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USAFA 64th Academy Assembly Proceedings
Editor’s Note

This issue marks an eager return to the journal’s heritage in space policy and strategy. At the same time, and consistent with our journal founders’ desire to break down artificial, bureaucratically imposed silos, the five peer-reviewed articles featured here speak to other emerging conflict domains such as nuclear—always linked with space strategy and broader concerns of statecraft.

Three of the articles, on i) regulating exploitation of celestial bodies, ii) leveraging principles from the nuclear domain for space arms control, and iii) consulting partners and adversaries to avoid the Kessler Syndrome in the age of satellite constellations, are authored by experts in international space law. The other features, by a former Stanton Fellow at Stanford’s Center for International Security and Cooperation and a researcher for the recent DOD MINERVA grant on Economic Statecraft, explore, respectively, the significance of gender for foreign policy decision making in emerging domains and the waning effectiveness of American sanctions for preserving national security in space.

Vol. 15, No. 1 includes our usual complement of outstanding student work, this time encompassing clean energy solutions as well as proposals for strengthening space and nuclear deterrence. The Student Voice section concludes with proceedings from the U.S. Air Force Academy’s 64th Academy Assembly, which focused on next-generation ideas for Waging Peace on the Final Frontier.

Academy Assembly, like similar undergraduate symposiums held at sister service academies and leading civilian institutions such as Columbia University, which hosted the first American Assembly under university president Dwight Eisenhower in 1950, offers a golden opportunity for cross-generational dialogue on public affairs. In this issue of *Space & Defense*, AA64 also supplied material for our senior leader contributors.

Former NASA deputy administrator Lori Garver delivered the Assembly keynote in the form of a fireside chat on the implications of NASA transformation regarding the agency’s relationship with new commercial space (NewSpace) for National Security. Then-deputy commander for USSPACECOM Lt Gen John Shaw, at the Assembly’s culminating event, gave the annual Truman Lecture. Gen Shaw (USAFA ’90) laid out urgent priorities for the newest combatant command as it wages peace in the Third Space Age, amid increasingly savvy, highly capable international competitors in orbit.

Encouraging distinct four-star commands to work together under hostile conditions brought about by growing coordination among U.S. adversaries is the subject of this volume’s lead Senior Essay: “The Unified Command Plan for a New Cold War” by Brigadier General (ret.) and former Assistant Secretary of State for East Asia and Pacific Affairs David Stilwell. General Stilwell’s call for flexible, smart boundaries and greater integration among military Areas of Responsibility recalls a touchstone from the first issue of *Space & Defense* published nearly twenty years ago. In the long
run, successful grand strategy rests upon political-economic foundations. This support structure itself demands consistent attention by policy makers and analysts to the integration of new technology across domains, emerging and traditional. These are the very ones we survey with each new issue of our expanded journal.

Damon Coletta
USAFA
June 2024
Pushing Boundaries: Feminism, Female Leaders, and the Fate of Feminist Foreign Policy

Sannia Abdullah

The study challenges the clearest, unqualified liberal claim on feminist foreign policy: namely, women equal peace and security while men equal war. In fact, women approach foreign policy challenges as judiciously as men and have proven their statesmanship. Feminist foreign policy promotes gender equality, women empowerment, and socio-economic parity based on a non-hierarchal system, but it fails to offer a resilient, conflict preventing, and environmentally friendly alternative framework capable of reducing contemporary foreign policy challenges.

A persistent cross-cultural belief reflected from national security debates and discourse is that masculinity embodies notions of authority and power. The origins of this viewpoint can be traced to historical times because statistically men have ruled and fought wars far more in number than women. The patriarchal viewpoint in contemporary war literature, as articulated by male historians such as Thucydides, Clausewitz, Sun Tzu, Machiavelli, Liddell Hart, and Bernard Brodie, continues to influence formulation of defense and security policies. Moreover, patriarchy reinforces the Realist school of thought, often enamored with the calculus that more weapons, particularly more advanced and lethal weapons, are essential for maintaining global order.

Feminist IR theory, by contrast and in line with Liberalism, challenges the predominant Realist paradigm and questions: “If women were included in such discussions, would the national interest be interpreted differently?” International Relations Feminists argue that by excluding women from the national security table, the course of international political affairs constricts the space for alternative arguments and critical voices in understanding a wider range of political solutions. Feminist scholars have brought worldwide attention to the fact that women remain victims of sexual violence in armed conflicts when they were not the ones who initiate wars. Some voice nuclear abhorrence due to disproportionate health effects on women exposed to radiation from nuclear bombings (Hiroshima, Nagasaki) to nuclear testing (Marshall Islands), or accidents (radiological fallout in Chernobyl), including but not limited to miscarriages, stillbirths, reproductive and congenital disabilities. Some argue that naming nuclear weapons as Fat Man and Little Boy reaffirmed patriarchal beliefs in national security affairs. Others in favor of nuclear disarmament write about how “nuclear deterrence is a product of patriarchy…designed to justify outrageous behavior by those with power and privilege—the behavior of spending billions of dollars on weapons that risk the world’s total destruction…”

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Despite varying viewpoints on foreign and defense policies, the proactive engagement of women in upholding democratic principles remains undisputed. They lead peace movements, serve in the armed forces, and participate in wars or in post-conflict rehabilitation zones. Nonetheless, this paper will show that their voice, as a gendered contribution on national security, has remained marginal.

Acknowledging the feminist critique of traditional national security realism, the UNSC unanimously adopted (October 31, 2000) the Resolution 1325 on ‘Women, Peace, and Security’ and emphasized the disproportionate impact of violence on women and girls in conflict zones. The Resolution called upon the UN member states for “promotion of peace and security, and the need to increase their role in decision-making about conflict prevention and resolution.”

The Resolution urged leaders to “adopt gender perspective” in peacekeeping operations and peace agreements. Some member states made noticeable efforts towards gender equality and women empowerment while some (such as Sweden, Canada, France, Luxemburg, Mexico…, etc.) took the lead and espoused Feminist Foreign Policy (FFP).

Yet, this laudable ambition rests on an underdeveloped concept of Feminist Foreign Policy; there is no universal definition, yet, although there is broader agreement on underlying assumptions. Countries that have adopted FFP generally customize it according to their demographic, socio-economic and political needs. This paper wrestles with why FFP has not made substantive progress on reducing violence and the risk of devastating war even though it brings attention to the most fundamental values of human security i.e., gender equity, women empowerment, and economic disparity. The study first argues that FFP needs to separate itself from misconstrued feminist assumptions such as ‘women as nurturers are innately peace lovers.’ Some contemporary feminist arguments make FFP seem utopian. Second, FFP, for the moment, should defer lofty expectations on conflict prevention, conflict resolution, and non-militaristic or non-violent foreign policy.

Some argue that the “feminist approach” would “strengthen deterrence overall and improve post-deterrence planning.” Others claim that “females attempt to mitigate threat through de-escalation (‘befriend’) and seek to bolster human security in situations of deterrence failure (‘tend’).” Such arguments place heavy moral weight not only on FFP supporters but also upon women in leadership roles, feminist scholars promoting gender inclusive/women empowered societies, and peace pundits who keep backing those ideals. Peaceful diplomacy, prosperity through trade, and non-violent approaches are not a one-way road. Decision makers (even those groups meeting gender equity standards) should not, on behalf of others, unduly

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3 Valerie M. Hudson and Rose McDermott, “Feminist Foreign Policy and Deterrence,” Center for Feminist Foreign Policy, July 07, 2021, at https://centreforfeministforeignpolicy.org/2021/07/07/feministforeignpolicyanddeterrence/

4 Ibid.
risk national security to foreign aggression.

To elaborate this *amicus* brief for prudent realism, this paper points to Pakistan as a major case and England, India and Bangladesh as secondary examples, where female elected leaders perceived national security threats and responded *in the same way* as their male counterparts. These cases challenge the key pillar of FFP that assigns heavy lifting for women to clean up the mess left by centuries of patriarchy through gender-centric foreign policy.

