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Future Space Controls and the Invisible Hand

Co-sponsored by the American Bar Association Standing Committee on Law and National Security and the Nonproliferation Policy Education Center

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Future Space Controls and the Invisible Hand

Workshop Report

Introduction:

The American Bar Association Standing Committee on Law and National Security (SCOLNS) and the Nonproliferation Policy Education Center (NPEC) held a law and policy workshop on Thursday, June 20, 2019. The workshop was the second such collaboration between SCOLNS and NPEC, and it concerned the legal and policy issues that are emerging as space becomes increasingly commercialized and accessible. As the emerging space domain presents new challenges and opportunities, it is the hope of SCOLNS and NPEC that this report will guide future legal and policy decisions.

The Workshop sought to address a series of questions regarding national security challenges in space:

- Commercial Space: What will be profitable and when?
- Future Undesirable Space Conjunctions: Who is and should be liable?
- Insuring Against Unwanted Space Conjunctions: What new norms, regulations, laws and understanding might be desirable?

The workshop also involved a lunch discussion featuring a leading expert in the space field.

The workshop was comprised of experts from SCOLNS, NPEC, the U.S. Air Force, the Defense Intelligence Agency, the Department of Commerce, the Department of State, nonprofits, think tanks, academia, and private companies and individuals. The discussion was governed under Chatham House rules, and therefore ideas and group affiliations from the workshop were not attributed to specific individuals.
# Workshop Participants

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Panel I: Commercial Space: What Will Be Profitable and When?

Introduction

The working group opened by asking a fundamental question about the nature of commercial space development – is this an area that can and will see profitability, thus incentivizing private sector activity? To help answer these questions the working group discussion was led by a discussant from a private company that is responsible for building and launching satellites.

The Private-Sector Perspective

The discussant first gave an idea of the kind of work that their private company is engaged in. They currently own and operate satellites, which come in three different sizes. The smallest of these, called a “dove,” are about the size of a microwave, and the company manages hundreds of doves operating in low-earth orbit. The purpose of these doves is actually quite simple – to take “a picture of the entire surface of the planet every day.” With regular launches every year, the “constellation” of these doves is constantly expanding, but also upgrading. And while they do not boast the same imagery resolution as defense or intelligence satellites, the sheer number of doves constantly taking photographs allows this company to track global relations and activities in regular increments.

To discuss the benefits of their company, and to detail their role, the expert described some examples for how their niche in the market could be a force within the commercial sector. One example included agriculture, where farmers can save time by photographing crop yields, while governments could better anticipate food shortages. Another example provided was the transportation sector, since having incremental satellite images could allow shipping companies to avoid developing storms. Governments have the ability to track building development, to allow them to know where the best place would be to focus their services. Further examples include
human rights groups tracking refugee displacement, or the Federal Emergency Management Agency being better able to allocate necessary aid and resources.

The company does not sell or lease out the satellites themselves, but they do sell the imagery and associated data. Half of the company are software programmers and imagery analysts; and because they are currently collecting over six terabytes of data every single day, the company is heavily reliant on machine learning and artificial intelligence to extract information from the massive amount of collected data.

**Emerging Concerns**

The discussant, having specific expertise in the commercial space and satellite field, emphasized a few concerns throughout this first panel. One of those concerns was what the norms of this arena could develop into were the U.S. to take a back-seat in their development. The discussant noted that there are many other countries who are developing similar technology, and some at incredible speeds. When asked, the expert believed that “18 months is the estimate of how long until China has comparable technology to what [we] have today.” The concern is that if the market flocks to cheaper Chinese products and satellite technology, it will not be based upon the ideals of openness and transparency. The expert strongly believed that their company offers global truth, and that could offer a safer and more accountable world. For that to happen, the U.S. Government has to take up a leadership role in allowing those industries to flourish.

A further concern was space traffic management and space debris, as there are no strong international regimes to address each of those issues. As more satellite technology is launched, potentially without adequate regulations, the risk of satellite conjunctions and resulting debris greatly increases. The more space debris is left to litter the commercial earth orbits, the better the chance that high-velocity shrapnel can damage
U.S. property and interests. Laws and regulations can be effective at policing the danger associated with high-velocity space debris, however “even if laws are not passed, norms are the next best thing.” The U.S. should set the tone for developing the norms of the commercial space sector for space traffic management and space debris.

