

Starliner Launches to Space Station. [Photo by: NASA](#)

The Private Sector's Assessment of U.S. Space Policy and Law

BY Alyssa Goessler

The United States' space sector has evolved significantly over the past sixty years. Originally the exclusive domain of states, space activities are increasingly impacted by the growing role of the private sector. International space law dictates that all commercial activities in space must obtain the authorization and ongoing supervision of a state, which typically takes the form of a license. U.S. space companies are therefore beholden to U.S. space policies and regulations.

These policies and regulations have fluctuated in tandem with shifting government priorities. Following the success and high cost of the Apollo Program, for example, President Nixon chose to place space

exploration on the same priority level of any other domestic policy goal.¹ The National Aeronautics and Space Administration (NASA)'s spending peaked as a percentage of total government spending in 1966 at roughly 4.5 percent; by the end of the following decade, it dropped to just shy of one percent.² This created a lull in U.S. space operations that persisted until the 1980's, when President Reagan's National Space Policy called for the adoption of regulatory measures that would enable the U.S. commercial space sector to thrive. The Commercial Space Launch Act and the Land Remote-

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¹ "Statement By President Nixon on the Space Program," 1970, via <https://history.nasa.gov/SP-4211/appen-j.htm>.

² Simon Rogers, "NASA Budgets: US Spending on Space Travel Since 1958 UPDATED," *The Guardian*,

<https://www.theguardian.com/news/datablog/2010/feb/01/nasa-budgets-us-spending-space-travel>

Sensing Commercialization Act are two prime examples of pro-private industry laws from this era of space commercialization.

While several new laws have since emerged, the bedrock of U.S. commercial space law remains in the end of the twentieth century. In order to see how this model of space governance has stood the test of time, this paper provides insight from representatives of U.S. space companies. Their views and policy preferences vary, but an overarching theme is the struggle to align a legacy regulatory system with an increasingly diverse space environment. Emerging space activities frequently lack a clear regulatory home, and U.S. national security goals sometimes conflict with U.S. commercial goals in space. Many company representatives commented that current regulatory mechanisms were designed for the space environment of the past, and they identify several areas for improvement.

Methodology

The author of this report conducted eight virtual interviews with employees of U.S. space companies who were familiar with the company's regulatory and policy preferences. Their job titles included export control specialist, vice president for government affairs, director of government relations, policy research analyst, and more. In about half of the interviews, more than one company representative participated. Interviewees were provided with the following questions in advance of the conversation:

- Which laws and policies most strongly affect your day-to-day workload?
- Are there areas where you want to see more regulation or policy guidance?
- Are there areas where you want to see less regulation or policy guidance?
- Has your business been affected by political elections at the federal, state, or local level?

A list of all questions asked during the interviews is included in Appendix 1.

The companies that participated varied in both specialization and longevity. The author interviewed on-orbit service providers, launch providers, and space situational awareness data providers. Some of the companies have or pursue federal contracts. Three quarters of the companies interviewed can be classified as “new space” companies, meaning that they were founded after the year 2000. The remaining two are “old space” companies that have been in the business since the early days of the U.S. commercial space sector.

Summary of Company Insights

Several themes emerged from the interviews conducted with U.S. space companies' representatives. They are summarized below in no particular order.

1) *The Proper Style of Policymaking*

A handful of interviewees expressed their vision of the ideal version of policymaking. During a discussion of different approaches to space traffic management, one interviewee emphasized that the government's duty is to set the standards. The operational side, however, should be left to the private sector:

We're at a crossroads now. We understand the legacy model where the government did everything for everybody based on taxpayer dollars. Now you have private investment that is able to go faster, reach farther, do it quicker, but we do not have the authority to regulate or govern or set the standards. From a commercial aspect, we want the government to declare what the standards are and then get out of the way.

Operations, they argued, are most efficiently conducted by the private sector. Leaving the operational side to the private sector also encourages innovation.

Another interviewee made a similar comment relating to the regulation of technology, advocating for behavior-based regulation rather than technology-based regulation:

There is a role for the government to set regulatory expectations of operators. What you want to avoid is regulation that locks in a specific set of technologies as opposed to expectations for performances of behavior.

They cited the example of space debris management:

Instead of saying ‘you need to ensure that you have x type of thruster propulsion on your spacecraft,’ say instead ‘you should be able to demonstrate maneuverability to conduct collision avoidance, and the method that you choose to do that is entirely up to you.’

This style of regulating, they noted, would be able to achieve desired policy goals without being prescriptive on a certain technology, “because that’s how regulations get outdated really quickly.” They noted that they were pleased by how much progress has been made in terms of updating regulation and policy but added that there is much work left to be done. Moving forward, they argued, the U.S. government needs to take a more proactive and nuanced approach to regulating emerging technologies.