**WHAT IS FEMINIST FOREIGN POLICY?**

FFP draws strength from the UNSEC Res 1325 WPS (Women, Peace, Security) agenda that was followed by nine supporting resolutions that stresses upon “strengthening women’s meaningful participation in preventing conflict and violent extremism or increasing the number of women in peacekeeping.” The academic literature on women’s rights and inclusion in the political realm included two distinct yet overlapping arguments. One group of scholars suggests that an equal representation of women and men in leadership and parliament is critical for democracy and improving development indicators. This debate emphasized the need “to address patterns of exclusion, structural barriers, stereotypes, and unequal power relations that produce and reproduce exclusionary practices and outcomes in societies…” This scholarly debate evolved into gender equality that basically says, ‘women rights are human rights.’

The second group of scholars argues that gender equality is not a goal in itself, but it’s an essential process for achieving the objectives of peace and security apart from sustainable development. This debate is inspired by feminists’ work and women’s rights’ activists who rightfully argue that women are considered a minority group because they do not share equal power and privileges as men, even though they constitute half of the world population. The significant distinction between these two debates is that the latter envisions more promising policy outcomes from women’s role in policymaking. This perspective eventually evolved into a feminist foreign policy vision. According to the International Center for Research on Women (ICRW): Feminist foreign policy is the policy of a state that defines its interactions with other states, as well as movements and other non-state actors, in a manner that prioritizes peace, gender equality and environmental integrity; enshrines, promotes, and protects the human rights of all; seeks to disrupt colonial, racist, patriarchal and male-dominated power structures; and

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6 “Gender Equality and Inclusion in Democracy,” Institute for Democracy and Electoral Assistance at https://www.idea.int/our-work/what-we-do/gender-democracy


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allocates significant resources, including research, to achieve that vision.\(^8\)

Different countries interpreted the needs of gender inclusion and economic liberty and redefined Feminist Foreign Policy according to their needs. For instance, the Sweden was the Feminist first country to formally adopt feminist foreign policy (2014) in the world. Swedish feminist foreign policy set the example of implementation and focused on 3R’s: 1) Rights, 2) Resources, 3) Representation, to elevate women’s social, economic, and political status. EU provided an action plan to implement UN resolution by ensuring that “the rights, agency and protection of women and girls are observed and upheld at all times, and to confirm that a meaningful and equal participation of women is secured in all institutions and processes of conflict prevention, peace-making, peacebuilding and post-conflict rehabilitation.”\(^9\) EU’s FFP framework lays out five key ingredients including (1) purpose, (2) definition, (3) reach, (4) intended outcomes and benchmarks, and (5) plans to operationalize. Mexico ranks third on feminist global index after Sweden and Norway to adopt feminist foreign policy in 2020. Mexico in 2020 announced to adopt FFP and became the first country of global south to adopt this vision. According to Mexico, “it is not only a Feminist Foreign Policy, but a Feminist Foreign Policy plus, because we are also including LGBTQI individuals and the disabled.”\(^10\) Cristopher Ballinas, Director General of Human Rights and Democracy, said for Mexico, FFP: Demonstrates the constant and committed effort of the Mexican State with human rights and mainly with the rights of women, adolescents, and girls in all their diversity. It is not only a recognition, but also a great responsibility to maintain the highest standards in international action, and to ensure that these have an impact on domestic politics and thereby reduce femicides and the gender violence that has so greatly affected women in our country.\(^11\)

Canada is another leading nation to adopt FFP. Canadian government announced feminist international assistance policy (June 09, 2017) with action plan that focuses on six areas: 1) Gender Equality and the Empowerment of Women and Girls, 2) Human Dignity, 3) Growth, 4) Environment and Climate Action, 5) Inclusive Governance, and 6) Peace and

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Security. FFP provides an alternate perspective of national security to interrogate the norms of violence in the hierarchical structure of decision-making dominated by militaristic and patriarchal thoughts. The key pillars include actionable policies to make foreign policy more democratic, challenge dominant neoliberal political discourse, restructure the hierarchical patterns of suppression and discrimination, empower the voices that suffered from militarized oppression, and update while eliminating the domestic and foreign policy decisions for a more just global order.

The advocates of the feminist foreign policy (FFP) argue that governments need to re-think the meaning of security and incorporate perspectives from the oppressed and marginalized groups of the society, including women and members of the LGBTQ+ community. Many countries have not adopted FFP but pledged to uphold some of its fundamental values. For instance, U.S. vice president Kamala Harris in support of the FFP vision, stated, “The status of democracy depends fundamentally on the empowerment of women, not only because the exclusion of women in decision-making is a marker of a flawed democracy, but because the participation of women strengthens democracy.” Likewise, France renames its feminist foreign policy approach as ‘feminist diplomacy’ that aims to support the “empowerment of women around the world through combating sexual and gender-based violence, fighting for occupational equality and fighting for the education of girls.” Yet, FFP framework envisions deeper claims than merely supporting women’s rights and increased representation in policy making.

FEMINIST DISCOURSE AND FEMINIST FOREIGN POLICY

A comprehensive review of the literature demonstrates the existence of gender bias towards male scholars who supported women rights, endorsed feminism, and even facilitated anti-nuclear movements led by women. Some argued the nuclear discourse being divided into pro-peace feminists and pro-deterrence male policy makers. This gender-driven academic divide underscores the extent to which gender biases and stereotypes have shaped nationalist perceptions and security policies surrounding nuclear weapons and the larger anti-nuclear movement, leading to a dichotomy wherein peace was linked with female gender and war with male gender. As a result, those scholars and policymakers who advocated for nuclear disarmament were also perceived as weak, while those supporting nuclear armament were seen as brave, embodying warrior-like qualities. Lawrence Wittner writes that during the early years of the Cold War, male scholars supporting disarmament received judgment within nuclear

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12 “Canada’s Feminist International Assistance Policy,” Pan American Health Organization, at Canada’s feminist international assistance policy - PAHO/WHO | Pan American Health Organization


policymaking circles. “To ‘be a man,’ after all, was to show an unfailing readiness to fight for one’s country. Thus, the masculinity of male antinuclear activists was often called into question.”

Feminist scholars supporting FFP argue that women’s under-representation at leadership levels affect political discourses and foreign policy choices; therefore, inclusive policy outcome perhaps could lead countries to a safer and peaceful world. One of the misleading facts within the FFP debates is that it builds a strong, linear, and affirmative connection of women with peace-oriented goal. For instance, some FFP authors argue that “There cannot and will not be peace without feminism.” The argument that women who are mothers and nurturers would always support peace and vote for economic stability and environmental sustainability over country’s sovereignty, is contested within feminists’ debates. The supporters like Helen Caldicott, the author of *Nuclear Madness,* argue that women are nurturers responsible for human production and are a natural antidote to warring males. Likewise, Micaela di Leonardo, in her intriguing article on “Morals, Mothers, and Militarism: Antimilitarism and Feminist Theory” linked feminism with nonviolence. She questioned “what women have to do with war,” particularly when men decide on wars. Her argument served as a catalyst for existing feminist movements, which have been critical of the hierarchical and bureaucratic structures that exist within military institutions. However, in history, there have been women emperors and warriors who fought like men, led armies, and conquered lands when they were also mothers. For instance, Queen Gwendolen of Britain (the 9th century BC) gathered an army and fought her ex-husband, King Locrinus, at River Stour. She led the war, killed Locrinus, assumed the throne, and ruled independently as Queen. Cleopatra II was a queen of Ptolemaic Egypt who ruled from 175 to 116 BC who also led a rebellion against her husband Ptolemy VIII in 131 BC and drove him out of Egypt. Tang Sai'er led an army against the Ming Dynasty in China (1420). Likewise, Rani Velu Nachiyar, the Indian queen from Tamil Nadu, was the first Queen to fight against the East India Company in India from 1760 to 1790.