**The National Security Perspective**

The panelists had the opportunity to ask the discussant questions about their work, since the private-sector perspective was novel and unique. The first question was about the national security implications, specifically, how has their existence been received by the intelligence community (I.C.)? The discussant was quick to point out that they were grateful for the government contracts, and that currently makes up a majority of their income. They do however see themselves as a “compliment to the I.C.” Despite their operations not being classified, the expert pointed out that their open-source images were still extremely valuable. Some examples were also provided:

- The private company was able to confirm the recent launch of a missile from North Korea, despite that country denying its occurrence. The expert noted that “they did not look up our orbit time. You can clearly see the [missile] contrail.”

- They also noticed increasing Russian activity in the Ukraine – specifically what seemed to be a new aircraft system, and how it could harm U.S. interests in the region.
During a recent skirmish between Pakistan and India, this company noticed that China had quietly moved their long-range bombers to the neighboring border. Because the I.C. has to prioritize their field of view, they evidently missed this development – meaning that this private company could prove to be a strategic compliment to the U.S. Government’s limited resources. The company knew the exact day they arrived at the border, because they had the “ability to rewind time for forensic analysis.”

Another panelist followed-up further regarding the national security perspective. They asked about the private company’s customer base, and if they work with foreign governments. The discussant admitted that they had worked with foreign governments, for example, working with European governments to track deforestation and human rights concerns. The expert emphasized however that there are certain countries and foreign governments that they are not able to work with due to U.S. regulation. The expert also emphasized the importance of due diligence prior to contracting with any customers, be they foreign governments or not.

Further Discussion & Looking Forward

Since this expert had direct knowledge of operating a private company in a growing commercial space sector, the other panelists were eager to learn about their recommendations. The discussant made a number of suggestions, however focused on a few key ideas:

1. The U.S. should set the tone for space traffic management. As more private companies develop the technology to launch satellites, space will quickly need to be better managed. This emerging market will continue to grow, so really the “U.S. needs to set that tone, or it will set itself.”
2. Communication is a big concern, as bandwidth development and spectrum availability will become scarce as this industry continues to grow.

3. Licensing should be addressed and reformed. The expert believed that the current process is outdated, and often regulators issue licenses far too late, or even worse, they are too confused about what license is required. Legislation could be streamlined with input from the private sector, with particular emphasis on remote sensing legislation and spectrum legislation.

The overall recommendation however was to implement a whole-of-government approach towards the increasingly-developed commercial space sector. With other global powers, especially adversarial powers with different geopolitical goals, starting to develop commercial space sectors of their own, it is increasingly important for the U.S. to set the norms and standards for the commercial space sector. The private-company discussant offered the following caveat:

If the U.S. does not make an environment that is healthy for commercial enterprise, it is not that hard for those companies to just go elsewhere. We need to ensure that as a government we create a vibrant ecosystem that protects national security and enables commerce to thrive.

Next, the working group had a chance to discuss space conjunctions, satellite-insurance, and the future of liability.
Panel II: Future Undesirable Space Conjunctions: Who is and Should Be Liable?

Introduction

After the working group discussed the role of the private sector, they had the opportunity to speak with an expert from the insurance and liability-side of the commercial space and satellite industry. This new discussant followed the same outline as the previous panel – detailing their role within this emerging sector, and then fielding various questions from the other panelists.

The Insurance & Liability Perspective

The insurance expert said that the insurance company is essentially the first responder when something goes wrong. When there is an issue with development, the launch itself, or even the risk of conjunction with other satellites or space debris, the insurance market plays a role. It also works to allow private companies to unlock their economic potential. Insurance companies enable innovation and investment, because without that added financial security, there would be “no protection for the inevitable things that go wrong.” The insurance expert believed that insurance companies are going to be on the forefront of the commercial space sector, similar to how early ship and aircraft industries developed.

Whereas the first discussant addressed what was needed in the developing commercial space and satellite industries, the insurance discussant addressed the how. The insurance expert posed a question to the group:

Can insurance markets be used to incentivize good behavior, or to punish bad behavior? Furthermore, what does that good behavior look like, and how could it best be implemented across the insurance-liability regime?
The expert believed that although it may come in various forms, good behavior can indeed be incentivized by insurance markets, while bad behavior can be equally discouraged.