2) *Balancing Risk and Innovation*

The companies diverged on their characterization of the proper role of government in the space sector. This divergence was more pronounced on specific policy and regulatory issues, such as the ideal model for the Federal Aviation Authority (FAA)’s licensing process. Despite this divergence, some general principles were echoed by the majority of interviewees.

Broadly speaking, company representatives agreed that the primary duty of the government in the space sector is to enhance safety and minimize risk— both material and financial risk. A representative of a startup company commented that their company advocates for “for smart regulation: regulation that is not too prescriptive and has the ability to iterate upon itself.” This regulation, they explained, acts as a baseline for assessing how risky their operations are. Risk assessment that is grounded in policy and regulation enables their company to achieve different business goals such as obtaining insurance, attracting investment, and closing business cases.

Similarly, a government relations representative of another startup noted that “the thing a commercial entity needs out of policy is stability more than anything else.” If policy questions “linger” too long, investors will be scared off, stymying the company’s growth. This representative cited NASA’s 2020 announcement of its solicitation of a private company to secure space resources as an apt example.³ The representative said that additional policy demonstrations will be needed for forthcoming missions to the moon and Mars. In-situ resource utilization is a necessary precondition of long-term interplanetary exploration, and, they argued, there is not yet enough policy precedent to unleash private sector research and development (R&D) and investment.

Representatives of a company with many years of experience in the industry strongly emphasized the government’s vital role in ensuring safety. Discussing various FAA regulations, they mentioned that “a lot of these regulatory processes were put there for a reason because something bad happened.” They cited the 2003

³ Jim Bridenstine, “Space Resources are the Key to Safe and Sustainable Lunar Exploration,” NASA, September 10, 2020,

<https://blogs.nasa.gov/bridenstine/2020/09/10/space-resources-are-the-key-to-safe-and-sustainable-lunar-exploration/>

Columbia and 1986 Challenger disasters as examples.⁴ They continued: “The bureaucracy of being safe does not stifle growth. You’re safe for a reason. You fly safe because you’re protecting people going on board these crafts or you’re protecting people on the ground. We need a regulatory safety culture to maintain the commercial space sector.”

This company specifically voiced concern regarding some new space companies’ efforts to deregulate or block regulation. “One thing that has really changed [in the industry] is the amount of money spent on lobbying.” Citing the database Open Secret,⁵ they noted that major space companies are pouring millions of dollars into their political action committees and lobbying efforts. The increase in spending on lobbying is a worrying trend in their view, as they fear it will undermine the culture of safety that characterizes U.S. space operations. “This isn’t the wild west,” they added, “and even though Congress is promising to accept more risk and NASA is saying they will accept more risk...we all accept risk, until someone dies.” They expressed their trepidation regarding not only loss of life, but also industry-wide slowdowns. High profile incidents can lead to overregulation by Congress—an outcome that can harm the prosperity of the whole sector, not just a single company.

While acknowledging the vital role of risk minimization and safety precautions in the sector, some companies emphasized that this must be balanced with the need to encourage R&D and innovation. Citing the evolution of remote sensing policy in the U.S., one startup representative noted that early U.S. regulation prohibited the industry’s growth in its early days. Remote sensing took off in foreign markets while lying

⁴ The Challenger and Columbia disasters occurred in 1986 and 2003, respectively, and each took the lives of nine NASA astronauts. Read more about these disasters at: Elizabeth Howell, “Space shuttle Challenger and the disaster that changed NASA forever,” Space.com, February 1, 2022, Space shuttle Challenger and the disaster that

dormant in the U.S. This interviewee theorized that the U.S. would likely have more companies specializing in remote sensing today had we not had restrictive policy in the early days.

Balancing risk and innovation is an ongoing challenge for another startup representative, who said:

You want to modernize regulatory expectations and requirements and do away with ones that are no longer appropriate. But you also do not want to allow for a blank slate, wild west where there are no expectations, no safety provisions, or no control of the risk that operators pose.

Risk, they added, must be known to the fullest extent possible, controllable, and reliably limited. This degree of risk assessment, they argued, empowers R&D by ensuring companies can attract the funding necessary to continue innovation.

