

**U.S. SPACE FORCE**

# **THE NEW FRONTIER OF NATIONAL SECURITY:**

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## **PREVENTING CONFLICT AND PROTECTING FREEDOM IN SPACE**

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'STARLINER ROCKET LAUNCHES SUCCESSFULLY ON  
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**PREPARED FOR: U.S. SPACE FORCE**

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Jorge Ruiz  
Chair, Harvard '24

## Introduction

Almost half a century after the conclusion of the first “space race” between the United States and the Soviet Union, outer space is once again becoming a field of primary importance for international relations. Technological advancements and the commercialization of space have brought forth an unprecedented period of space-focused innovation, with companies such as SpaceX and Blue Origin spearheading the development of reusable rockets and space tourism.<sup>1</sup> And with the National Aeronautics and Space Administration making plans to land humans on the moon by 2024, it seems like we are on the verge of a new golden age of space exploration.<sup>2</sup>

However, at the same time that this new wave of technological advancement expands human potential in space, the capacity of our adversaries to project power beyond the exosphere continues to grow. The main rivals of the United States in space, Russia and China, are investing heavily in systems that pose a serious challenge to our national security. These include anti-satellite weapons, hypersonic missiles, and electronic jamming devices.<sup>3 4 5</sup> And though conflict in space may seem trivial due to the remoteness of this new frontier, space warfare could have catastrophic consequences for civilians on the ground. Furthermore, with our growing dependence on technology, a targeted disruption of our communication, location, and information systems would have dire effects on society.

Recognizing the danger that these developments represent for space exploration and our national security, the United States decided to elevate the United States Space Force, formerly a branch of the Air Force, into its own independent military branch. Dedicated to protecting the interests of the United States in outer space, the Space Force has the mission of safeguarding many of our communications systems while preventing major conflict.<sup>6</sup> However, the field of space policy is just recently beginning to be taken seriously. Furthermore, with many international treaties regarding space remaining largely unenforced, ensuring that other nations “play by the rules” continues to be a challenge for the United States.<sup>7</sup> Therefore, the goal of this policy report is to assess policies and strategies that the United States Space Force should pursue in order to deter conflict in space and protect our national interests in space exploration and

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<sup>1</sup> Shammas, Victor L., and Tomas B. Hoken. “One Giant Leap for Capitalistkind: Private Enterprise in Outer Space.” *Palgrave Communications* 5, no. 1 (2019). <https://doi.org/10.1057/s41599-019-0218-9>.

<sup>2</sup> “Artemis Missions.” NASA. NASA, n.d. <https://www.nasa.gov/specials/artemis/>.

<sup>3</sup> Harrison, Todd, Kaitlyn Johnson, Thomas G Roberts, and Makena Young. Rep. *Space Threat Assessment 2020*, n.d.

<sup>4</sup> Panda, Ankit. “The Dangerous Fallout of Russia's Anti-Satellite Missile Test.” Carnegie Endowment for International Peace, November 17, 2021. <https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804>.

<sup>5</sup> Axe, David. “America May Have Found the Secret to Killing Hypersonic Missiles.” *The National Interest*. The Center for the National Interest, February 6, 2021. <https://nationalinterest.org/blog/reboot/america-may-have-found-secret-killing-hypersonic-missiles-177824>.

<sup>6</sup> “National Defense Authorization Act for Fiscal Year 2020.” United States House of Representatives, December 2019.

<sup>7</sup> Leepuengtham, Tosaporn. “International Space Law and Its Implications for Outer Space Activities.” Essay. In *The Protection of Intellectual Property Rights in Outer Space Activities*, 8–31. Cheltenham, UK: Edward Elgar Publishing, 2017. [https://www.elgaronline.com/view/9781785369612/06\\_chapter1.xhtml](https://www.elgaronline.com/view/9781785369612/06_chapter1.xhtml).

commerce. We also highlight international legislation proposals that would create mechanisms of accountability for adverse actions in space.

The paper begins by discussing the existing framework of space regulation, both international and domestic, in order to contextualize the present state of international relations in space. This first section highlights the lack of enforcement of space treaties and the severe ambiguities in the management of space debris and cyberattacks. The paper then goes over important advancements in space technology and weapons systems, both the innovations spearheaded by the United States and the potential threats from Russia and China. Furthermore, the role of the private sector in advancing space exploration, commerce, and national security is assessed. The report then draws upon this research to propose potential strategies for the United States government and the Space Force. In particular, the paper argues in favor of incorporating guardrails similar to those from the naval treaties, improving property rights in space, investing in innovative space defense systems, leveraging the private sector, and promoting greater operational and financial independence for the United States Space Force.

## **International Space Law and Regulation**

### **The Laws and Principles of the United Nations for Outer Space**

The majority of international space regulation consists of soft laws with few guardrails and a patchwork of diverse national legislation.<sup>8</sup> Most of international space law is currently based on the five international conventions implemented by the United Nations – the Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention, and the Moon Agreement. Together, these five conventions deal with issues such as sovereignty in space, regulation of space armaments, freedom of navigation, the sharing of space activities with the international community, and accountability for the damage of property in space.<sup>9</sup> However, with the rapid development of space technologies and the emergence of space mining and tourism, many of these laws now face severe challenges and impending obsolescence.<sup>10</sup> At the same time, with the rise of new rivalries in space, the international community has struggled to enact new, binding laws.<sup>11</sup>

However, significant progress has been made in recent years. In particular, the Artemis Accords of 2020 were an important step toward advancing international governance of space. These agreements outline principles for cooperation in civil exploration and use of the moon, mars, comets and asteroids for peaceful purposes.<sup>12</sup> The first major directive of the Accords is “transparency”, which mandates a commitment to transparency in the broad dissemination of

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<sup>8</sup> Ibid

<sup>9</sup> “United Nations Office for Outer Space Affairs.” Space Law Treaties and Principles, n.d. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>.