The discussant also broke down the types of insurance that are typical within the commercial satellite community. First, asset insurance is security against failure of a launch, operation, or damage. When an asset needs to be replaced due to technological failure, asset insurance is available for satellite companies. The second type is liability insurance, which pays for bodily injury or property damage to unrelated third parties. When asked, the discussant disclosed that their company has paid billions of dollars in asset insurance claims, yet they have paid essentially no liability insurance claims to date.

Emerging Concerns

The discussant next stated what many panelists agreed is inevitable: “there will be collisions in space.” Both the public and the private sector have to consider how to respond to these collisions. A liability-based solution could come through contract law, where each respective party agrees to hold each other company harmless, or perhaps just hold harmless the actors within the production chain (vehicle operator, launch company, etc.). Further development will also need to address the space debris problem, because as one panelist indicated, “the regime is old and untested.”

The discussant responded saying that instead of debris risk, it should be called collision risk, therefore you can “make it everyone's problem” and help encourage collective action.
Some panelists posed interesting solutions to the space debris problem. One asked, “why do companies not pay for active debris removal? We [should] encourage it.” A solution posed was a launch tax, which could then be channeled towards removing debris for the greater good. Another panelist believed that the insurance companies, as opposed to the launch companies, could provide financial incentives for the removal of space debris. This is especially the case, as one panelist indicated, because it is in the insurance companies’ interest to not have the increased risk associated with space debris colliding with satellites.

The insurance expert also offered the idea of on-orbit servicing. Generally, commercial satellites are operable until they break, at which point they either contribute to the space debris problem, or they deorbit and, hopefully, are burned-up in the atmosphere. This theory however would allow repairs and satellite servicing while those satellites are still in orbit. The expert believed it was a “wonderful idea,” however admitted that it would face challenges to implement. Some of those challenges included proximity limits, servicing processes for cooperative or uncooperative satellites, and/or accidental damages caused by the servicer. For these issues, the insurance expert believed that relying on strong legal contracts would be a key starting point in terms of assessing liability.

**Commercial satellites are operable until they break, at which point they either contribute to the space debris problem, or they ... are burned-up in the atmosphere.**

**Technological Recommendations to Reduce Liability and Risk**

The discussant also addressed some key ideas on regulation, saying that the U.S. should be the world leader in regulating the commercial space sector, “even though it is often not.” And while companies tend to not like regulation when they are trying to do things in an agile manner, some simple technological regulations could pave the way for reform:
1) Beacons could be on every satellite. Even small beacons could allow other satellite operators to have a better picture of their current field of space traffic. These could be small and transmit a ping “every 10 minutes.”

2) Cameras, while more expensive, could prove helpful in addressing the liability problem of attributing risk and damage to satellites. While the discussant admitted that cameras use a lot of bandwidth, they have “proven useful in most cases.”

3) For satellites that operate beyond 600 kilometers into space, companies should implement propulsion methods. Currently, many satellites do not need a heavy motor to effectively operate. However, for satellites that are capable of reaching higher altitudes, a propulsion system would be an effective tool to either avoid collision, or to ensure that a defective or end-of-life satellite can be maneuvered into a graveyard or re-enter the atmosphere and burn up so as to not become another piece of hazardous space debris.

Finally, to help avoid the inevitable space collisions, the discussant believed that “space traffic management is possible.” While some panelists were more skeptical, developing robust international norms with a majority of global powers is not unheard of when thinking about the aerospace or telecommunications industries. The expert thought of space traffic management as a sort of hybrid between what we currently know about satellite congestion, and what we should be doing with regard to satellite congestion. Some parties may be able to address their issues contractually, and thereby not rely on the Outer Space Treaty. Even at a basic level however, a minimum regime of space traffic management should be a goal of both the U.S. Government and the private commercial sector.
Further Discussion & Looking Forward

The panelists were able to ask the discussant from the satellite insurance company some questions. One panelist was concerned about safety zones around top-priority satellites, asking how feasible they are from an insurance perspective. While the insurance discussant was open to the idea, they still believed that collisions, even collisions that may be deemed aggressive and intentional, may run into attribution problems. Again, the discussant framed the solution as the U.S. leading by example on norm development.