3) *Interagency Friction: “Who holds the talking stick?”*

The author asked each company to discuss any time when their ability to do business was affected by interagency dynamics. Most interviewees could not think of a specific example or incident, but several noted the tension between certain national security goals and commercial or civil goals in the space domain. One launch provider, for example, noted that their efforts to achieve contracts with foreign entities were warmly welcomed by folks in the Department of State (DoS), but that they encountered more scrutiny from the Department of Defense (DoD). The State Department has historically advocated for the diplomatic use of space to achieve U.S. goals across policy topics,

changed NASA forever; Elizabeth Howell, Daisy Dobrijevic, “Columbia Disaster: What happened and what NASA learned,” Space.com, October 11, 2021, <https://www.space.com/19436-columbia-disaster.html>

⁵OpenSecrets, <https://www.opensecrets.org/>

including nuclear non-proliferation. While the DoD also desires this end goal, it is generally less inclined towards sharing capabilities or technology with other states. DoS export regulations also limit the ability of companies to achieve foreign partnerships, particularly with states in the Middle East. This interviewee noted, however, that political will can often overcome these export control limitations, citing a lucrative sale to a state in the Middle East that was achieved thanks to governmental buy-in at the federal level. It is therefore evident that while different agencies may share some policy goals, their preferences for achieving those goals can relay mixed messages to private sector entities.

An export control specialist noted that much of their time was dedicated to trying to figure out which capabilities the different parts of the U.S. government want to guard. “For me, that is one of the biggest challenges because you have so many different players who are involved in the decision-making process and you have different camps in the government when it comes to certain technologies.” They therefore work to predict which of the involved agencies will have concerns with the export of different systems so that they can prepare for possible pushback.

The lack of transparency surrounding intragovernmental dialogue was a source of great difficulty for some space companies. One launch company discussed an incident where their team was trying to make progress on a regulatory issue and ended up getting “a bit of a run around”:

We were trying to resolve an issue but then after several weeks we realized that issue did not exist, and we did not know where the holdup was. I think a lot of it was really interagency communication. I do not think that we were intentionally misled...and I don't know if your average space company deals with this kind of incident.

Another company working with non-Earth imaging technology described a challenging regulatory experience that was “largely driven by interagency dynamics”:

There are some elements of the government that are very concerned about what can be seen by this technology, and other elements are not so concerned about it. The challenge we faced there was that our only view into this was through [the National Oceanic and Atmospheric Administration (NOAA)], so we did not get to interact directly with the agencies that were raising the concerns so that we could understand the concerns, how we can address them, and maybe do things in a different way so that it is not a concern.

Despite these difficulties, companies broadly seemed to understand national security concerns and desired to be a part of the solution. Their specific challenges emerged largely from an inability to interact directly with the individuals voicing the concerns so that they could efficiently adjust course.

4) *Growing Pains: Technology Continues to Outpace Regulation*

Nearly every interviewee noted the difficulty of regulating an industry that is rapidly evolving. One company representative with both public and private sector experience noted that “government policy is incapable of moving fast enough to stay in front of where investment is leading us.” Several interviewees commended the evolution of export control regulation and FAA licensing over the years, while noting there remains room for progress. Respondents were sympathetic to the challenges faced by policymakers and had some specific insight for addressing this challenge. These discussions also highlighted challenges produced by interagency dynamics—

specifically, the challenge of identifying who should take the lead on certain regulations.

One interviewee who works for a launch company noted that in export control, “some of the guidance has not kept up with the technology.” They specifically identified the existence of certain commercially available off-the-shelf (COTS) products as an area where U.S. export control law needs to catch up. Cubesat deployers, for example, are available commercially with only slight calibration needed to match them to the interface. At present, they noted, cubesat deployers are caught under International Traffic in Arms Regulations (ITAR) regulation,⁶ but the respondent believes their commercial availability warrants their migration to Export Administration Regulations (EAR).⁷

Often I see things held by [the Department of] State that should probably be moved to [the Department of] Commerce, but because State is overwhelmed, they haven’t gotten to it. Cubesat deployer is one example where I would want clear guidance.

Two companies specializing in on-orbit servicing expressed concerns regarding the government’s ability to efficiently regulate their activities because they work with niche, emerging technology. Both had specific recommendations for a revision of the U.S.’s approach to mission authorization. In the U.S., mission authorization for private space activities has historically come from the FAA for launches, and the FCC for communications activities. Companies that specialize in on-orbit servicing have no clear regulatory home, often

liaising with multiple agencies and going through several licensing processes.

In discussing the mission authorization question, one representative expressed some optimism for novel in-space activities that do not fall under an established jurisdiction:

It is still something that each of those entities has been very proactive in wanting to enable as much as they can, while inflicting as little of a burden as possible on the company trying to pioneer these new types of activities. Because they know how much private investment has gone into the tech development, they know how much tech transfer has come from other areas of the government like NASA and [the Air Force Research Laboratory] and other entities.