<sup>10</sup> Zhao, Yun. “Space Commercialization and the Development of Space Law.” Oxford Research Encyclopedia of Planetary Science, 2018. <https://doi.org/10.1093/acrefore/9780190647926.013.42>.

<sup>11</sup> Ibid

<sup>12</sup> The Artemis Accords - NASA.” Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, October 13, 2020. <https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf>.

information regarding national space policies and scientific data.<sup>13</sup> Another important directive is the “deconfliction of space activities”, which affirms a commitment to the aforementioned Outer Space Treaty, outlines provisions relating to harmful interference, and provides consideration to the UN guidelines for long-term sustainability of outer space activities – including a provision for the safe, timely and efficient passivation and disposal of spacecraft at the end of their missions.<sup>14</sup>

Thus, the Artemis Accords, which were signed by over ten countries and are open for signature indefinitely, constitute the single most important international agreement of our current time. The Accords are grounded in the United Nations Outer Space Treaty of 1967 and have the goal of reinforcing the existing five international conventions. That being said, unless efficient accountability mechanisms are instituted to penalize countries that fail to comply with the stipulations, it is uncertain whether the Artemis accords are enough to ensure freedom and security beyond the exosphere.

### **Sovereignty and Property Rights in Space**

Space law regarding property rapidly evolved throughout the 20th century, with the introduction of the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, the 1972 Convention on International Liability for Damage Caused by Space Objects, and the 1976 Convention on Registration of Objects Launched in Outer Space<sup>15</sup> which provide the legal framework for considerations about national property rights, and damage liabilities. However, similarly to the five resolutions from the United Nations, many of these laws and agreements have yet to be reexamined since they were initially instated and are in dire need of revisions to reflect our modern society and technologies.

The role of the private sector specifically needs to be reflected in international conventions. The 1972 Convention on International Liability for Damage Caused by Space Objects provides a basis for liability claims for any damage caused by space objects belonging to a “launching state,” however the convention does not address modern concerns about the orbital trafficking with regards to the private sector, nor provide clear procedures for damages caused by space debris.<sup>16</sup> This omission is particularly concerning because the head researcher of the Astronautics Research Group at the University of Southampton, U.K., Hugh Lewis, has estimated that SpaceX’s Starlink satellites are involved in about 50% of spacecraft close encounters on a weekly basis.<sup>17</sup> In addition to the cost of managing this orbital trafficking, accusations of near-collisions can cause friction between nations, such as when China filed a

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<sup>13</sup> Ibid

<sup>14</sup> Ibid

<sup>15</sup> Leepuengtham, Tosaporn. “International Space Law and Its Implications for Outer Space Activities.” Essay. In *The Protection of Intellectual Property Rights in Outer Space Activities*, 8–31. Cheltenham, UK: Edward Elgar Publishing, 2017. [https://www.elgaronline.com/view/9781785369612/06\\_chapter1.xhtml](https://www.elgaronline.com/view/9781785369612/06_chapter1.xhtml).

<sup>16</sup> Leepuengtham, Tosaporn. “International Space Law and Its Implications for Outer Space Activities.” Essay. In *The Protection of Intellectual Property Rights in Outer Space Activities*, 8–31. Cheltenham, UK: Edward Elgar Publishing, 2017. [https://www.elgaronline.com/view/9781785369612/06\\_chapter1.xhtml](https://www.elgaronline.com/view/9781785369612/06_chapter1.xhtml).

<sup>17</sup> Pultarova, Tereza. “SpaceX Starlink Satellites Responsible for over Half of Close Encounters in Orbit, Scientist Says.” Space.com. Future US Inc., August 18, 2021. <https://www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise>.

formal complaint against SpaceX for allegedly requiring Chinese astronauts to take evasive maneuvers to avoid colliding with SpaceX satellites in late 2021.<sup>18</sup> While the complaint pertains to the Outer Space Treaty rather than the 1972 Convention on International Liability for Damage Caused by Space Objects, it is still important to consider how the United States could be held liable for damages from a privately owned satellite collision under the 1972 Convention on International Liability and how these instances could affect foreign relations.

### **Accountability for Generation and Mismanagement of Space Debris**

There is also little discussion about the role of debris in space law in terms of space exploration and insurance law. The Registration Convention of 1976 was created with the aim to allow for the identification of objects in space, however the act of registering a space object does not necessarily bestow nationality on the registered object,<sup>19</sup> making it more difficult to assert ownership of debris to a particular nation from a legal perspective. While the Outer Space Treaty<sup>20</sup> may be applicable when considering the production of space debris, since it is not of interest to other states to produce debris, this legal framework is unlikely to deter kinetic energy weapons testing, such as direct-ascent anti-satellite missiles that generate low-orbit space debris<sup>21</sup>.

As previously explained, a significant risk to national security concerns is the accumulation of debris in the lower atmosphere. These cause significant issues for three key reasons, the first being that it makes it more difficult for parties to access space, and may create an environment where space becomes so congested it is virtually unusable. We do not want this to happen as it will significantly impair our communication systems and inhibit missions into space. The accumulation of space debris is causing a phenomenon known as the Kessler Syndrome, defined by Wall as “a phenomenon in which the amount of junk in orbit around the earth reaches a point where it creates more and more space debris.”<sup>22</sup> This leads onto the second significant impact, in which satellites and space stations face increasing risk of damage, which will not only be costly but may also raise questions of liability in which current legislation does not fully address. Finally, and tangentially, this may heighten tensions between states, with conflict arising over who compensates for damage in space, and potential mistaking of collision as intentional attacks. With many private and public entities planning massive satellite launch missions into the lower atmosphere, this becomes a more pressing issue for the United States Space Force to address.

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<sup>18</sup> Barrabi, Thomas. “Elon Musk Slams Claims His SpaceX Satellites Are Blocking Rivals.” *New York Post*. New York Post, December 30, 2021. <https://nypost.com/2021/12/30/elon-musk-slams-claims-spacex-satellites-are-blocking-rivals/>.