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17 Nina Bernarding and Kristina Lunz, “A Feminist Foreign Policy for European Union,” Center for Feminist Foreign Policy, (June 2020) at Study-Feminist-Foreign-Policy-for-the-European-Union.pdf (centreforfeministforeignpolicy.org) op cit, p. 12
MISSING LINKS IN FEMINIST FOREIGN POLICY

Despite women’s contribution to global initiatives towards peace and anti-nuclear campaigns, it is troubling that their representation in national security roles is marginal. This issue of empowerment can be effectively tackled through legislative measures at the state level. To safeguard human and women's rights within a nation, it's imperative for countries to establish internal laws and mechanisms for their enforcement. The presence of women in leadership positions is crucial for a democratic society that genuinely represents its entire populace, including all genders, with a special focus on women. However, how such measures would contribute to a feminist foreign policy framework – offering non-militaristic, non-violent, anti-war, pro-peace, anti-capitalist, anti-weapon, non-hierarchical, non-discriminatory – is not convincing. FFP clearly states that: a) it rejects patriarchy as a social norm, b) it declines militarism, c) and capitalism. It also declares its goal: to move decision-makers away from investing in military security and global dominance, but it fails to elaborate: How FFP would be instrumental in perceiving national security threats or find peaceful resolution to conflicts heavily brewed in armaments or how will it replace the interests’ of allies when interstate conflicts are intertwined with capitalism and weapons exports are key drivers of world’s biggest economies. Understanding these fundamental flaws, the Swedish government last year (2022) abandoned feminist foreign policy. Swedish Minister of Foreign Affairs Tobias Billström said, “Gender equality is a fundamental value in Sweden…But we’re not going to continue with a feminist foreign policy because the label obscures the fact the Swedish foreign policy must be based on Swedish values and Swedish interests.” Critics argue that Sweden confronted with practical obstacles to enforce gender parity within all departments/institutions and faced challenges in incorporating a gender-focused outlook into all aspects of foreign policy.

The feminist foreign policy debate lacks clarity about interstate interactions, particularly with other nations that have not embraced or align their values with FFP. For example, Sweden's feminist foreign policy recognized tough choices because it had a “clear conflict between Sweden’s strong standpoint for women’s rights and democracy and its weapons export to dictatorships like Saudi Arabia, the United Arab Emirates and Thailand.” FFP debates are unclear about protecting national security if they denounce weapons war is imposed on them? Another bigger challenge for Sweden was selling weapons when feminist foreign policy clearly opposes militarism. Because of conflicting tensions emanating from different feminist debates

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22 Elis Liss, “10 Reasons Why We Need Feminist Foreign Policy,” Open Canada, 10 reasons why we need feminist foreign policy - Open Canada

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that FFP lacks conceptual clarity. As Diana Thorburn notes, “there can never be a truly singular voice of feminist foreign policy simply because of the diversity of views within feminism itself.”

Since feminist foreign policy also draws strength from anti-nuclear peace movements where women led disarmament campaigns, it remains unclear if nuclear weapons states (or potential nuclear weapon states) would adopt feminist foreign policy? For instance, in Japan, feminism has mostly stayed on the fringes of Japanese politics and hasn't been considered a primary policy focus. They actively backed the worldwide advancement of gender equality and the empowerment of women and girls, even though it is still underperformed within its own borders. If Japan were to choose between pursuing a nuclear weapons path or adhering to a feminist foreign policy, their decision-makers would face a challenging dilemma. Although Japan has witnessed the tragedies of human history, the choice to obtain such weapons isn't a straightforward one; otherwise, Japan would have done so a while back. Feminist envisioning foreign policy oversimplified the security needs for nuclear deterrent as Ray Acheson, author of Banning the Bomb, Smashing the Patriarchy, argues that nuclearism is an “epic feat of gaslighting that insists that weapons that can kill everyone on the planet many times over are the only things; keeping us safe.”

Feminist foreign policy advocates should settle some claims coming from feminism regarding gender equality and women empowerment. For instance, women empowerment gives women the right to choose their profession even if its armed forces or even if they choose to be mothers. The value judgment of women to be nurturers/caregivers, born to be peace lovers negates the very definition of gender equality that reaffirms ‘the rights and access to opportunities is unaffected by gender.’ Adam Jones, in his famous article, “Does 'Gender' Make the World Go Around,” writes: If woman's equal peace and men war, then we are again looking at a project to feminize politics. However, suppose these associations are more construed than innate. In that case, the dichotomy (men-as-militarist, women-as-caregiver) reflects stereotypical patterning of the kind that has always inhibited the expression of women's full potential and personality. These conceptually blurred boundaries limit the scope of the feminist foreign policy framework which is why western/liberal democracies like Norway, Finland, the Netherlands, Australia, South Africa, and the United States upheld their commitment to gender equality but did not publicly confirm to feminist foreign policy.

23 Diana Thorburn, “Feminism Meets International Relations,” SAIS Review vol. 20, Issue. 2 (Summer-Fall 2000): 1-10


25 Ray Acheson, “75 Years of Nuclear Violence Must End Now,” WILF, August 06, 2020, at https://www.wilpf.org/75-years-of-nuclear-violence-must-end-now/

There is not much evidence to prove that women in bureaucracy/power seemingly pushed for pro-peace and anti-militaristic policies. Survey research by William Bendix and Gyung-Ho Jeong, analyzing several decades of US (House and Senate) voters’ patterns, questioned if the existing literature showed any correlation between female lawmakers pushing for cuts in defense budgets. Their research found no evidence to support increasing female representation, decreasing militarism, and affecting legislative behavior. Therefore, the argument of women as doves and men as hawks “offers suggestive correlations, but no direct evidence.” Bendix and Jeong’s research explained that “gender plays a small role in shaping legislatures [U.S.] foreign policy preferences. Members appear to take on national security positions largely in line with what their voters want.” Like any other nation, it’s not unusual for election candidates to tailor their campaigns to appeal to their supporters, regardless of their gender. Prof. Scott D. Sagan and Prof. Benjamin Valentino on "Revisiting Hiroshima in Iran." The authors surveyed a hypothetical scenario replicating the 1945 decision by the U.S. administration to use nuclear weapons against Iran to end the war in response to imposing U.S. economic sanctions. The survey sample is the American public that approved U.S. atomic bombings “killing 2 million Iranian civilians if they believed that such use would save the lives of 20,000 U.S. soldiers.” Their research shows that American women supported “nuclear weapons use and violations of noncombatant immunity no less (and sometimes more) than male respondents.” Authors recorded public opinion and found that American women are equally hawkish as American men when it comes to self-defense.

Likewise, Pakistani women’s perspectives on national security are no less different on defense and security. Most of the women scholars working in thinktanks on national security support nationalist stance with respect to need for armaments and strategic parity with India. Like Benazir Bhutto, women in positions of leadership also expressed a favorable stance towards the nation's nuclear armament policies and offered minimal objection. Pakistan’s


28 Ibid.

29 Ibid.


31 Ibid.
former ambassador to the United States, Maleeha Lodhi, supported Pakistan’s development of battlefield nuclear weapons “to counterbalance India’s move to bring conventional military offensives to a tactical level.”

Although, FFP is still in its formative stages and has yet to become a successful framework, it is important that FFP debates also suggest a comparative framework that is resilient against foreign invasion/nuclear threats. Feminist writings on anti-nuclear policies received a push-back from policy makers contesting the utopianism of the disarmament argument. The realpolitik within the corridors of power remained inflexible towards pro-peace perspectives, mostly shunning them down as unrealistic, weak, or unpopular ideas. Therefore, feminist scholars (whether male or female) despite valuable contributions could not impact states’ strategic state preferences in favor of disarmament. These academic/scholarly biases will keep throwing curveballs in the way of FFP debates.