Despite these good intentions, the interviewee noted that the present “piecemeal, fragmented licensing approach” needs to be streamlined if the U.S. wants to empower a thriving commercial space economy. Streamlining licensing, they noted, can help space companies achieve timelines that are more “befitting of commercial investment.” “We have a lot more processing power than we did thirty years ago,” they noted. “You can build satellites a lot more cheaply and faster—and to the same standards of safety—than we could thirty years ago.” While the interviewee had no expressed preference for which agency should take the lead on this type of streamlined licensing, they noted that the selected agency should act as a “shepherd” of the process, helping to minimize regulatory hurdles.

⁶ The International Trade and Arms Regulation governs the manufacture, sale, and distribution of items listed on the U.S. Munitions List, and is overseen by the U.S. Department of State. Learn more about ITAR at: Jeff Petters, “What is ITAR Compliance? Definition and Regulations,” October 10, 2018, <https://www.varonis.com/blog/itar-compliance>

⁷ The Export Administration Regulation governs the export of dual-use items, and is overseen by the Department of Commerce. Learn more about EAR at: “The Export Administration Regulations - EAR,” Office of the Vice President for Research, MIT, <https://research.mit.edu/integrity-and-compliance/export-control/information-documents/export-control-regulations/export#off-canvas>,

A representative of a different on-orbit servicing company also advocated for streamlining the licensing process. They specifically advocated for “a single agency for licensing space missions,” which, they argued, would only become more necessary “as space missions become more and more diverse in terms of their capabilities.” They characterized the current licensing scheme as “too restrictive for modern space activities.”

On the topic of emerging technology and its regulation, a representative of an established space company commented that “U.S. policies just are not keeping up.” Noting the number of new entrants into the space domain, as well as the proliferation of new technologies, they commented that “now is the time” to start having conversations on the commercialization of space and its regulation. The interviewee also discussed the 2019 Space Policy Directive on Emerging Technologies, which they had personally submitted a comment on:

That came out in 2019, and we still have not seen a draft of all the comments that everybody submitted...we are still waiting. What I thought was important three years ago regarding changes to the export regulation, for example, has changed so drastically to what we are looking at today. My comments today would be very different than they were then.

Companies that had been awarded federal contracts often provided specific insight on federal acquisitions regulation (FAR) and export control. One young space company deemed FAR to be “excessive for a start-up to comply with” and expressed their preference for “Other Transaction Authority” (OTA) contracts over FAR-based contracts. The same company noted that the “significant amount of time required to get employees [sensitive compartmented information] indoctrinated after a government contract is signed...limits the speed and agility of a startup.” A different startup that has been awarded federal contracts echoed this sentiment,

noting that maintaining entity registration to be eligible for contracts “can be a bit of a headache,” and post-award tracking also adds to the difficulty. They simultaneously acknowledged the possible missed opportunity cost of not pursuing federal contracts: “If you do not target those government contracts, you’re losing a big portion of potential revenue. Especially with the way that the U.S. is really trying to expand their space capability as of recent.” Contracts and the regulations surrounding them were not mentioned by the older space companies, excluding a brief reference to COVID protocol which will be discussed in the following section.

5) Business and Politics

The majority of interviewees did not believe that their business had been affected by elections at the federal, state, or local level. Some noted that tax laws do change between presidents, which naturally affects business, but this tax impact is not unique to the space industry. “Tax law changes with the wind here in DC,” one respondent added. Others noted that presidential priorities in space may shift, but that broadly speaking, U.S. space policy is consistent across presidential administrations. This is in part due to the fact that civil space priorities are largely determined by NASA’s decadal survey. Similarly, defense budgets are set far in advance of the actual release of funding. Despite this general perception of insulation from electoral politics, respondents did provide some interesting insights on the overlap of their business and politics that are worth exploring.

One respondent who works for a launch company said they did not observe any major shifts in U.S. space policy between elections except for flagship programs. As an example, they mentioned that they worked on four different shuttle replacement programs during their first five years in the industry. “But general space policy does not change much,” they added.

“In terms of local politics,” they continued, “there is certainly a lot of influence, particularly by appropriators in the current space centers.” They provided Huntsville, Alabama—which has a large aerospace and defense sector—as an example. Huntsville today is “highly developed, largely due to political influence. You can bring appropriations into an area via politics.” They added a fascinating footnote about the inversion of politics in the space industry:

The space industry tends to be counterintuitive to politics because the red states tend to have big NASA installations and the blue states do not. Therefore, red states are focused on big government programs and blue states are focused on commercialization. You tend to see a reversal of traditional politics.