<sup>19</sup> Leepuengtham, Tosaporn. “International Space Law and Its Implications for Outer Space Activities.” Essay. In *The Protection of Intellectual Property Rights in Outer Space Activities*, 8–31. Cheltenham, UK: Edward Elgar Publishing, 2017. [https://www.elgaronline.com/view/9781785369612/06\\_chapter1.xhtml](https://www.elgaronline.com/view/9781785369612/06_chapter1.xhtml).

<sup>20</sup> Garber, Stephen J. “Outer Space Treaty of 1967.” NASA. NASA, October 26, 2006. <https://history.nasa.gov/1967treaty.html>.

<sup>21</sup> Davis, Margaret. “Russia's Anti-Satellite Weapon Test Created 1,500 Space Junk, Prompting Astronauts in the ISS to Take Shelter in Escape Pods.” *Science Times*, November 23, 2021. <https://www.sciencetimes.com/articles/34659/20211123/russias-anti-satellite-weapon-test-created-1-500-space-junk.htm>.

<sup>22</sup> Wall, Mike. “Kessler Syndrome and Space Debris Problem” *Space.com*, Nov 15 2021

## Digital Warfare

There are also no specific international treaties surrounding cyberattacks of satellites and satellite protection, which is regulated by the International Telecommunication Union.<sup>23</sup> There is currently a lack of debate surrounding reform to these laws or improvements towards the interpretations of existing laws in the case of a cyber-attack. The UN Charter certainly provides guidance about prohibiting “use of force” and permitting use of space for self-defense, and describes the rights and possible responses a nation can employ in instances of harmful interference in times of peace.<sup>24</sup> A universally agreed upon legal definition of a cyberattack — distinguished from the “use of force” or a cybercrime — has yet to be developed,<sup>25</sup> which hinders legal progress.

## Emerging Technologies and Developments

### Semiconductor Procurement and Development

The U.S. and its allies face the challenge of staying ahead of Russia and China in technological development, as well ensuring a steady supply of electronic components to make such efforts possible. One especially vital electronic part is the semiconductor, which is a key component of both satellites and computers. Semiconductors allow for fast communications and computer processing, and without them, U.S. national security posture would be severely compromised.

A report from the US Congress describes the current industry for semiconductors as being at the heart of innovation for space exploration and defense development.<sup>26</sup> The report describes manufacturing chain issues that arose from the Covid-19 pandemic, and compared these to the shortages that would arise if access to fabrication plants in Taiwan was hindered in the event of a war. And given the global political situation, it is feasible that China could attack Taiwan in the near future. Looking at the U.S. supply chain by nation, it is evident that the US and other nations rely heavily on Taiwan for the manufacturing of semiconductors as the manufacturing process requires highly specialized machinery.<sup>27</sup> Currently, Taiwan manufactures

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<sup>23</sup> Helena Correia Mendonca; Magda Cocco; Juliana Macedo Scavuzzi dos Santos, "International Laws Regulating Satellite Communications and Their Intentional Disruption in Times of Peace and Conflict," *Annals of Air and Space Law* 40 (2015): 105-154

<sup>24</sup> Helena Correia Mendonca; Magda Cocco; Juliana Macedo Scavuzzi dos Santos, "International Laws Regulating Satellite Communications and Their Intentional Disruption in Times of Peace and Conflict," *Annals of Air and Space Law* 40 (2015): 105-154

<sup>25</sup> Helena Correia Mendonca; Magda Cocco; Juliana Macedo Scavuzzi dos Santos, "International Laws Regulating Satellite Communications and Their Intentional Disruption in Times of Peace and Conflict," *Annals of Air and Space Law* 40 (2015): 105-154

<sup>26</sup> Platzner, Michaela D., John F. Sargent Jr., and Karen M. Sutter. 2020. "Semiconductors: U.S. Industry, Global Competition, and Federal Policy." R46581. Congressional Research Service. <https://crsreports.congress.gov/product/details?prodcode=R46581>.

<sup>27</sup> Ibid

around 60% of the world's total semiconductors.<sup>28</sup> Thus, technological development would be severely hindered if China invades Taiwan.

Though China is a generation behind in wafer design, they are rapidly making advances through the transfer of technology and collaboration, specifically US-led open-source technology platforms.<sup>29</sup> Therefore, understanding the role of US innovation in a global context, especially regarding the semiconductor industry, is of critical importance for the United States to succeed in the new space race.

## **Satellite Development**

At present, the largest strides in technological innovation are from U.S. rivals such as China, Russia, Iran, and North Korea. However, there is still some significant innovation in U.S. allied nations such as France, Israel, and Japan. In 2017, France alleged that one of Russia's satellites was positioned close enough to interfere with French military communications, and thus France issued a new defense strategy in 2018 which includes the development of defensive laser mounted satellites, as is Israel.<sup>30</sup> The Japanese Space Domain Mission is cooperating closely with the United States and its own civil space agency, developing active defenses using robotic arm technologies and having the potential to create a co-orbital anti-satellite weapon.<sup>31</sup>

## **Digital Threats from Adversaries**

Space infrastructure is split into three categories: user segment (devices and networks used by administrators to monitor technology in space), ground segment (receives signals from satellites in space), and space segment (delivers information from space back to Earth).<sup>32</sup> All three of these categories are under threat from cyberattacks, and in 2019, NASA discovered a successful attempt to compromise its network, using a hardware backdoor to steal sensitive information.<sup>33</sup> If ground elements are compromised, attacking agents are able to intercept traffic from satellites, snooping in on important information. There are many different parties, both governmental and private, that seek to do this, and the best way to combat this threat in its infancy is to spread public awareness, which hopefully will spur further development in space security.