FEMALE LEADERS: A TEST FOR FEMINIST FOREIGN POLICY

In modern history, this paper showcases three minor cases of female leaders who addressed national security threats no different from male decision-makers. Unfearful of risking their popularity, some women leaders took bold decisions. For instance, Margaret Thatcher, Britain's first female prime minister (1982), is a good example. She risked severe criticism from her cabinet and public yet decided to go to war. Mrs. Thatcher’s domestic policies made her unpopular initially: she ordered government spending cuts and constraints on unions amid a decline in manufacturing that brought about simultaneous inflation and high unemployment. When Argentina invaded the Falkland Islands, Conservative Party members of Parliament, close friends, and allies, including U.S. President Ronald Reagan, advised her for peace talks instead of war. However, Margaret Thatcher chose war, sending a British naval task force 8,000 miles in South Atlantic to expel Argentina. After seventy-four days of fighting, the conflict ended with the Argentine surrender on June 14, 1982. Undeterred by her declining popularity and domestic criticism, strong-willed Mrs. Thatcher earned the title of ‘Iron Lady’.

Likewise, Ms. Indira Gandhi, daughter of the first Indian prime minister (Jawaharlal Nehru), a central figure of the Indian National Congress, also served as the first female prime minister of India for three terms (from 1966-1977; 1980-84). She envisioned India’s foreign policy known as Indira’s Doctrine ‘to increase India’s power into the extended neighborhood and beyond.’ One manifestation of her rule was Ms. Gandhi’s support of West Bengal’s movement that separated East Pakistan from the West and successfully launched a diplomatic campaign to shape international opinion in favor of India’s military intervention. In 1975, she was convicted of electoral corruption in the 1972 elections by the High Court of Allahabad,

prohibiting her from another election for six years.\textsuperscript{33} Instead of resigning, Mrs. Gandhi responded with a state of emergency, restricting the civil liberty rights of the citizens, censoring the press, and detaining her opponents without trial. Many critics in India remember the time of suppression as ‘Reign of Terror’. Some argue that Ms. Gandhi was “a no-nonsense Prime Minister and demanded total and unquestioned obedience. Some also stated that Indira Gandhi was the only ‘\textit{man}’ in the Cabinet.”\textsuperscript{34} Ms. Gandhi was assassinated in 1984 while she was the prime minister of India by her security guards seeking retribution for the communal violence of the Sikh community. The Sikh uprising ignited when Indira ordered to suppress the demands of Sikhs using force.

In 1996, Sheikh Haseena Wazid - daughter of Sheikh Mujibur Rehman - the founding father of Bangladesh, became an elected prime minister. She is the longest-serving female prime minister (from June 1996-July 2001 & Jan 2009 - today). Ms. Wajid joined politics in 1981 as president of the Awami League. Ms. Haseena’s life struggles to explain her political determination. In 1975, her parents and three brothers were assassinated before she stepped into politics. She faced six years in exile in India, several detentions, and house arrests followed by protests and strikes during the martial law regime. Under her premiership, Bangladesh progressed on several fronts, including a high literacy rate, employment opportunities, and six percent economic growth; however, “enforced disappearances, in particular, have become a hallmark of Prime Minister Sheikh Hasina Wazed’s current decade-long rule.”\textsuperscript{35} The report cites an activist stating political suppression in the country around the 2018 general elections where Haseena’s ruling government ordered mass arrests. He says, “In terms of media space and civil society space, I don’t think we’ve ever had such a bad situation. Even under previous military regimes, people had the right to speak up. They were not subject to disappearance.”\textsuperscript{36} While the international community raised concerns about extrajudicial killings and forced disappearances, the government ignored all requests for an independent investigation. Haseena Wajid’s political tenure is no different from her counterparts and cannot “escape some controversies.”\textsuperscript{37} Haseena’s authoritative policies despite being an “elected” member do not offer a hopeful case of increased women’s representation. It is hard to dismiss the notion that there is no rule to feminist exception. Power and authority, even when vested through

\textsuperscript{33} “Indira Gandhi: Prime Minister of India,” Britannica Encyclopedia at https://www.britannica.com/biography/Indira-Gandhi


\textsuperscript{36} Ibid.


\textit{Spring 2024}
democracy, may not always be non-hierarchical and non-violent.

PAKISTAN’S NUCLEAR PROGRAM UNDER FEMALE PRIME MINISTER, BENAZIR BHUTTO

Benazir Bhutto was an extraordinary woman in South Asia’s politics. She was the daughter of the former prime minister, Zulfikar Ali Bhutto, who won the elections twice and served as Pakistan’s first female prime minister. Ms. Bhutto’s premiership brought hope for liberal democracy, women empowerment, and nuclear nonproliferation norms. Mrs. Bhutto was an ambitious political leader who studied abroad in the world’s best universities and married another feudal lord, Mr. Asif Ali Zardari (also former president of Pakistan). Mr. Zulfikar Ali Bhutto was a proud patriarch who shared his words of wisdom with his daughter in the last days of his execution. Born of rich parents, Benazir’s education and international exposure contributed to her bold and courageous personality that fulfills 3R’s of FFP: Rights, Resources, Representation. Emily MacFarquha describes Benazir Bhutto as “a product of the anti-war years at Harvard, was seen to be the real anti-nuclear thing. She was everyone's best hope for a democratic, bomb-free Pakistan.” However, when it came to power, she was no less different from her counterparts. She supported nuclear weapons as a necessary deterrent after India’s (1975) nuclear explosion and believed that Pakistan’s nuclear program was critical for the regional balance of power. After India’s nuclear tests of May 1998, Benazir Bhutto (who was not in power) writes in Los Angeles Times, “If a preemptive military strike is possible to neutralize India's nuclear capability, that is the response that is necessary.” Many Indian critics blame Benazir Bhutto for ‘supporting terrorism’ in Indian-held Kashmir. Ajai Sinha, executive director of the Institute for Conflict Management, told ABC News, “I would find it very difficult to find a single element with her relationship to India that is positive and for the betterment of her country or the region.” India’s leading newspaper Hindustan Times describes Benazir as: “hawkish on India and Kashmir, giving New Delhi sleepless nights by raising the human rights issue in Geneva…It was a period of virtual non-contact between India and Pakistan.” In her interviews during foreign visits, Benazir Bhutto projected her perseverance to fight for democracy against military dictators who killed her father, yet, back


home, she was in a Feminist constant struggle to prove her loyalty to the nuclear cause and emerging nationalism. Therefore, to argue that Prime Minister Benazir Bhutto was in constant disagreement with the military is an overstatement. Bhutto's strained relationship with the military was primarily limited to General Zia, who ordered the execution of her father in a highly controversial trial. However, she remained critical of military generals for obstructing democracy in Pakistan and keeping nuclear matters secret from her.42 Shuja Nawaz, author of Crossed Swords, who interviewed (late) Benazir Bhutto writes that “she had been kept in the dark about these issues” and when “she asked for briefings and was told they would be given but never were.”43 Feroz Khan, Pakistani American scholar, explains that Benazir Bhutto’s entry into Pakistani politics as part of a political deal with then army chief General Aslam. From historical standpoint, Pakistan’s elections and political wins are mostly orchestrated by military establishment’s approval at the behest of the sitting army chief. Feroz Khan, in his famous book Eating Grass: The Making of the Pakistani Bomb, writes: General Beg brokered a five-point deal with Benazir as quid pro quo for her becoming prime minister: (1) not to be vindictive toward the family of Zia-ul-Haq; (2) not to change defense policies or interfere in the affairs of the armed forces; (3) not to make sweeping bureaucratic/administrative policy changes; (4) not to alter the Afghan policy, and to keep the experienced Sahabzada Yaqub-Khan as foreign minister; and, most important, (5) not to alter nuclear policy, and to let the veteran President Ghulam Ishaq Khan guide and control the secret nuclear program.44