Representatives of two launch companies identified COVID as a politicized issue that definitively affected their businesses. The first representative began their comment by noting that generally political elections do affect the space industry, largely via the president’s ability to put their mark on NASA priorities:

[Presidential impact] is increasingly on the NASA side, because that discretionary budget is easily influenced by any administration. They come in with these large NASA priorities because they have less discretionary spending to make an impact on defense spending, which is set in motion for nearly a ten-year period. And the population responds to it immediately, so it is one of those areas where you get a good political bounce by talking about NASA or science or climate change or planetary research or going back to the Moon or onwards to Mars.”

Moving on to COVID, this interviewee discussed how COVID policies placed on federal contractors made them more vulnerable to political winds:

We have factories, and in order to build a rocket, you must have people in person. We had government customers that mandated certain requirements and built them into our contracts. COVID was a very political issue, obviously, and was driven in different directions by democrats and republicans. That definitely affected our business.

Another launch company with federal contracts had a similar COVID experience that was made more complex by state-level politics. They were also beholden to COVID policies that were baked into their contracts. The company is headquartered in a state that was notorious for its opposition to any government-mandated COVID policies.

We were kind of stuck in the middle. We’re all headquartered and physically located in [the state] and the state tells us not to do anything, while the federal government says you must do all this stuff. When it comes to politics and our business, it’s less about elections themselves and more about who wins and the stereotypical posturing of political parties at federal, state, or local level. They will have different approaches to things that affect the industry.

While the majority of respondents did not believe elections affected their business, one representative of an established space company strongly disagreed with this sentiment. “In the export and import areas, when we have a change in administration at the presidential level, it’s huge,” they commented. As a global business, they viewed shifting presidential preferences in terms of regional policies as a major variable. “Specifically with the Middle East, there was a very different shift between the previous administration and the current administration.” Relating to space policy specifically, they commented that

You will have one president that may push space harder than another one, given their priorities. But when it comes to defense issues, elections absolutely have an impact in terms of who is getting what sales through congressional notification for ITAR and EAR, and what is going through for [Foreign Military Sales].

6) *Foreign Threats and Cybersecurity*

China dominated the respondents' input relating to foreign threats. This was unprompted insight: the author did not ask respondents to assess foreign adversaries of the U.S. and/or their impact on business. Cyber also emerged as an issue that stands to impact the industry in coming years. Several respondents relayed their concerns about cybersecurity infrastructure, both in terms of its present weakness in the U.S. as well as the difficulty of implementing federal cyber policies.

A representative of a launch company discussed how U.S. restrictions on selling rocketry to some countries has created a market opportunity for China. They noted that their company's "ability to export [to the Middle East] is challenged by that region's lack of membership in the [Missile Technology Control Regime]," a nonbinding export control regime that aims to limit the proliferation of missile technology. As a member state to this regime, the U.S. prohibits companies from selling missile technology to any state that is not party to the MCTR. The interviewee noted that this does not always achieve the end of nonproliferation, because "Chinese rockets are up for sale." They continued: "We are stuck in a position where our nonproliferation regime creates proliferation for the other countries. They cannot buy our rockets, but they can go buy the Chinese rockets."

Another established space company echoed the concern about Chinese competition in the context of the U.S.'s slowness to rollout proactive space policies:

Space is the future and we need to start thinking through these tough policy issues. And there are other spacefaring nations that are very active, like China and Russia. If we want to sell systems, we of course prefer to sell them to allies. But China and Russia are off selling to whomever.

This respondent also noted how U.S. restrictions on collaboration with China on space issues affects their ability to achieve partnerships that could advance R&D:

Even working with U.S. universities that have foreign professors or foreign students is a challenge. Because it is considered an export, we have to get an authorization. A student here on a student visa from China, for example, could not support the program.

A seasoned launch company repeatedly expressed concerns about Chinese infiltration of the U.S. commercial space industry and of U.S. government space programs. They first expressed concerns regarding Chinese efforts to obtain valuable intellectual property (IP) by buying up smaller Silicon Valley companies via venture capital (VC). "I think that is a topic that people are downplaying for obvious reasons," they added, "and it should not be ignored."

Their concerns regarding Chinese activities also extended into the cyber domain. Their company has been busy bolstering their information technology (IT) systems "because if there is an attack on us from China, what they would get is pretty tremendous and could impact our country's national security." Another representative of the same company added that, in their view, U.S. taxpayers are "subsidizing Chinese R&D" by virtue of all the investment in NASA and its partners that China is able to capitalize off of by infiltrating weak IT systems. This representative added that such measures would naturally be more difficult for smaller companies to implement:

If I'm a small company and I want to work with the U.S. Government, they are going to give me a list of firewall requirements and regulations that I have got to meet in order to work with the government. But to do that, I'm not going to be able to pay my employees for the next month. So, there has got to be a balance— regulatorily speaking. You cannot quell innovation, but you have to protect the data and your company's IP. That IP may eventually end up in a U.S. government defense system.”