Technological developments aimed at disrupting satellite communications, especially regarding the Global Positioning System, are of particular concern. One such threat is the use of electronic jamming devices to impact GPS signals and neutralize American defense capabilities.<sup>34</sup> The GPS system is composed of a network of 31 satellites, as well as 24 spares,

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<sup>28</sup> Lee, Yen Nee. "2 Charts Show How Much the World Depends on Taiwan for Semiconductors." CNBC. CNBC, March 16, 2021. <https://www.cnbc.com/2021/03/16/2-charts-show-how-much-the-world-depends-on-taiwan-for-semiconductors.html>

<sup>29</sup> Ibid

<sup>30</sup> Harrison, Todd, Kaitlyn Johnson, Thomas G Roberts, and Makena Young. Rep. *Space Threat Assessment 2020*, n.d.

<sup>31</sup> Ibid

<sup>32</sup> Ibid

<sup>33</sup> Ibid

<sup>34</sup> Ibid

which are located in 6 orbital planes managed by the United States Space Force. The services provided by the system, which include positioning, navigation, and timing (PNT) signals, are critical for the civilian economy and virtually all military operations.<sup>35</sup> As such, enemies of the United States are very interested in being able to not only jam, but provide the U.S. with false PNT Data - also known as spoofing.<sup>36</sup>

To counter this threat, the Space Force has committed itself to reinforcing the “GPS Enterprise” and shore up the satellites in space, the ground control system, and user equipment.<sup>37</sup> The Department of Defense is also looking into alternatives and backups in case the GPS system fails.<sup>38</sup> In order to preserve the integrity of military communications, vital to the success of any operation, the U.S. must ensure all space based communication systems are preserved and protected against digital attacks.

### **Physical Threats from Adversaries**

In addition to cyber and other “invisible attacks”, Russia and China are also working on physical anti-satellite weapons. On November 15th, 2021, the Russians launched a direct ascent anti-satellite missile into space and destroyed an old Soviet era satellite.<sup>39</sup> The PL19 interceptor hit a COSMOS 1408 satellite at an altitude of approximately 300 miles.<sup>40</sup> One of the most immediate and far reaching consequences of this test was the thousands of pieces of space debris scattered as a result of the explosion.<sup>41</sup> Unlike debris on Earth, metal chunks from the destroyed satellites have the potential to collide with manned spacecraft such as the International Space Station, as well as to damage satellites that are in use. Such a disruption is not only dangerous for astronauts and space equipment, but it could also lead to a crisis on Earth by shutting down important systems necessary for everyday function. Currently the U.S. Space Force’s 18th Space Control Squadron is monitoring the movement of the space debris from this Russian test.<sup>42</sup> Such a weapon in the hands of the adversaries of the United States represents a threat to both national security and future development prospects in space.

Another major aerospace threat to the U.S. is the hypersonic missile, which travels through space before falling back down to earth at an extreme velocity. Hypersonic missiles that are reportedly being developed in China (DF-17) and Russia (Avangard) are often described as the greatest threat to US security because of their inability to be intercepted mid-flight and may be able to stay in orbit for prolonged periods of time.<sup>43</sup> Current U.S. technologies such as the

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<sup>35</sup> Ibid

<sup>36</sup> Ibid

<sup>37</sup> Ibid

<sup>38</sup> Ibid

<sup>39</sup> Panda, Ankit. “The Dangerous Fallout of Russia's Anti-Satellite Missile Test.” Carnegie Endowment for International Peace, November 17, 2021. <https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804>.

<sup>40</sup> Ibid

<sup>41</sup> Ibid

<sup>42</sup> Panda, Ankit. “The Dangerous Fallout of Russia's Anti-Satellite Missile Test.”

<sup>43</sup> Axe, David. “America May Have Found the Secret to Killing Hypersonic Missiles.” The National Interest. The Center for the National Interest, February 6, 2021. <https://nationalinterest.org/blog/reboot/america-may-have-found-secret-killing-hypersonic-missiles-177824>.

SM-3 interceptors are unlikely to work against hypersonic missiles, though the Pentagon has reported some success in interception tests.<sup>44</sup> Defense against hypersonic missiles is much more feasible when the missile is in the terminal stages of the trajectory, so the DoD is investing many resources into terminal interception defense programs.<sup>45</sup>

To counter Russia and China, the DoD is identifying their potential threats, as well as the advantages of U.S. space developments. Russia emphasizes the development of countermeasures to neutralize the threats of foreign space forces and is predicted to be developing a grounded mobile missile system to destroy ballistic missiles or weapons in Earth's low orbit.<sup>46</sup> Russia is likely developing laser weapons against satellites in orbit as well.

China has a particularly strong IRS system with a satellite fleet numbering over 120 that can provide "electro-optical and synthetic aperture radar (SAR) imagery, as well as electronic intelligence and signals intelligence data."<sup>47</sup> China is also developing a secure communications system by testing quantum-enabled communications, which would provide a strategic advantage in the global satellite communications industry.<sup>48</sup> They are assumed to be pursuing laser weapons, like Russia, but are also emphasizing offensive cyberspace capabilities, making the need for well-defined laws surrounding potential cyberattacks more critical.<sup>49</sup>

## **The Potential of the Private Sector**

### **Capitalism in Outer Space**

Obama's 2010 National Space Policy emphasized increasing the competitiveness of the U.S. space industry while Trump's government advocated for deregulation of outer space to support the private space industry.<sup>50</sup> This may be further bolstered by the view that space is a private commodity: the American Space Commerce Free Enterprise Act, a U.S. House of Representatives bill introduced in 2017, declares that space is not a public good, but rather a private property.<sup>51</sup> Privatization of Space has been established by The Outer Space Treaty of 1967, which established space as terra nullius- meaning land that is legally unoccupied or uninhabited.<sup>52</sup>

In general, the United States benefits greatly from collaborating with the private sector, which has proven to be an indispensable source of innovation. By continuing to leverage developments from companies like Blue Origin and SpaceX, the Space Force will be able to continue improving its Intelligence, Surveillance, and Reconnaissance (ISR) systems through

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<sup>44</sup> Ibid

<sup>45</sup> Ibid

<sup>46</sup> 2019. "Challenges to Security in Space." DIA F 01403 A. <https://media.defense.gov/2019/Feb/11/2002088710/-1/-1/1/SPACE-SECURITY-CHALLENGES.PDF>

<sup>47</sup> Ibid

<sup>48</sup> Ibid

<sup>49</sup> Ibid

<sup>50</sup> Ibid

<sup>51</sup> Ibid

<sup>52</sup> Ibid

Cooperative research and development agreements. However, we need to be mindful of the capacity for competition and conflict in space due to these emerging technologies.