General Aslam Beg confirmed his plan to bring Benazir Bhutto to power in his interview to Herald (2001) where he and General Hamid Gul decided to create an electoral alliance of religious and conservative parties to avoid PPP from coming into power with two-third majority. According to Hamid Gul (then DG-ISI), “a sweeping election win by the PPP would be detrimental to the causes dear to the military.”45 Therefore, the Pakistani military establishment strategized a covert political maneuvering to prevent any political party from obtaining a two-thirds majority in parliament, that would enable them to wield constitutional powers to implement reforms in the country. To maintain its hold on power, the establishment employed a weak coalition governance, consistently subjected to scrutiny and reproach from opposition parties, and insufficiently empowered to effect significant governmental reforms. As a result, the military remains the preeminent force capable of regulating, supervising, and adjusting the power dynamics among the various stakeholders within Pakistan. Any political leadership that garners significant public support and seeks to employ that popularity to effect substantial changes to the powers of the executive branch or to curtail the authority of the

judiciary or military is met with strong resistance. In such cases, the opposition parties are mobilized to dissolve the government through the exercise of power politics. Given the military's pervasive influence in the country, exemplified by the controversial trial and execution of Benazir Bhutto's father by a former military dictator, Bhutto sought to maintain cordial relations with the military and supported its policies on key issues such as, nuclear program, military weaponry and equipment, Kashmir issue, relations with Afghan Government. In one of her official trips to Washington, she tried to convince American leadership that Pakistan was not pursuing the nuclear weapons path so that the U.S. would release the confiscated weapons, including F-16 aircraft. Although she was unsuccessful in her diplomatic stunt, “She had shown her military generals that she still carried clout enough in Washington to resist nuclear concessions and yet bring some military hardware home.” 46 Benazir Bhutto held a steadfast commitment to Pakistan's nuclear program, which she viewed as an essential aspect of her father's political legacy. The vision of Zulfikar Ali Bhutto, who initiated the country's nuclear program, 47 served as a driving force behind Benazir Bhutto's support for the program. During her two terms as Prime Minister, she provided substantial funding for various national security and defense initiatives. In terms of nuclear policies and national security, her political beliefs aligned closely with those of the military. Zahid Hussain writes that Benazir’s stance was firm about Pakistan’s nuclear weapons that it is “linked with the Jammu and Kashmir issue” and vowed that “Pakistan would not give up its nuclear weapons program despite pressure from Washington.” 48 Nonetheless, “Pakistan’s generals and intelligence officials have never trusted Bhutto, and they still believe she is too beholden to the Americans.” 49 However, with regard to matters concerning nuclear affairs, critics contend that the military’s covert nuclear program was impervious to the involvement of civilian authorities. Some individuals assert that it was not a matter of gender but rather that “civilian engagement in the secretive military program was not deemed desirable.” 50

Shyam Bhatia, an Indian-born British investigative journalist, cites his interview with Benazir Bhutto (2004), in his book Goodbye Shahzadi: A Political Biography of Benazir Bhutto. Bhattia writes that when Benazir Bhutto visited North Korea for the second time as Prime Minister, she was requested by A.Q. Khan to ask for No-Dong missiles. The book recounts that during a state banquet featuring chestnuts and steamed fish, Bhutto nervously


stammered while requesting the favor from North Korea's founding father, Kim Il-Sung. She “reportedly returned home with design details for a North Korean NoDong missile.”51 Bhatia claims that “Before leaving Islamabad she shopped for an overcoat with the 'deepest possible pockets' into which she transferred CDs containing the scientific data about uranium enrichment that the North Korean wanted.”52 According to Benazir Bhutto, A.Q. Khan was used as a scapegoat to cover up the involvement of higherups including some military officers who sanctioned A.Q. Khan’s visits and had the details of his visits to North Korea. She said, “He [A.Q. Khan] couldn’t even leave the country without somebody watching everything he did, and to accept that he ran an international operation — that Israeli businessmen were involved, Indian businessmen were involved, that parts were coming from South Africa and Malaysia without anyone knowing — is unbelievable.”53 Despite the contention of some critics who argue that Shyam Bhatia lacks evidence to support his claim of an off-the-record conversation,54 David Albright, a prominent expert in nuclear nonproliferation, asserts that the narrative is plausible because of “the timing of the data transfer would correspond to other information suggesting North Korean interest in acquiring uranium enrichment technology.”55 Benazir Bhutto was an authoritative political leader who wanted to enjoy power over all affairs, much like her father.

In case of Iran, she not only voiced her opposition but also attempted to stop the transfer of centrifuge technology agreed between two militaries because the deal was negotiated without her knowledge. Douglas and Collins write, “Bhutto…was furious to find out from Rafsanjani that Pakistan was providing its nuclear technology to Iran. She said she responded by ordering that no nuclear scientist be permitted to travel outside Pakistan without her approval.”56 Nonetheless, her stance was notably divergent in the case of North Korea, as A.Q. Khan garnered her trust and solicited her aid in brokering discussions with the North Korean leader pertaining to missile designs. Here, Benazir not only approved A.Q. Khan’s move to seek designs but also became part of the game. In fact, “When she returned from her trip, Bhutto


53 Ibid.


handed over the designs for the missile to Khan.”\footnote{Ibid.} Pakistan’s military exercises strong control on political and national security affairs of the country for decades. The civilian leadership in the national command authority (NCA) receives information on a need-to-know basis that constrains decision-making powers of the head of the government as well as the state. Similarly, it was not Benazir Bhutto “as a woman” but “as a civilian” threat to Pakistani military authorities who were reluctant to give her more space on nuclear/security-related details. The civil-military relations (CMR) in Pakistan operates in favor of pro-war, pro-weapons, pro-nuclear and hence higher defense budget stance coming from military. The civilian leadership encountered the classic predicament where “Prudent leaders make choices that they think will help them retain power: they choose in such a way that they do not precipitate an internal overthrow of their authority.”\footnote{Bruce Bueno de Mesquita and Randolph M. Siverson, “War and the Survival of Political Leaders: A Comparative Study of Regime Types and Political Accountability,” \textit{The American Political Science Review} Vol. 89, No. 4 (Dec. 1995), p. 843.} Many Pakistani prime ministers (male) received the similar treatment from military leaderships of the time and were ousted either through martial law regimes or replaced by quasi-martial law/pseudo-democratic governments in Pakistan because they tried to control authority relationship vis-à-vis military.

CONCLUSION

The adoption of a feminist foreign policy by democracies that uphold women's empowerment, inclusive social norms, and increased women's representation in leadership encounters serious practical hurdles some of them stem from broad assumptions of feminism. The FFP framework involves debates that lack coherence and consistency both among themselves and when compared to historical approaches. This paper addresses through academic, analytical, and empirical approaches that women led, or women/gender inclusive foreign policy vision may not sponsor anti-militarist, non-hierarchical, non-nuclear/denouncing weapon exports, conflict preventing and diplomacy over war kind of policy outcomes.

FFP does not explain how increased women representation in leadership roles would shape pro-peace policies or would stop on-going armed conflicts. The proponents of feminist foreign policy have not explained how interstate conflicts could be avoided if feminist foreign policy was in place? The study showcases four examples from the recent history with countries led by female leaders Mrs. Thatcher, Mrs. Indira, Mrs. Bhutto, and Mrs. Wajid, who decided for conflicts when national security was called into question. These cases revolve around strong-
willed leaders which make it hard to believe that women representation would have decided diplomacy over armed conflicts. The option of diplomacy was always on the table, but they approached national security with Realism.

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American Sanctions on China's Space Program: Effective Economic Statecraft?

Paul J. Bolt

American economic statecraft as a tool to manage competition with China’s Space Program is likely to remain contentious as it amplifies enduring debates in U.S. foreign policy: i) the tension between international realism and American liberalism; ii) the questionable benefit of government involvement in picking winners and losers from the private sector; and iii) the difficulty of defining long-term success in foreign policy outcomes.

Economic statecraft has been foundational to American interactions with the People’s Republic of China. After the communist victory in China’s civil war in 1949, the United States restricted trade with China. After the PLA killed citizens in Beijing in 1989, the US imposed an arms embargo that continues to this day. More recently, the US has increased tariffs on China, restricted imports from Xinjiang, sanctioned Huawei and other Chinese companies, sanctioned leaders affiliated with the crackdown on Hong Kong, limited Chinese investments in the United States, and restricted the sales of advanced microchips and equipment using American technology that can produce semiconductors. China has reciprocated with its own sanctions against the US.