National security themes were often woven into the discussion as well, however the discussant was aware that the commercial space sector would be easier to regulate. One panelist was concerned about anti-satellites, and adversarial technology. Another panelist brought up how cyber-weaponry may develop to a stage where it can cripple, or even manipulate foreign satellites. Finally, another asked that, provided beacons are required on all launched satellites, would adversarial nations not obviously mask their activity, or fly a “beacon of convenience?” On these issues, more questions were raised than solutions. Most agreed however, that a whole-of-government solution would need to actively incorporate the defense industry and intelligence community.
Keynote: National Security Implications of a Growing Private Commercial Space Sector

Introduction

During a lunch discussion, the panelists listened to a keynote speaker on the growing private commercial sector in space. The keynote speaker discussed how the Department of Commerce is carving out a dedicated niche for the private sector to expand in space. After the keynote speaker led the discussion, panelists were able to ask questions, and further develop the conversation.

The Government Perspective

The speaker emphasized the importance of the public-private partnership. He characterized the current relationship as a “merchants and guardian movement where we don’t understand each other.” While individual private companies may be searching for the next million- or billion-dollar industry, and while other U.S. Government agencies are considering the national security implications of every move made, the Department of Commerce sees “tons of benefits that can improve life on earth.” That public-private partnership is important as well, and the panelists discussed a few of the key reasons why:

1. The private sector has a larger ecosystem to work within,
2. A strong public-private partnership can save money and reduce costs,
3. Diffusing commercial and national security tasks across the private sector can complicate efforts taken by adversarial nations to stymie those tasks.
4. You can generally achieve much faster innovation.
Emerging Concerns

The U.S. Government speaker then allowed ample time for questions and further discussion, and the first question turned to the global perspective. On this, the speaker was quick to point out that the regulations and norms that govern space activity may face strain as other nations develop a commercial space sector. The speaker also addressed the different mindset that other nations may take towards national security and commercial space development. Simply put, “when there are alternative views, we need to be more deliberate on our views.”

A potential problem was highlighted as well when it comes to international mindsets. Even for non-adversarial nations – the ones that the U.S. will need to work with for dedicated and strategic partnerships – different nations may have a different definition as to what exactly their commercial market is. Some may consider it simply the trade of goods and services, but not include certain sectors (such as agriculture, or transportation). Others may have a very broad view of what constitutes commerce but have an incredibly hands-off approach to any form of regulation. The panelists broadly agreed that working with these diverse perspectives is important but will need a whole-of-government approach to best develop any sort of international regime.

One panelist questioned about potential pushback that the national security industry gives when the Department of Commerce is advocating for more innovation and development. That panelist offered a few reasons, which could help convince those who are more defense-minded:

- Defense and military intelligence can tap into the innovation provided by the private sector for an overall more effective strategy.
- A growing space economy creates resilience, which is something that adversaries must consider.
- The private sector offers unique capabilities, and the varied perspectives can provide for a more strategic advantage in thinking.

Safety zones were again a concern during the lunch discussion. The question was, even for the private sector, is the idea of a safety zone something that is being followed, or is it even possible? While the speaker and other panelists believe that this strayed more into the national security side of the discussion, other panelists offered a solution. They believed that if the commercial side were to adopt that idea, even as a general norm (as opposed to a stricter regulation), the national security arena could move towards that direction with time.

**The Government Recommendations**

The speaker also left the panelists with some lessons as to what to consider for the future. First, the speaker emphasized that “we have to be careful not to stifle innovation and allow for dual innovation,” – or innovation that offers both private sector and public sector opportunities. Second, the U.S. Government has to get better at perceiving what the markets may look like, and how to better predict what new technology may require regulatory action or licensing. An example was given on this point, that when a company approached the Department of Commerce asking for a license to develop hyperspectral imagery technology, that they were not prepared to give one, or to even understand what exactly that technology was. Simply put, “we have to anticipate the future,” because if the U.S. is not prepared for innovation, then “that’s death for industry.”
The keynote speaker’s overarching idea was a message for the whole of government:

We as a nation need to pay more attention to the unique role that the private sector can play in space security. There are myriad national security issues taking place within space, and as those complexities only continue to grow, the private sector will continue to be on the forefront.