Opportunities for the private sector include producing carrier rockets, placing satellites into orbit around Earth, as well as the long-term exploration, exploitation and colonization of celestial objects like asteroids and eventually planets.<sup>53</sup> There is an unprecedented potential for capital accumulation on a scale that's never been seen before. With satellite manufacturer NewSpace Systems predicted to become the first trillion-dollar company, the commercialization of space may create some of the world's first trillionaires in the future.<sup>54</sup> By being a political partner of corporations like NewSpace, the US government is positioning itself in an advantageous position compared to countries less friendly to free enterprise like China.<sup>55</sup>

The US Space Force can collaborate with the private sector in a number of ways. Firstly, they can meet military needs by integrating commercial remote sensing satellites with dedicated national satellites, which enhances their capabilities in a way that is “much more robust and resilient than just any one piece of that all by itself.”<sup>56</sup> Moreover, they can also leverage the private sector's unique “powerful sensors and data analytics systems to track and investigate space objects”. Finally, they can optimize the price and quality of their products.<sup>57</sup>

Perhaps one of the best examples of the private sector aiding the interests of the Space Force is Starlink, which provides internet service to much of the world.<sup>58</sup> Russia's attacks on Ukraine has illustrated how targeting satellites is now a prime war tactic and as such development of countermeasures is increasingly important. As illustrated by the source, SpaceX's usage of Starlink Satellites is invaluable to furthering US interests.<sup>59</sup>

However, the capacity for profits in space can create conflict. Space billionaires appear to regard their individual space visions and profits highly, which create potential for conflict in the race to privatize the space industry. Elon Musk and Jeff Bezos, two key space billionaires, have had a history of violence in their corporate practices.<sup>60</sup> Elon Musk has “a long history of opposing the unionization of workers” while having high worker injury rates, while Jeff Bezos has a higher than industry average rate of injury.<sup>61</sup> Another potential for conflict lies in the

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<sup>53</sup> Shammass, Victor L., and Tomas B. Holen. “One Giant Leap for Capitalistkind: Private Enterprise in Outer Space.” *Palgrave Communications* 5, no. 1 (2019). <https://doi.org/10.1057/s41599-019-0218-9>.

<sup>54</sup> Ibid

<sup>55</sup> Ibid

<sup>56</sup> Erwin, Sandra. “Space Force Thinking about NASA-Style Partnerships with Private Companies.” *SpaceNews*, June 5, 2020. <https://spacenews.com/space-force-thinking-about-nasa-style-partnerships-with-private-companies/>.

<sup>57</sup> Ibid

<sup>58</sup> Wall, Mike, and Tariq Malik. “SpaceX Launches Starlink Satellites on 'American Broomstick' and Lands Rocket at Sea.” *Space.com*. Space, March 9, 2022. <https://www.space.com/spacex-launch-48-starlink-satellites-march-2022>.

<sup>59</sup> Ibid

<sup>60</sup> Marx, Paris. “Yes to Space Exploration. No to Space Capitalism.” *The Wire Science*, June 10, 2020. <https://science.thewire.in/spaceflight/elon-musk-jeff-bezos-space-capitalism>.

<sup>61</sup> Ibid

varying visions that these billionaires have. While Elon Musk wishes to colonize Mars, Jeff Bezos is more interested in building space colonies in orbit.<sup>62</sup>

## Policy Recommendations

### **Adopt historical lessons from the Naval Agreements to develop a new International Space Treaty with appropriate guard rails:**

The United States is in a new era of great power competition, the likes of which have not been seen since the first half of the twentieth century.<sup>63</sup> The historical case study used to demonstrate the need for a new space treaty is the naval arms control treaties of the interwar period. Their temporary success in the 1920s offer valuable lessons, as do their failures in the 1930s that contributed to the rise in tensions that led to World War II.<sup>64</sup>

Following the aftermath of World War I, the Washington Naval Treaty of 1922 sought to ensure a balance of power between the victorious allied powers (United States, United Kingdom, France, Italy, and Japan).<sup>65</sup> This was done by setting maximums on the number of ships that each navy could consist of, and limits on the size of these battleships. Crucially, the force level maximums were not identical for each power, reflecting the fact that the United Kingdom had a justification for more ships than Italy, for example.<sup>66</sup> This treaty was largely successful for the first decade of its existence, because all the signatories had an interest in maintaining it.<sup>67</sup>

Yet the treaty unraveled in the 1930s, as rearmament began in earnest. The Washington Naval Treaty had four major flaws. One, it did not allow for independent checks. Countries self-reported, allowing them to more easily misconstrue what they were doing. Second, there was no independent body to affirm that every nation was acting in accordance with their obligations. This incentivized nations to cut their own deals between each other and other third parties, such as in the Anglo-German Naval Agreement of 1935.<sup>68</sup> Third, there was no mechanism for enforcement. If a signatory violated the treaty, the only response other countries could take was to respond in kind, which undermined the treaty even more so.<sup>69</sup> Fourth, the Washington Naval

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<sup>62</sup> Ibid

<sup>63</sup> Till, Geoffrey. 2018. *Seapower: a Guide for the Twenty-First Century*. Fourth edition. Abingdon, Oxon ; New York, NY: Routledge, an imprint of the Taylor & Francis Group.

