ideas. The Republican House proposal to create a Bureau of Space Commerce that is the lead agency for promoting commercial space and being its advocate within the government is an excellent idea, and O’Connell is the right person to lead it. But given the political situation in Congress, it makes sense to give responsibility for providing civil SSA data and services, creating safety standards for on-orbit space activities, and managing the air-space traffic interface to the DOT. Doing so would also make it easier to address the concerns over how the rapid increase in commercial space launches may cause disruptions to commercial aviation. These responsibilities should be given to a new Bureau of Space Transportation within DOT, created by elevating AST out of the FAA. Creating a separate bureau allows for a stronger focus on space, better resourcing, and more independence from the FAA and their overwhelming focus on aviation.

The harder question is what to do with the responsibility for mission authorization and licensing of new and innovative commercial space activities. Ideally that authority should be married with the civil SSA mission as the two complement each other and form the foundation of STM, which would mean giving mission authorization to DOT. However, giving both civil SSA and mission authorization to DOT would represent a significant reversal of the policy direction in SPD-3 and may be politically unacceptable for the White House. If that’s the case, then the next best alternative would be to give mission authorization to DOC, along with promotion and advocacy of commercial space, while civil SSA and safety standards goes to DOT.

While this compromise with split authorities between the Bureau of Space Commerce and Bureau of Space Transportation doesn’t reach the ideal of having everything consolidated into one agency that was never in the cards to begin with. DOC and DOT, along with the Federal Communications Commission, were already going to retain separate licensing authorities, even under the original SPD-3 policy, because of the way the legal authorities in the United States are currently set up. Under the compromise outlined here, DOC and DOT will still need to work together, along with other agencies like the Department of Defense and the State Department, to implement the rest of the excellent ideas put forth in SPD-3. There’s even a good role for NASA to play in fostering science and technology innovation for civil SSA and STM. Regardless of who’s in charge of what, this will still need to be a whole-of-government effort.

The risks of letting the status quo go on for another two years are just too high. The looming rapid increase in space launches and satellites on orbit could result in long-term harm to the space environment, or even loss of life from a tragic accident, if steps are not taken now to put in place the tracking capabilities and oversight authorities to enable sustainable development. That, in turn, could stifle the booming commercial space sector, which would impact US economic growth and the development of new and innovative space applications that could improve life right here on Earth. From a U.S. perspective, it might also mean commercial innovation in space heads to other countries that are already taking steps to put in place modernizing oversight frameworks. Now is the time for the White House and Congress to reach a bipartisan compromise on STM.
Commentary | David Logsdon and David Grossman

Paving the way to a 21st century infrastructure ecosystem through GPS

Ever wonder what a world without GPS would look like? It would mean a whole lot more than simply not being able to navigate your way through a new city. GPS is the backbone of America’s infrastructure system. As the U.S. Congress considers the modernization of our nation’s infrastructure, we hope they will consider how GPS has and will continue to make these investments smarter, more efficient and safer.

America has a history of creating infrastructure milestones. In the 20th century, our nation was transformed by explosive growth in its public infrastructure ecosystem.

Now we are at the intersection of another key milestone, one that can pave the way for a 21st century infrastructure ecosystem that benefits all Americans. In almost every aspect of infrastructure deployment, GPS, a constellation of satellites located 20,000 kilometers above the Earth, has played an integral role.

While a 21st century infrastructure ecosystem includes upgraded transportation, water and energy, it also includes cross-cutting smart technologies that is enabled by ubiquitous broadband connectivity and sensors.

As we invest in our infrastructure, we must consider physical and digital emerging technologies that make physical infrastructure smarter. These technologies range from commercial earthmoving and grading equipment that use GPS to digital 3D models that can help streamline construction. When we use these technologies, we can increase savings and improve productivity, reducing delays associated with the engineering, construction and operation of infrastructure projects.

Roads and Highways/Smart Transportation

Simple enhancements to our transportation infrastructure ecosystem could have profound effects. Americans spend 5.5 billion hours in traffic each year resulting in $120 billion in extra fuel expense not being able to navigate your way through a new city. GPS is the backbone of America’s infrastructure system. As the U.S. Congress considers the modernization of our nation’s infrastructure, we hope they will consider how GPS has and will continue to make these investments smarter, more efficient and safer.

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Surveying and Construction

Have you driven over a newly built bridge or interchange? A variety of technologies, including GPS, Bluetooth and Automated Machine Guidance helped ease the construction process. State transportation agencies who use these technologies are saving money, time and even benefiting from enhanced roadway safety.

Additionally, GPS is an integral component of land surveying, reducing errors and thereby enabling greater efficiency. One estimate pegs the savings at 45 to 55 percent in comparison to traditional surveying.

Smart Grid

On the surface, one could say little has changed in how consumers and businesses interact with the electric grid. However, this perspective fails to consider the remarkable innovation happening behind the scenes to make the grid more reliable and resilient. Thanks to the multiple atomic clocks found in every GPS satellite, it can deliver the nanosecond-level accuracy needed to synchronize electric substations, power plant generators and help identify power outages more quickly.

While many electric power companies have used GPS for the past two decades, a more recent effort is underway to make the grid even smarter. Using computer processing, advanced sensors, artificial intelligence and other cutting-edge technologies, more than 9,200 electric units, will be made more efficient, reliable and secure.

Public Utilities

Utility operations and asset management rely heavily on precise data. GPS-based data have allowed public utility officials to provide more efficient services to citizens when it comes to water quality, water safety and waste water management. Many of our existing water systems, whether an urban water supply system or an outside faucet in a residential home, suffer from some level of water leakage, however, GPS derived data allows practitioners to proactively monitor and detect leaks.

Airports

It has been well over 100 years since Wilbur and Orville Wright successfully flew the world’s first airplane, and a lot has changed since then. GPS, along with other technologies, have transformed the aviation sector, making flying safer and more efficient. Continued investment in the FAA’s modernization plans will reduce fuel consumption and emissions, allowing planes to fly closer together and improving the flying experience.

Whether in the air or on the ground, it is imperative that we invest in infrastructure built for the 21st century. The status quo of aging bridges or a lack of broadband connectivity is simply unacceptable. We must aim for American exceptionalism. GPS will play a leading role in that exceptionalism, one that we hope Congress will spotlight when it considers a comprehensive infrastructure package later this year.

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DAVID LOGSDON IS EXECUTIVE DIRECTOR OF THE COMPTIA SPACE ENTERPRISE COUNCIL. DAVID GROSSMAN IS EXECUTIVE DIRECTOR OF GPS INNOVATION ALLIANCE.
Our legacy of innovation is shaping space modernization

With a wide range of space capabilities, BAE Systems is modernizing new mission areas and defending our nation’s critical assets. We are celebrating 10,000 years on orbit and leveraging our expertise to shape the future of space.

Join us
We’re looking for talented engineers to join our team and support the space mission. Learn more at jobs.baesystems.com.

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TOGETHER, WE **GO BEYOND**® CLARITY & ACCURACY.

Ball Aerospace delivers accurate, actionable environmental data to civilian and military weather forecasters—with spacecraft, instrumentation and expertise that eliminate data gaps in the U.S. weather satellite network. It’s all part of our collaborative approach as we work together to assure better tracking of Earth’s weather trends and greater protection of our communities. Find out more at booth 523 during Space Symposium.

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