A small startup echoed concerns about cybersecurity, but also noted that present cyber requirements for federal contractors “require the expenditure of considerable resources.” They identified the Cybersecurity Maturity Model Certification, the Joint Special Access Program Implementation Guide, and the Federal Risk and Authorization Management Program all as bearing excessively difficult compliance standards for small businesses. When asked if there were areas where the company wanted to see more regulation, the company said they supported more regulatory requirements “surrounding threat-based preventions, detections and remediation that would be driven by threat intelligence.” They characterized current cyber compliance standards as “cost-prohibitive” and “years behind the latest cybersecurity trends,” arguing that threat-based prevention was the proper path forward.

A larger startup added that “the cybersecurity requirements for federal contractors are rapidly changing...and you have to track that evolution to be eligible for federal contracts.” This is another area, they stated, where interagency dynamics come into play: “Those cyber standards are not even necessarily held by NASA or the DOD...maintaining your status [as a federal contractor] requires you to keep up with evolving policy in many different agencies.”

Another theme relating to foreign threats and the U.S. space industry was raised by an export specialist in a seasoned space company. Discussing the topic of U.S. protectionism, they expressed a concern that efforts to “buy American” will inhibit their company's supply chain security. While the interviewee understood the value of not relying on foreign assets for national security reasons, they also were “very concerned about closing that market off to international capabilities for certain components, because we want to make sure that we have sufficient suppliers in our supply chain for cost and schedule reasons.” They continued:

When we look at certain components, I need to be sure we have two to three sources that we can get bids from...and in some areas when you look at components, there are components where an international source has a better product than is made in the U.S. So, you want to be sure to continue to have that supply chain base.

This same export specialist also highlighted the difficulty of balancing the need to protect U.S. technology with the need to remain competitive internationally.

Countries do not want to be told how they can use their assets. A lot of times— especially with imaging spacecrafts— there are the conditions that fall upon the country who is procuring the system if they buy from the U.S. That creates a ton of challenges for that host country, because they are beholden to U.S. government regulations on their now-procured asset.

Taken in whole, companies' insights on foreign and cyber threats illustrate a complex challenge that regulators will continue to face. Ensuring a prosperous U.S. space economy requires that U.S. companies are competitive on the international stage, but that

competition is at times hindered by national security concerns. Similarly, there is a need to bolster cyber defenses for space activities in both the private and public sector. Policymakers will need to continue innovating ways to do so without needlessly burdening companies— particularly smaller companies that do not yet have the bandwidth to comply with rigorous cyber requirements.

7) *Orbital Debris, Proliferated LEO, and Space Sustainability*

Several companies expressed their concerns regarding the crowding of low Earth orbit (LEO) and the proliferation of orbital debris. One representative said they wanted to see the U.S. take leadership on both domestic and international fronts in space environment management: crafting the policy that supports space sustainability, investing in necessary R&D in debris removal technologies, creating and exploring economic models to incentivize sustainable behavior, and resolving international liability questions relating to on-orbit servicing. They envisioned this framework evolving via mini-lateral coalitions of like-minded nations agreeing on certain responsibilities and principles. Similar to the Artemis Accords, they added, it could later be opened to additional member states.

A launch company also mentioned challenges they faced with increased orbital congestion and debris. “During a certain launch, we were given a very low number of opportunities for a launch because of all the debris that is up there. It worked out, but say there had been weather problems— we would have lost that launch, and every scrub costs a lot of money.” They mentioned the increasing presence of satellite constellations as a possibly problematic trend and said that “The whole of government— the FAA, FCC, NASA, probably the DOD too, needs to tackle the proliferated LEO issue and needs to engage internationally as well.”

A startup also expressed concern over orbital debris, but preferred the use of a space sustainability rating over any concrete treaty provision:

We support a space sustainability rating that will provide a new, innovative way of addressing the orbital challenge by encouraging responsible behavior in space through increasing the transparency of organizations’ debris mitigation efforts in lieu of an international treaty or the establishment of an international body that would set standards for space traffic management.

This rating, they added, should be used to make space insurance more affordable for responsible space actors.