This paper presents a case study of American policies regarding China’s space program. Such policies have consisted of a confused mix of incentives, sanctions, and outright prohibitions. There is clearly an economic component to this policy, as space launches, satellite production, communications, and GPS technology generate large profits. However, with the dual use nature of space technology (military and civilian purposes) as well as the cutting-edge character of such technology, there are national security, strategic, scientific, and reputational components to American economic statecraft as well. Moreover, segments of the space industry are still financially dependent on government, lessening the distinction between national security and private business interests. American policy has at times been driven by multiple pressures, bureaucratic actors with competing interests, and inconsistent objectives. As a result, the American approach has been more chaotic than rational, although policy has become more consistent in recent years with increasing restrictions on China’s space program beginning in the early 2000s.

SHIFTING AMERICAN POLICY TOWARD CHINA’S SPACE PROGRAM: COMMERCIAL, POLITICAL, BUREAUCRATIC, AND NATIONAL SECURITY INTERESTS

Geopolitics has played a major role in Sino-American relations and subsequently cooperation in space. One of the initial motivations for Nixon’s opening to China was to build a partnership against the Soviet Union during the Cold War and utilize China’s help in ending the

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1 For a comprehensive list of stories on American sanctions on China from the South China Morning Post, see https://www.scmp.com/topics/us-sanctions-china.
Vietnam War. During the Carter and Reagan administrations, the US saw China as a quasi-ally against the Soviets, shaping American policy towards China’s space program specifically and technology transfers more broadly. So, for instance, in 1979, shortly after normalization, Jimmy Carter and Deng Xiaoping signed an Agreement between the Government of the United States of America and the Government of the People’s Republic of China on Cooperation in Science and Technology. One of the areas included under the agreement was space.²

In September 1988, President Reagan permitted American-produced communications satellites to be launched on Chinese rockets under conditions specified by three memoranda of agreement between the US and China written, in part, to protect American technology. Reagan justified the move as enhancing American security and furthering trade, and export licenses were approved for the launch of three Hughes communication satellites in 1989. However, major debates preceded the decision. The explosion of the space shuttle Challenger in 1986, along with subsequent failures of Titan and Delta rockets, left US satellite makers with few options due to a lack of available rockets to take satellites into space. Thus, while satellite manufacturers lobbied to allow satellites to be launched in China, rocket manufacturers in the United States and Europe fiercely opposed the move. Within the administration itself, the Transportation Department opposed Chinese launches on national security grounds and to protect the competitive interests of American rocket manufacturers, while Commerce and State gave qualified support to the proposal.³

The 1990s proved to be an eventful decade in US-Chinese space relations. It was characterized first by battles in Washington over US satellites launched on Chinese rockets, with sanctions placed on Beijing over human rights concerns and missile proliferation and presidential waivers to such sanctions. The political battles occurred both within administrations and between the president and Congress, with debates on whether it made more sense to cooperate with the Chinese in space or exclude them to protect American technology and questions over who should have the authority to approve satellite exports. There were continued lobbying efforts by rocket manufacturers to restrict satellite launches and satellite manufacturers to allow them, accompanied by substantial political donations. There were successful launches of American satellites in China but also spectacular failures where people were killed. The assistance that American companies gave in improving China’s rocket systems in the wake of these disasters ultimately led to investigations and loud accusations that Americans gave too much technology to a rising China. All of this took place in the context of debates over the importance of military versus commercial considerations in space.

The first event to interrupt the launch of American satellites on Chinese rockets was the killing of Chinese citizens by the PLA as soldiers fought their way through Beijing to Tiananmen Square on 3–4 June 1989. Congress prohibited satellite export licenses, but allowed waivers if China made human rights progress. President Bush issued a waiver in December 1989 for three satellites that had been earlier approved. Additional sanctions were imposed in

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² The signed text of the agreement can be found at https://www.energy.gov/sites/default/files/pi_iec/098b7ef980003cff.pdf.
1990, and Bush again issued waivers. As a result, an American satellite, the Hughes-built Asiasat-1, was launched into space on a Chinese Long March rocket by the China Great Wall Industry Corporation on 7 April 1990. In the same year, the Bush administration also permitted Soviet rockets to also launch American satellites.4

The launch of the next two American satellites, the Optus B1 and B2, were delayed by a different issue. In June 1991, the Bush administration imposed sanctions on supercomputers, missile technology, and satellites due to China providing M-11 short range ballistic missile (SRBM) technology to Pakistan. Thus, while the original sanctions on American satellite launches were due to human rights issues, the new sanctions were aimed at Chinese missile proliferation. The sanctions were waived in March 1992, and the Optus satellites were launched in August and December. Additional sanctions on satellites were imposed by the Clinton administration in 1993 due to China’s transfer of M-11 equipment to Pakistan, and these were waived after a nonproliferation pledge by Beijing in 1994. Later during the George W. Bush administration, the US sanctioned Chinese companies for missile proliferation by banning satellite export licenses in 2001 and 2003.5

Another issue that played out during the 1990s centered on which agency had the authority to approve satellite exports as well as satellite technology and components, demonstrating the importance of bureaucratic politics to American economic statecraft. This was vital not only for the US-China space relationship, but also American allies. Until 1992, the United States controlled the export of satellites as if they were munitions, thus requiring that stringent State Department criteria be met before approval for export to China or any other country. However, in 1992 the Bush administration agreed to allow less advanced communication satellites, measured by nine criteria, to be exported under licenses granted by the Commerce Department with less restrictive requirements. This made it easier to export American satellites and components, although satellite technology and manufacturing methods remained on the munitions list. This move was beneficial for the American satellite industry. The Clinton administration further relaxed the rules in allowing communication satellites to be licensed by Commerce, a move that State fought against and lobbied Congress to change.6

The question of which agency approves satellite exports is an issue of bureaucratic politics, with different agencies trying to expand their power. However, there are also fundamental philosophical and national security issues at stake. First, are satellites primarily about national security or commerce? The answer changes as technology advances, the number of satellite producers increases, and national power ratios change. Second, is American national security best promoted by a robust satellite industry that is economically competitive abroad, or by a policy that protects American technology at the cost of commercial gains?7

The United States signed commercial launch agreements with China in 1995 and 1997.

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4 Reddy, 237-238; and Zhang and Seely, 4-5.
7 Lewis makes the case that restrictions hurt both security and commerce.
Throughout the 1990s, 26 waivers were granted for satellites to be launched on Chinese rockets, with the last waiver issued in 1998. These included satellites from Motorola, Hughes, and Loral. Chinese rockets aided the American satellite industry by lifting satellites into orbit relatively inexpensively when other options were limited. However, there were also launch failures and disasters. In December 1992, a Chinese rocket carrying a Hughes communication satellite exploded, and Hughes conducted a seven-month review to assess the cause of the accident. In January 1995, a Chinese rocket that carried the Hughes Apstar 2 satellite exploded on the launch pad, killing six workers and leading to another investigation. Then in February 1996, a Long March 3B crashed onto the launch tower, destroying a $200 million Loral satellite and killing numerous people. A review led by Loral consisting of team members from seven satellite companies ensued.9

At this point actors in the United States government began to fear that accident investigations were transferring rocket technology to China in a manner that could harm US national security by aiding Chinese missile programs. The technical assistance provided by American companies to China’s space programs after these disasters led to enhanced scrutiny of satellite exports and new concerns that American corporations were aiding the Chinese military. These fears were bred in part by the fact that there is little distinction between China’s civilian and military space programs.