The keynote speaker said that the U.S. Government is not currently taking advantage of these public-private relationships. Perhaps more importantly however, the speaker said that the U.S. Government still has to learn exactly how to take advantage of these public-private relationships. Specifically, the speaker was concerned that we as a nation “have to change quickly if we are going to strengthen our global leadership role.”

**Further Discussion & Looking Forward**

Before the session ended, the keynote speaker was asked if he could identify any problems going forward, or rather, what his specific goals were for the Department of Commerce for the future. The speaker highlighted three of them:

1. Elevation of the Office of Space Commerce to a bureau within the Department of Commerce will impart permanence to its critical functions, and allow it to leverage space expertise across the Department of Commerce. A dedicated bureau would go a long ways to ensuring that commercial space interests always have a seat at the table for whole-of-government discussions.

2. Make solid progress on the space debris problems. As discussed earlier, there are a number of solutions – some of which may work better than others. The space debris issue however is one that is not going away, and which must be dealt with, particularly before that task becomes an impossible one.
3. The U.S. must construct a regulatory environment that is “more conducive towards business.” The U.S. needs to develop that path for the licensing of new innovation, so when someone brings a brand-new idea to the Department, they have a real chance to develop that “idea and have that million-dollar application.”
Panel III: Insuring Against Unwanted Space Conjunctions: What New Norms, Regulations, Laws and Understanding Might be Desirable?

Introduction

The panelists then discussed how to approach unwanted space conjunctions, or possible collisions. Satellite owners and operators rely on conjunction warnings to avoid collisions, but the current warning system has large areas of uncertainty with regard to the actual location of at-risk space objects. While issues of space conjunctions were dealt with throughout the entire working group discussion, this panel specifically focused on addressing that concern. The panelists’ discussion was led by an expert from a private commercial-technology company. As with the other leading experts, the working group asked questions following the discussion.

Liability and Changing Normative Behavior

Liability was generally viewed by the panel as a foundational tool for effecting normative change in the commercial space sphere. When a conjunction happens, assigning financial liability for the conjunction may help to reduce the risk of future conjunctions. It is for this reason that the leading discussant strongly emphasized that “liability should not be discussed as the end in and of itself, but as a means to an end. The real end should be structural, behavioral, and normative change.” While liability may not directly incentivize cautiousness with outer space activity for every actor (as different companies and different governments may be incentivized by other means), a robust international liability regime was largely viewed by the panelists as something that should be developed.

Developing that robust regime may take time, but one panelist offered a possible solution. This panelist proposed that liability can be mandated as a condition for applying for a...
launch license when launching from a state that adheres to the regime. For example, if you want to launch a satellite from the United States, you should have to get a launch license, and with that you would accept the current liability regimes in place (similar to insurance and liability markets for drivers’ licenses). Or perhaps, as another panelist later suggested, a detailed public registry should exist, to help address foreseeable ownership and attribution problems.

**The Due-Regard Standard**

One panelist pointed out that a commercial company and the military have different primary concerns. When a satellite owned by a U.S. company (as a third party) is damaged by a foreign satellite (its owner or state as the insured or first party), the company’s key concern is adequate reparation. On the other hand, when a satellite critical to support warfighting is in imminent danger of being attacked by a potential antisatellite spacecraft, the U.S. key concern is to prevent the targeted satellite from becoming impaired or inoperable far more than to get full monetary compensation. Thus, a key question for this workshop is how the U.S. can legitimately establish a safety zone around each of its critical but vulnerable satellites so that any of an adversary’s satellites, without prior consent, will always keep a minimum safe distance away to avoid accidental or intentional physical interaction with a U.S. satellite. The discussant suggested that state and privately-owned companies must operate under the Due Regard standard, as required in Article IX of the Outer Space Treaty of 1967. Due Regard simply means that those operating in the space sector must act with care for the safety of others’ satellites. This can be towards, for example, one satellite not getting too close to any other satellite without prior consent, the incentive towards warning others of a conjunction, or even being mindful of the debris left behind from their own satellite operations. While most panelists agreed that this was generally a low standard, some voiced optimism that it was a positive starting point for the military to legitimately establish a safety zone so as to get warning to activate defense to prevent the invader from disabling our satellite. Safety zones can be a way to keep satellites safe from both commercial operations and hostile actions.
satellites safe from both commercial operations and hostile actions. Other participants believed that there were two significant difficulties with safety zones. The first is that the protective designation could signal which satellites are most important to the nation, potentially increasing the motivation of adversaries to attack them. The second is that a “keep out” area like a safety zone could run afoul of the Outer Space Treaty’s prohibition on appropriating space for one nation’s sovereign use.