A representative of an on-orbit servicing startup had an additional recommendation relating to space sustainability. They highlighted the need for the U.S. government to “sweat their assets” by investing in existing space assets rather than solely rolling out new technology:

The U.S. government has an awful lot of satellites in space that are providing valuable services today that would benefit from servicing. However, the government is largely only thinking about servicing for the future, but at this moment in time, we have this stuff in orbit. We can use it, we can make it last longer, and it is very valuable. But the way the government is structured...they are not looking at preserving the stuff that we have. Because, of course, it is more sexy, more fun, to build new stuff. But I think the taxpayers—as a taxpayer myself— would like to see the government sweat those assets, make them last longer. Use them as much as you can.

While many topics discussed during the interviews generated lively discussion, the issue of space

sustainability and orbital debris generated more specific policy prescriptions than in other areas. It is unclear if this is because the topic is generally popular in the field, so interviewees had ideas fresh in their memory, or if it is an issue of particular concern to companies.

8) Strategic Propellant Reserve

One startup representative presented a policy suggestion that emerged from recent events. Reflecting on Russia's invasion of Ukraine, the interviewee discussed the "tremendous shortfall of supply of critical propellant for the space industry":

Xenon is a propellant that is used for electric propulsion...the vast majority of both xenon and krypton is produced in Russia and the Ukraine, so the market price for xenon has gone up tenfold in the last couple of months. What used to cost us \$2.5 million to fill a satellite might now be costing us \$25 million or more.

Just as it does for oil and gas, the representative argued that the U.S. government should have a strategic reserve of these propellants to insulate both the government and private industry from shortfalls resulting from conflicts, natural disasters, or other unforeseen production interruptions.

Conclusion

These conversations generated some key insights. It is important to note that the companies interviewed for this study are not perfectly representative of the entire sector, and the sample size is not large enough to draw statistically reliable conclusions. All the same, the themes that emerged from this inquiry elucidate some of the current goals and challenges of U.S. space companies.

Technology Outpaces Regulation

The most prevalent theme throughout the interviews was the difficulty of operating in a business environment that is regulated by dated laws and policies. Technology's speed and regulation's slowness causes friction that industry leaders experience firsthand regardless of their company's service offerings. Launch companies find that export control laws and federal acquisition regulations have not kept pace with the realities of the industry. For example, some technologies that are available commercially are still caught under export regulation's most stringent control category. Similarly other countries, notably Russia and China, are willing and able to sell launch services to states that the U.S. prohibits business with. On-orbit servicing companies are even more susceptible to this friction. Their technologies often have no clear regulatory home, and are often dual-use in nature, placing them in the crosshairs of a civil vs. military space goals conflict. Interagency dynamics deepen this challenge. Businesses specializing in emerging technologies discussed challenges they faced in navigating the interagency process. They noted that a streamlined licensing process characterized by transparency would enable them to best perceive and respond to regulators' concerns. Several companies suggested that the traditional system of licensing in the U.S. does not align with currently available commercial capabilities. Space technologies increasingly dip into several—or no—regulatory buckets, resulting in a piecemeal licensing schema.

U.S. Foreign Threats and Private Industry

An unexpected theme of the interviews was the role of foreign threats in U.S. commercial space operations. Strategic competition with China appears to be an area of great concern—or at the very least, awareness—for some policy and regulatory officials in the private space sector. As previously mentioned, interviewees were not

prompted to comment on China or any U.S. adversaries. Nonetheless, competition with China and the threat of Chinese cyber infiltration loomed large in some interviewees' minds. Chinese attempts to obtain valuable IP by purchasing up startups via VC funding was one such threat. Interviewees also discussed how weak IT systems are prime targets for Chinese infiltration, resulting in a de facto U.S. subsidization of Chinese R&D. Additionally, Russia's ability to sell launch services to countries that the U.S. does not do business with was cited as another foreign threat that undermines U.S. non-proliferation goals. Interviewees also discussed how a shift towards protectionism and "buy American" policies could harm their supply chain stability, negatively impacting business operations. Several companies also had a forward-looking view on the need for better cyber protections in the industry. For some companies, this would take the form of more oversight and more regulation. Others advocated for a different type of regulation that imposes less of a burden on companies, such as threat-based prevention.

Old Space vs. New Space

Another interesting finding was the relative harmony of views between older and newer space companies. One old space company expressed a perception that new space companies were laser-focused on deregulation and limited government oversight of their activities. While one new space company did identify several areas for less regulation, all the remaining new space companies had far more to say on the topic of additional regulation and policy guidance that they would like to see. These companies viewed policy as a means to enhance their standing with would-be customers and investors. Given that these startups often focused on emerging areas of space activity, they expressed a desire

to know the rules of the road so that they could best align their business strategies with government guidance, thereby crafting sustainable business plans.