<sup>64</sup> Zhai, Shaoming. 2019. "Road to Infamy: Interwar Pacific Under the Washington Naval Treaty." *American Research Journal of History and Culture* 5 (1).

<sup>65</sup> Kuehn, John T. 2010. "The U.S. Navy General Board and Naval Arms Limitation: 1922-1937." *The Journal of Military History* 74 (4): 1129–60

<sup>66</sup> Spennemann, Dirk H. R. 2021. "Managing the Heritage of Arms Limitation Treaties." *International Journal of Historical Archaeology* 25 (4): 931–58.

<sup>67</sup> Asada, Sadao. (2006). "Between the Old Diplomacy and the New, 1918–1922: The Washington System and the Origins of Japanese-American Rapprochement." *Diplomatic History*, 30(2), 211–230.

<sup>68</sup> Hoerber, Thomas. 2009. "Psychology and Reasoning in the Anglo-German Naval Agreement, 1935–1939." *The Historical Journal* 52 (1): 153–74.

<sup>69</sup> Hurd, Archibald. 1923. "IS THE WASHINGTON NAVAL TREATY DOOMED?" *Fortnightly Review*, May 1865-June 1934 113 (673): 13–27.

Treaty was not able to adapt to changing technology. It did not even discuss aircraft carriers, for example, which would go on to be the dominant force in naval combat in the Second World War.

With the lessons of the past in mind, the U.S. Space Force should work with its international partners to create a new international space treaty that seeks to ensure peace in space. The central aims of this treaty would be to define sovereignty, and to impose arms control limits in space through independent checks verified by an independent international body. This treaty would need to be regularly revisited to account for changing circumstances, especially technology advances. Further, there would need to be mechanisms for accountability, such as limiting access to international space assets for those who violate the treaty. These key components would make the treaty more durable and thus avoid the pitfalls of the Washington Naval Treaty of 1922.<sup>70</sup>

### **Improve domestic space regulation and define national jurisdiction of space-faring objects and satellites:**

As the U.S. continues to develop its Space Force military branch, it is essential that we reexamine the current legal jurisdiction concerning warfare in space and equitable use of space with respect to the private sector. As satellite attacks become an increasingly common war tactic, there is a lack of clarity defining what constitutes a cyberattack on satellites (and what response is then warranted). While this ambiguity may deter cybercrimes out of fear of provoking the U.S., it is nevertheless important to foster international discussions to improve laws defining what constitutes a cyber-attack to avoid escalating international conflicts. By fostering international discussions about how to improve laws defining what constitutes a cyberattack and the response it will trigger, the United States could deter potential cyber attackers from testing the boundaries. Rather than use terminology such as “use of force” as outlined in the UN Charter,<sup>71</sup> the U.S. should move to legally distinguish a cybercrime from a cyberattack through an effects-based approach, as outlined by Mendoca et.al<sup>72</sup>. Policymakers need to begin discussing the creation of specific, enforceable international laws for satellite attacks and protection, rather than rely on the International Telecommunications Union to regulate satellites.

Secondly, there is an ever increasing need to define legalities surrounding space debris. Currently, legal precedent defines liability principles for damages from space objects, however the role of space debris within this framework is unclear. One potential avenue for recourse is to expand the 1972 Liability Convention to declare all objects within a nation’s spacecraft as the legal responsibility of that particular nation and expand initiatives to track space debris, such as NORAD in the U.S. and Canada, to assign liabilities. This approach’s feasibility is bolstered by the precision of the U.S. Space Force Surveillance Network, which has the capability to monitor “about 30,000 live and defunct satellites and pieces of debris down to the size of 4 inches.”<sup>73</sup>

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<sup>70</sup> Goldman, Emily O. 1994. *Sunken Treaties: Naval Arms Control Between the Wars*. University Park, Pa.: Pennsylvania State University Press.

<sup>71</sup> Ibid

<sup>72</sup> Ibid

<sup>73</sup> Pultarova, Tereza. “SpaceX Starlink Satellites Responsible for over Half of Close Encounters in Orbit, Scientist Says.” Space.com. Future US Inc., August 18, 2021. <https://www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise>.

Alternatively, policymakers could recognize space debris as negative externality that warrants a fine from the nation responsible for a collision, given that the issue of financial compensation for damages caused by space debris could be complicated by the difficulty with associating space debris to a particular nation. This fine could then be used to compensate a nation whenever a space debris collision destroys national property, rather than extending the 1972 Convention on International Liability for Damage Caused by Space Objects to include space debris. This tax would disincentivize the testing of kinetic energy weapons like direct-ascent anti-satellite missiles that generate low orbit space debris.

### **Invest in the development of weapon systems capable of rivaling or outperforming the technology of our rivals in space:**

In terms of the militarization of space, the progress of the United States is mixed. Though the U.S. is the first country in the world to create a space focused military branch, China and Russia have been rapidly testing and building weapons that use space to threaten American space interests for multiple years.<sup>74</sup> To ensure that space does not become dominated by hostile governments, the United States Space Force must develop effective deterrents through the possession of weapons capable of countering enemy space militarization. Such weapons are primarily meant to be defensive measures in case our adversaries decide to act first. However, in case of hostile action, the Space Force must be prepared to neutralize all threats to U.S. space interests with forceful and deliberate military actions. This includes destroying enemy satellites, disrupting their space communications, and being able to intercept potential enemy space-based weaponry that is designed to hit earth-based targets.<sup>75</sup> In order to keep space as demilitarized as possible, it would be preferable to keep most of these defensive weapons earth based. By keeping such defensive measures in place, the Space Force would be able to ensure that space remains peaceful and free from any Earth-based conflict.