In 1998, Congress created a select committee to investigate US-built satellites being launched in China, as well as other issues related to American security vis-à-vis China, demonstrating the importance of domestic politics on US economic statecraft. The committee was headed by Representative Christopher Cox. The unclassified version of the committee report charged that US companies had funded Chinese military modernization and ultimately strengthened Chinese ballistic missile capabilities. The report asserted that sensitive information was not protected at launch sites and improper information had been shared with insurance companies. The committee concluded that the work done for China by Hughes and Loral had enhanced China’s military capabilities in violation of the International Traffic in Arms Control Regulations (ITAR). Moreover, working with Western companies had also aided China in learning diagnostic processes. The committee noted a variety of other ways in which the work of western companies harmed US security interests, such as Lockheed Martin assisting China with a kick motor for a satellite. The Justice Department began its own investigations, and Lockheed Martin settled with the government for $13 million in 2000. Loral agreed to a $20 million settlement, while Hughes and Boeing reached a $32 million settlement with the State Department for violating ITAR.10 While some analysts disagreed with the conclusions of the Cox committee and believed they were unfair, the report set the tone for further restrictions on...
American Sanctions

space cooperation with China. At the same time, there were growing American concerns over Chinese industrial espionage. These fears later intensified with widespread evidence of the loss of American intellectual property to China.

Political struggles between Republicans and Democrats exacerbated the national security debate. There were claims that Chinese citizens linked to the space industry had illegally funneled money to the Democratic Party, while the chief executive of Loral was the biggest donor to the Democrats in 1996. Opponents of President Clinton argued that American policy on the export of satellites to China was based on political considerations rather than national interest. The Justice Department and both houses of Congress launched investigations on the export of satellites for launch.

From this point on, American economic statecraft towards China’s space program consisted of further restrictions on cooperation. The Strom Thurmond National Defense Authorization Act of Fiscal Year 1999 moved satellites back to the US Munitions List, thus shifting the responsibility for export licenses from the Commerce Department back to the more restrictive State Department. The State Department then declared that even fundamental research on satellite technology counted as munitions, stifling cooperative research efforts between American and international universities. The Act also required the president to notify Congress 15 days before any export of missile equipment or technology, certifying that such exports do not violate specific American interests. With this, Congress dampened the prospects for cooperation not only with China but also other states, including European allies and Japan.

While new rules in 2014 eased controls for European and other states, the rules did not change for China.

The issue of space was contentious during the George W. Bush administration as it was during the Clinton administration, although there was notable space diplomacy. In 2004 the head of the Chinese National Space Administration (CNSA) visited NASA, and in 2005 CNSA’s vice administrator gave a presentation at the National Space Symposium in Colorado Springs. In 2006, NASA administrator Michael Griffin visited CNSA in China. However, the administration’s abrogation of the Anti-Ballistic Missile Treaty and the militant tone of the 2006 US Space Policy alienated Beijing. The Bush space policy emphasized American control of space, freedom of action, and preventing adversaries from using space capabilities viewed as

detrimental to American interests. Moreover, China’s 2007 debris-generating anti-satellite test shocked the United States. During the Obama administration, NASA administrator Charles Bolden visited China in 2010 and in the same year the administration’s National Space Policy outlined a more cooperative space doctrine. However, in 2011 Congress acted to forestall any serious bilateral engagements with China in space. The Wolf Amendment, named after former Congressman Frank Wolf and renewed every year since 2011, prevents funds allocated to NASA or the Office of Science and Technology Policy (OSTP) from being used in bilateral cooperation with China or Chinese-owned companies. This severely restricts any partnership between the US and China in space. Although the Wolf Amendment does not specifically ban cooperation among private companies, it has a chilling effect.

Nevertheless, the ban does not apply to working with China in multilateral organizations, such as the Inter-Agency Space Debris Coordinating Committee (IADC), which includes NASA, CNSA, as well as eleven other space agencies. There have been other limited areas of cooperation between China and the United States. For example, there was data sharing related to the Chang’e lunar mission, and in 2014 the US National Academy of Sciences and Chinese Academy of Sciences held meetings relevant to space. There has also been cooperation in earth observation and shared meteorological data. Further, during the Obama administration, the US Air Force Academy’s Eisenhower Center held Track Two discussions with the Chinese on space activities under the sponsorship of the Defense Department’s Office of International Security Affairs.

Since the Wolf Amendment was first passed by Congress, the political conditions between China and the United States have further deteriorated. The PLA and state corporations tied to China’s military dominate China’s space endeavors, although China has attempted to introduce civil-military integration into the space sector, and there continues to be a lack of transparency in China’s space goals. The general political climate between the United States and China continues to worsen, harmed by disputes over trade, intellectual property, the South China Sea, the Diaoyu/Senkaku Islands, COVID 19, Taiwan, and China’s unwillingness to condemn Russia for its 2022 invasion of Ukraine. American charges of Chinese human rights violations in Xinjiang and Tibet are seen by Beijing as an effort to undermine CCP rule, while the strengthening of the Quad, AUKUS, and NATO’s public concerns about China lead Beijing to believe that Washington is forming an international coalition to counter China’s rise. Continued improvements in PLA and American capabilities fuel a security dilemma. Moreover

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18 Reddy, 244-247.
China's “Made in China 2025” strategy and American pushback on Huawei and Chinese semiconductor manufacturers make technology an even greater field of competition. Perhaps most importantly, space is seen by both countries as an arena of strategic competition and a warfighting domain. In September 2016 the US House of Representatives Subcommittee on Space held hearings entitled Are We Losing the Space Race to China? where committee members and panelists lamented sluggishness in US space programs and major gains in China’s program. In March of 2019, Vice President Mike Pence asserted that the US and China are in a new high stakes space race, with China having an “ambition to seize the lunar strategic high ground and become the world’s preeminent spacefaring nation.” Kevin Pollpeter and co-authors, in a report for the US-China Economic and Security Review Commission, assert that “China’s goal is to become a space power on par with the United States and to foster a space industry that is the equal of those in the United States, Europe, and Russia,” although the report also notes that in spite of China’s progress, it is still only a “partial space power.” China, Russia, and the United States further engage in satellite maneuvers that involve espionage and perhaps rehearsals of space war tactics.

China’s English language sources designed for foreign consumption often downplay the element of a space race. For example, Liang Xiao asserts that China is not seeking to compete with the US in space, instead being a cooperative power that sees the universe as belonging to everyone. Liang asserts the US claims of a space race come from the desire for space-related agencies to gain bigger budgets and the colonial ideology of the US. As a 2022 RAND report notes, China and Russia both emphasize the need to avoid arms races, including in space, while they engage in such arms races. Nevertheless, China's official mission in space does explicitly include a national security aspect. The space white paper states China’s space mission is: to explore outer space to expand humanity's understanding of the earth and the cosmos; to facilitate global consensus on our shared responsibility in utilizing outer space for peaceful purposes and safeguarding its security for the benefit of all humanity; to meet the demands of economic, scientific and technological development, national security and social progress; and to raise the scientific and cultural levels of the Chinese people, protect China's national rights

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20 US Congress, House, Subcommittee on Space, Committee on Science, Space, and Technology, Are We Losing the Space Race to China: Hearing before the Subcommittee on Space, Committee on Science, Space, and Technology, 114th Congr, 2nd sess, 27 September 2016.
21 Kevin Pollpeter, Timothy Ditter, Anthony Miller, and Brian Waidelich, China’s Space Narrative, China Aerospace Studies Institute, 2020, 7.
and interests, and build up its overall strength. Moreover, China sees US space activities as threatening to China’s national security. Beijing believes American counterspace capabilities and threats to China’s nuclear deterrent from space-based assets demonstrate hostile American intent.

Chinese strategists clearly see space as essential to national security, discussing space as the ultimate high ground and viewing the US military’s reliance on space as a weakness that can be exploited. China’s focus on space and development of counterspace weapons, illustrated by the 2007 direct ascent anti-satellite (ASAT) test that caused a great deal of space debris, clearly demonstrates that the PLA does indeed treat space as a domain of strategic competition. Chinese sensitivities regarding space are seen in in the Global Times article where analysts complain about Starlink satellite constellations launched by SpaceX, seeing them as a military threat to China.