There are a couple of possible explanations for this outcome. The first is that this is not a representative sample of new space companies, and that we would discover that more new space do want deregulation if we were to have a more representative sample. The second is that this is, in fact, a representative sample, and that new space companies do view policy development as a means to achieve the stability that will help their companies thrive.

Another third explanation relates to the nature of the U.S. space industry. It is the norm for career professionals in policy and regulatory roles at space companies to have had prior experience in the public sector, and vice versa. This was certainly the case for this sample of interviewees: many of the representatives referenced prior governmental experience during the discussions. While respondents were asked to consider all questions from the vantage point of their commercial roles, their public sector experience may have bled into their assessment, presenting answers that are overly sympathetic to the challenges of governance.

Taken in whole, the companies' input reflects the growing pains of a rapidly developing industry. Space has always been a military domain, but the expansion of commercial opportunities is making waves that policymakers find difficult to ride. This challenge will only become more evident as global profits from space activities continue to rise. The Space Foundation reports that the global space industry stood at \$424 billion in 2020.⁸ Estimates on the future value of the industry vary,

⁸ Via Michael Sheetz, "The space industry is on its way to reach \$1 trillion in revenue by 2040, Citi says," *CNBC*, May 21, 2022, <https://www.cnbc.com/2022/05/21/space-industry-is-on-its-way-to-1-trillion-in-revenue-by-2040->

[citi.html#:~:text=America%20and%20others.-,The%20global%20space%20economy's%20value%20reached%20%24424%20billion%20in%202020,satellite%20sector%2C%E2%80%9D%20Citi%20said.](#)

but generally project that it will stand at \$0.9–\$1.5 trillion by 2040.⁹

Proactive U.S. space policy and law will help the country obtain a larger portion of that growing income.

Exploring industry perspectives helps to understand the realities of regulation and policy, and highlights key pressure points. By attuning their efforts to these areas of focus, policymakers can empower the commercial industry to thrive, protecting innovation by minimizing risk. ▶

⁹ Ryan Brukardt, Jesse Klempner, Daniel Pachtod, and Brooke Stokes, “The role of space in driving sustainability, security, and development on Earth,” McKinsey & Company, May 19, 2022, <https://www.mckinsey.com/~media/mckinsey/industries/aerospac>

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Appendix: Questions Asked During Interviews

Guiding research questions that were presented to all interviewees in advance of and during interviews:

- Which laws and policies most strongly affect your day-to-day workload?
- Are there areas where you want to see more regulation or policy guidance?
- Are there areas where you want to see less regulation or policy guidance?
- Has your business been affected by political elections at the federal, state, or local level?

Additional questions raised with some or all interviewees, depending on flow of discussion, the company's characteristics, and the interviewee's role:

- Does your company have or pursue federal contracts? If yes, can you describe how you navigate the regulations surrounding federal contracts?
- Can you tell me about your experience, if any, with ITAR and EAR? Do they affect your company's ability to achieve its business goals?
- Have you witnessed any interagency dynamics (IE, DOD v. NASA, Commerce v. DOS)? Have these affected your ability to achieve your company's business goals?
- How often do U.S. space laws hinder your company's ability to conduct R&D?
 - a. Never
 - b. Sometimes
 - c. Frequently
 - d. Consistently
- How often does U.S. space law hinder your company's ability to achieve foreign partnerships?
 - a. Never
 - b. Sometimes
 - c. Frequently
 - d. Consistently
- How often does U.S. space law hinder your ability to sell a product to a foreign company?
 - a. Never
 - b. Sometimes
 - c. Frequently
 - d. Consistently
- Which U.S. agency/regulatory body do you work with most frequently? Please distinguish between agencies you work with via contract vs. for regulatory purposes (licensing, consultation, etc).
 - a. **Department of Transportation** - Federal Aviation Authority
 - b. **Congress** - Federal Communications Commission
 - c. **National Aeronautics and Space Administration**
 - d. **Executive Office of the President** - OMB, Office of Science and Technology, or National Space Council
 - e. **Department of Commerce** - National Oceanic and Atmospheric Administration (NOAA), including National Environmental Satellite, Data and Information Service (NESDIS), the Office of Space Commerce (OSC), the Office of Foreign Assets Control
 - f. **U.S. Department of State** - Office of Emerging Security Challenges, Bureau of Arms Control, Verification, and Compliance (AVC); Office of Space Affairs, Bureau of Oceans and International Environment and Scientific Affairs
 - g. **Department of Defense** - Space Force; U.S. Space Command (USSPACECOM); Office of the Secretary of Defense (OSD); other DOD components
 - h. **Department of Energy** - Lawrence Livermore, Los Alamos, and Sandia National Laboratories
 - i. **The Committee on Foreign Investment in the United States**

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