### **Develop defense systems capable of protecting American satellites and space networks from space debris, cyberattacks, and belligerent offensive action:**

The second technological goal that the U.S. Space Force should pursue is the development of systems capable of protecting our own spacecraft against artificial space debris, as well as enemy cyberattacks. Russia and China have both tested antisatellite weaponry in the past two decades and show no sign of stopping, and each of these tests result in thousands of pieces of space debris being scattered.<sup>76</sup> Space debris is a major threat to satellites, space stations, and other equipment in space, and thus the arming of American space equipment to

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<sup>74</sup> 2019. "Challenges to Security in Space." DIA F 01403 A. <https://media.defense.gov/2019/Feb/11/2002088710/-1/-1/1/SPACE-SECURITY-CHALLENGES.PDF>

<sup>75</sup> Axe, David. "America May Have Found the Secret to Killing Hypersonic Missiles." The National Interest. The Center for the National Interest, February 6, 2021. <https://nationalinterest.org/blog/reboot/america-may-have-found-secret-killing-hypersonic-missiles-177824>.

<sup>76</sup> Panda, Ankit. "The Dangerous Fallout of Russia's Anti-Satellite Missile Test." Carnegie Endowment for International Peace, November 17, 2021. <https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804>.

conduct self-defense should be considered a priority.<sup>77</sup> Future American communications satellites and manned space equipment should have the capability of neutralizing floating debris to protect themselves and other satellites.<sup>78</sup> Our space equipment is being threatened by adversaries who take no responsibility in cleaning up after their own actions.<sup>79</sup> Thus, this mandate should be upheld by the United States Space Force.

Russia and China are also developing cyber capabilities to interfere with American satellites and space-based communications. Since this can significantly affect U.S. civilian and military operations on Earth, as well as in space in an adverse manner, the U.S. must take measures to ensure security of our communications systems in space. This can be accomplished through more funding and investing in the cyber capabilities of the Space Force. Both defensive mechanisms to prevent cyberattacks, as well as offensive cyberweapons for potential retaliation and deterrence, need to be maintained and further developed.

In order to achieve its goals, the U.S. Space Force needs to work with other U.S. military branches to share technology and intelligence to protect each other from space-borne threats. The future of warfare is joint, and collaboration with other branches will be key to not only identifying enemy threats in space and combating the threats, such as missile depots, before they become too big, it will also make the U.S. military as a whole a much more cohesive and capable fighting force. In addition, each branch has common needs, such as semiconductors for equipment, and procurement collaboration will be essential to maintain a necessary supply and identify threats to them. If China were to take over Taiwan, which sources 80% of semiconductors in the U.S., all the branches will need to find a replacement.<sup>80</sup> As such, it would be ideal for the DoD as a whole to diversify its sources for electronic imports, as well as potentially figuring out a plan for domestic manufacturing.

The rationale behind these goals is to ensure that the land-based operations of the United States can continue with our space-based equipment and systems, such as GPS, as well as to disincentivize adversary nations from militarizing space. Interbranch collaboration will be essential to maintain the operational capabilities of the whole DoD to perform these missions. By working towards these goals, the Space Force will be able to make the space domain and Earth much safer from potentially devastating military actions.

### **Leverage the private sector as a comparative advantage:**

The U.S. Space Force should collaborate with the private sector for innovations. Firstly, they can collaborate with the private sector for materials such as carrier rockets and satellites in

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<sup>77</sup> Khalili, Joel. "Kamikaze Satellites and Shuttles Adrift: Why Cyberattacks Are a Major Threat to Humanity's Ambitions in Space." TechRadar. TechRadar pro, September 18, 2021. <https://www.techradar.com/news/kamikaze-satellites-and-shuttles-adrift-why-cyberattacks-are-a-major-threat-to-our-ambitions-in-space>.

<sup>78</sup> Harrison, Todd, Kaitlyn Johnson, Thomas G Roberts, and Makena Young. Rep. *Space Threat Assessment 2020*, n.d.

<sup>79</sup> Panda, Ankit. "The Dangerous Fallout of Russia's Anti-Satellite Missile Test."

<sup>80</sup> Lee, Yen Nee. "2 Charts Show How Much the World Depends on Taiwan for Semiconductors." CNBC. CNBC, March 16, 2021. <https://www.cnbc.com/2021/03/16/2-charts-show-how-much-the-world-depends-on-taiwan-for-semiconductors.html>.

orbit around Earth.<sup>81</sup> They can also integrate commercial remote sensing satellites with dedicated national satellites and leverage the private sectors' powerful sensors and data analytics systems to monitor space debris.<sup>82</sup> Doing so will allow the U.S. Space force to optimize the price and quality of their products.

With the arrival of NewSpace, the community of new aerospace companies collaborating together to build cheaper access to the space sector, there is an unprecedented potential for capital accumulation as NewSpace is set to become the first trillion dollar industry.<sup>83</sup> Moreover, we see that on the whole, there have been steps towards this direction by the U.S. government as Obama's 2010 National Space Policy emphasized increasing the competitiveness of the U.S. space industry while Trump's government advocates for deregulation of outer space to support the private space industry.<sup>84</sup> This appears promising for the U.S. Space Force as it will likely be supported by the government in decades to come.

However, it must be noted that the rise of space commercialization may mean commercial rivalries within the private sector. As space billionaires are likely to regard their vision and profits highly, there may be potential conflicts in the race to privatize the space industry.<sup>85</sup> Thus, it is important that the bolstering of free enterprise in space is accompanied by appropriate legislation to prevent the monopolization of extraterrestrial industries.

### **Promote and uphold the independence of the Space Force:**

Given the ambiguity in current regulations on the space domain, the United States must pursue legislation with both domestic and foreign parties. These include limitations on the private sector, or large-scale compromises and treaties between international actors. However, as the military branch responsible for navigating US involvement in commanding space power, the Space Force must have the authority to act on national interests without being hampered by needless bureaucracy and budget limitations. This is the prerequisite for executing the other policy recommendations in their entirety and is currently being pursued to some extent by the Space Force. The Space Force must also have the ability to work with the private sector as a tight collaborator in order to fully utilize the space power capacity of the United States.<sup>86</sup>

The Space Force was created out of the need for an independent military branch dedicated to securing United States space power and ensuring freedom in the space domain.<sup>87</sup> Unlike the creation of a separate Air Force to control the air domain, the Space Force was founded before major conflicts over space power could arise. This demonstrated a recognition by part of the United States that space has become a critical aspect of both domestic and foreign

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<sup>81</sup> Shammass, Victor L., and Tomas B. Holen. "One Giant Leap for Capitalistkind: Private Enterprise in Outer Space." *Palgrave Communications* 5, no. 1 (2019). <https://doi.org/10.1057/s41599-019-0218-9>.