Emerging Concerns

The discussion turned to the issue of attribution, as any attempt at assigning liability for an unwanted space conjunction is premised on the idea that you can attribute actions to a specific actor. This can be particularly difficult in space when satellites are moving at high speed and may not have an identifiable indicator or beacon. The discussant broke down how, depending on how to attribute the satellite, the outcome from a conjunction may be approached differently. Assuming that the collision is not the result of space debris, the panelist outlined that a private company’s satellite colliding with that of another company may be solved contractually, however satellites of different governments may need a more diplomatic and political solution.

These issues of course become more complicated in dual-use space, as the technology of private companies may also be utilized for government purposes, and the line between private versus government ownership may not be clear. The panelist also showed concern over the national security impact as well, stating that certain adversarial governments may wish to hide their ownership of a satellite, or perhaps mask their cooperation with private companies.
Speaking further on dual-use technology, one panelist questioned how behavior can be changed when satellites could operate as both public and private property, particularly for adversarial nations. Another panelist answered their question that liability is an effective tool, but in those situations, it is not the only solution available. Political, diplomatic, and economic tools also exist, and in that sense, changing international behavioral norms faces the same challenges that every new domain has had to.

Another panelist believed that, to an extent, the market may help address this issue: global commerce may not want to interact with an actor that has “a track record of irresponsible behavior that could result in a higher risk.” Some panelists agreed, with one recalling a company that had “lost business because of bad experiences.”

**Further Discussion & Looking Forward**

Ultimately, most panelists agreed that setting conditions of responsibility on the players within their own jurisdictions – either companies that operate from there, or actors who launch from that state – would have a normative benefit overall. As one of many solutions, the workshop panelists agreed overall with the concept that a state should have *some* responsibility for the satellite operations it is involved in, even if that regime is difficult to build and enforce globally. One panelist described this idea by distinguishing legal liability mechanisms versus policy responsibility, emphasizing that “they aren’t mutually exclusive.”

Regardless of the liability mechanism used and how effective it turns out to be, the same theme echoed throughout this panel that was emphasized through the entire work-group discussion: the U.S. should lead the way in creating and maintaining structural and behavioral norms, which could shape the commercial space and satellite discourse of the future.

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Final Takeaways

As mentioned at the outset, the purpose of the working group was not necessarily to reach a consensus or unanimous opinion. It was also not to address every possible idea or complexity out there. The purpose of the working group was to simply offer and discuss ideas, which industry experts believe may have an outsized impact on the development of the commercial space and satellite industries going forward.

The panelists of the working group left the discussion with a few final takeaways:

- The United States needs to become a world leader in the realm of developing the commercial space and satellite industry. It should set the tone for space traffic management, develop effective liability and insurance regimes, and consider proactive measures to counteract the risk of satellite conjunctions and the reality of increasing space debris.

- Insurance markets and liability can be used as both a positive or negative incentive for companies moving towards the commercial space sector. Technological changes can be implemented – or even required – which can help counteract conjunction-risk, including beacons, cameras, and in some cases, propulsion systems.

- More private companies are going to enter the commercial space and satellite sectors. The U.S. Government must actively work to not stifle innovation, and in many cases, this could come from fostering dedicated public-private partnerships. It would also help to make more permanent U.S. Government Department offices, which are involved with commercial space and satellite activity.

- The Due Regard standard in the air, at sea and on land should be further studied to justify its extension into space traffic management, regulation and law.
While the Due Regard standard is a helpful starting point, liability and attribution issues during unwanted space conjunctions will remain a challenge. Safety zone might well be a transparent red line so that the international community can promptly observe and determine the party, whose satellite gets into another party’s safety zone without prior consent, is automatically at fault and liable for damages to satellites in the zone. The U.S. should however lead the way towards building a robust international regime, which prioritizes real, behavioral, and structural norm development. This regime must meet the goal of peace and prosperity in space.