<sup>82</sup> Ibid

<sup>83</sup> Ibid

<sup>84</sup> Ibid

<sup>85</sup> Marx, Paris. "Yes to Space Exploration. No to Space Capitalism." *The Wire Science*, June 10, 2020. <https://science.thewire.in/spaceflight/elon-musk-jeff-bezos-space-capitalism>.

<sup>86</sup> Moltz, James Clay. "The Changing Dynamics of Twenty-First-Century Space Power." *Journal of Strategic Security* 12(1), Spring 2019: 15-43.

<sup>87</sup> "National Defense Authorization Act for Fiscal Year 2020." United States House of Representatives, December 2019.

relations.<sup>88, 89</sup> However, while the Space Force is independent on paper, it currently lacks both support from the government itself and, following from that lack of internal standing, respect from civilians and foreign powers.<sup>90</sup> In order to effectively accomplish its missions, the Space Force must prioritize recognition as a powerful military branch with the same authority as the Army, Navy, and Air Force.

The Space Force must secure a larger budget for personnel recruitment and the further development of large-scale projects, as it continues to gain traction within the United States government.<sup>91</sup> Although technically allocated its own budget, the Department of Defense has constrained Space Force funding to a fraction of the budget allowed for the Air Force. This obstacle of funding reflects a broader trend with the newly formed Space Force: it is treated as a subsidiary of the Air Force, not as an independent branch. Attempting to increase budget can be pursued through two primary means. First, direct petition to the Department of Defense through bureaucratic processes will yield small but consistent changes to overall funding for the Space Force, if an increase in budget is clearly shown to have merit for the program. Second, effective military action will strengthen those petitions and boost the esteem of the Space Force. Hard evidence of successful cyber operations, critical information gathering, and apprehension of foreign interference in the space domain would all serve to strengthen the propositions of the Space Force to internal government departments.

In crisis situations, the Space Force must have the authority to take executive action and engage in quick response protocol. Much of the conflict that currently occurs in space is either through satellite measurement jamming or cyber-attacks by foreign adversaries. The current Space Force has the capacity and objective of mitigating the effects of these small-scale attacks, but in practicality lacks the authority to respond to major events in space. These include the simultaneous disruption of multiple civilian or military satellites involved in digital communication and physical attacks on United States satellites by anti-satellite weapons.<sup>92, 93</sup> Increasing both the Space Force budget and authority will allow for the expansion of crisis response protocol and targeted solutions to larger scale foreign interference.

After fully acquiring independent status within the United States government, the Space Force must establish itself as the singular representative of US space power. While foreign powers recognize the dominance of the United States in space, that military might is not reflected in the Space Force, but in a combination of the federal government and the private sector.<sup>94</sup> The Space Force was created with the intent of acting as the spearhead for United States efforts in

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<sup>88</sup> Wright, Ashley M. "Space Force Releases 1st Doctrine, Defines "Spacepower" as Distinct Form of Military Power." *United States Space Force*, August 10, 2020.

<sup>89</sup> Smith, M.V. "Ten Propositions Regarding Space Power." *Air University Press*, October 2002.

<sup>90</sup> Farley, Robert. "Space Force Ahead of Its Time, or Dreadfully Premature?" *Cato Institute*, December 1, 2020.

<sup>91</sup> "Department of the Air Force Fiscal Year 2023 Budget Overview." United States Air Force & United States Space Force, March 2022.

<sup>92</sup> Trevithick, Joseph. "U.S. Satellites Are Being Attacked Every Day According to Space Force General." *The Drive*, November 2021.

<sup>93</sup> Khalili, Joel. "Kamikaze Satellites and Shuttles Adrift: Why Cyberattacks Are a Major Threat to Humanity's Ambitions in Space." *TechRadar*, September 18, 2021.

<sup>94</sup> Shammas, Victor L., and Tomas B. Holen. "One Giant Leap for Capitalistkind: Private Enterprise in Outer Space." *Palgrave Communications* 5, no. 1, 2019.

space and must unify the disparate components of the nation's space program. Having taken over the federal responsibilities, the Space Force should prioritize working with private sector groups. Rather than simply providing capital to encourage the private sector to innovate space technology on its own, the Space Force must enter long-term partnerships with private entities to aggregate the potential of United States space power. Only after assuming bureaucratic, political, military, and commercial responsibility for the United States space program will the Space Force be able to successfully carry out its duties.

## Conclusion

As the new frontier of national security and defense, international relations in outer space is a field that finds itself at a decisive moment. On one hand, outer space can remain the common heritage of mankind, a peaceful realm of cooperation, exploration, and innovation to be shared between all peoples of the world. However, it could just as easily become a militarized arena kept in tense equilibrium only by the threat of mutually assured destruction. The ultimate fate of humanity in outer space rests upon the rules of the game that end up taking effect in outer space, rules that are implemented by whoever is able to establish a presence in space first.

This is why, when it comes to space exploration, the United States must lead. Not all nations, especially our biggest rivals in space, share our commitment to freedom and democracy. So, to ensure our national security both in space and on the ground, the United States Space Force must continue to project power in the space domain by investing in technological development, pursuing international treaties that create mechanisms of accountability for adverse activities in space, and strengthen alliances with the private sector. The government of the United States, by its part, must reinforce its commitment to a free and secure outer space by granting the Space Force more independence and agency to do what it originally intended to do – preserve peace in space and aid mankind's first steps into the stars.

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