However, talk of a space race must be kept in perspective. Both China and the United States are using space as part of their broader political and military competition. Furthermore, China does threaten American space assets. Nevertheless, the United States is still the premier space power. It accounts for over half the satellites in space, almost seven times as many as China. China spent almost $9 billion on space in 2020, compared to $48 billion by the United States. Furthermore, as China’s assets increase in space, it may become more invested in a safe space environment. China has not repeated the 2007 ASAT test, while Russia conducted such a test in 2021, causing significant debris, and India carried out an ASAT test in 2019.

HAS THE UNITED STATES ACHIEVED ITS OBJECTIVES?

Has American statecraft toward China’s space program achieved its objectives? This is a complex question. American objectives have varied over time. They have included pressing China to improve human rights, halting Chinese missile proliferation, protecting the American rocket industry, promoting the American satellite industry, preventing the transfer of American

27 Blanc et al.
28 Pollpeter et al, China’s Space Narrative, 55-64.

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technology to China, and isolating China’s space program from international partners. The proper way to use economic statecraft to achieve these goals has been contested – various administrations, Congresses, executive branch agencies, and lobbying organizations for the US space industry have taken different perspectives on economic statecraft. In a world where China has had more than one potential partner for space cooperation, the amount of leverage held by American economic statecraft is also debatable.

American limitations on cooperation with China’s space program have had no discernable effect on Chinese human rights policies. Although Congress imposed sanctions on China’s space program after the Tiananmen Square violence, these sanctions were quickly waived by the president, indicating that space sanctions were not seriously meant as leverage over human rights. Sanctions designed to convince China to end missile proliferation were more long-lasting. Between 1991 and 2009, the US sanctioned Chinese firms and individuals 26 times for weapons or missile proliferation, including bans on satellite exports for launch in China in 2001 and 2003. While China’s behavior in terms of proliferation improved as it began to see its own interests differently, it is uncertain if this was tied to the ban on US satellite exports.

American sanctions have been largely successful in preventing American technology from being used in the Chinese space program. In a report by the Johns Hopkins Applied Physics Laboratory, Matthew Daniels asserts “US and Chinese space technologies and activities are substantially separated today: there are almost no direct links between the United States and China with regard to space technology research, development, and operations.” This is due to both American and Chinese policies controlling space technology.

Nevertheless, China has a lengthy list of space achievements in the military, commercial, and civic domains, bolstered by indigenous supply chains. While not as advanced as the American program, China’s space program is comprehensive and innovative. For example, China has developed a reusable space plane, has completed its BeiDou worldwide satellite navigation system, has enhanced its space launch capabilities with new rocket developments, and has over 200 satellites in its reconnaissance and remote sensing fleet. Many of China’s communications and remote sensing satellites are of high quality. The PLA has also developed robust counterspace systems. In civil space, China has deployed the Tiangong space station, 33 Kan, “China and Proliferation,” 51, 58-64.

34 For an argument that China should be allowed to join the Missile Technology Control Regime (MTCR), see Victor Zaborsky, “Does China Belong in the Missile Technology Control Regime?” Arms Control Today, October 2004, https://www.armscontrol.org/act/2004-10/features/does-china-belong-missile-technology-control-regime. China has agreed to adhere to the regime, but has not become a member.

35 Daniels, 3. For a comprehensive list of the costs and benefits of the separation of the US and Chinese space programs, see 13-16.


37 Office of the Secretary of Defense, “Military and Security Developments Involving the
which may in coming years be the only manned space station if the life of the ISS is not extended. The final module of the space station was launched in October 2022. In 2019 China landed a spacecraft on the far side of the moon, and the following year sent a spacecraft to the lunar surface that picked up rocks and soil and returned them to earth. China also released a land rover on Mars. In 2022 China had 64 orbital launches, second only to the US in tonnage, with similar plans for 2023. China is developing reusable rockets and has plans to send astronauts to the moon and then Mars.38

In terms of protecting the American space industry, sanctions on China resulted in lost revenues in the past. In 2001, the Satellite Industry Association claimed that the transfer of satellite export controls to the State Department cost California’s satellite industry over 1,000 new jobs and $1.2 billion in potential revenue. Similarly, James Andrew Lewis makes the case that in 1995 US satellite component suppliers had 90 percent of the market, dropping to 56 percent in 2000. In the same timeframe, Europe’s share jumped from under 10 percent to 34 percent. This was caused in large part by US export controls. Export controls create delays while adding expense, uncertainty, and risk.39 In other words, US sanctions on China that extended to the rest of the world created a degree of international isolation for American satellite companies.

Have US sanctions isolated China’s space program internationally? Here the record is mixed. Most notably, China has been kept out of participation in the ISS by American opposition, leading China to develop its own space station. While China has obtained essential technology through foreign cooperation, reverse engineering, and espionage, it is difficult to know what has come from outside sources and what has come from Chinese innovation due to the opaque nature of its space program.40

Not surprising considering the strength of their overall relationship, there has been cooperation in space between China and Russia. In the 1950s, the Soviet Union assisted China with rocket technology. In the 1990s, Russia provided China with a life support system and docking mechanism that China adapted for its Shenzhou space capsule, as well as trained Chinese astronauts. The two states have integrated their satellite-based navigation systems, GLONASS and BeiDou, and worked together on science projects. China has purchased additional space technology from Russia as well. And in 2021, China and Russia agreed to work together on plans for a moon base, the International Lunar Research Station, although there are

People’s Republic of China 2021,” 66-68.


significant challenges before this becomes a reality.\textsuperscript{41}

Space cooperation between Europe and China has been particularly interesting. Europe, both the European Space Agency and individual European countries, has taken a different approach from the US, seeking to forge a more cooperative partnership with China that has had mixed results. This approach is rooted in Europe’s longing for strategic autonomy. Europe does not want to be dependent on the United States for its space activities. A report by the European Parliament in 2020 notes that the Galileo global positioning system is an example of strategic autonomy in space because it is an autonomous European system that can enable European armed forces. American ITAR restrictions demonstrate a lack of European strategic autonomy, as the US government imposes rules on European space systems that utilize American technology or parts. The 2020 Artemis Accords exhibit the lack of strategic autonomy as well, as the United States has induced individual European countries to sign on rather than engaging the European Union.\textsuperscript{42} Similarly, a researcher at the European Space Policy Institute asserted Europe’s best policy option regarding its relationship to China’s space program was to serve as a bridge builder between the US, China, and other states.\textsuperscript{43} Space cooperation with China has been seen by many European policy analysts as a means to balance the United States in a way that enhances strategic autonomy. Moreover, the limitations of the European space program require it to have international partners.

Individual European companies, as well as the European Space Agency (ESA), have cooperated with China in a variety of ventures. For example, from 2004-2007, the ESA collaborated on the Double Star project, two satellites with Chinese and European instruments, to study the earth’s magnetosphere. The Dragon and Dragoness programs stimulated cooperation on earth and maritime observation. France and China have worked on joint satellites to study the oceans and gamma ray bursts. The University of Surrey in the UK and Tsinghua University in China formed a joint venture to build microsatellites, launching the first one in 2000. Germany and China have worked on space life sciences. Most notably, the ESA and China have been in discussions on European astronauts visiting the Chinese space station. In 2012 the head of ESA’s human spaceflight division noted that some European astronauts were taking Chinese language lessons as ESA considered joint space missions with China. European space officials were frustrated with NASA canceling a US-European Mars project the previous year.\textsuperscript{44}

Chinese-European space cooperation faced a notable failure with the Galileo satellite

\begin{flushright}
\textsuperscript{43} Marco Aliberti, When China Goes to the Moon…(Cham, Switzerland: Springer, 2015), 289-300.
\end{flushright}
navigation project. China and Europe signed a cooperation agreement on Galileo in 2003, at a
time when some European countries and the United States were at odds over the Iraq war. There
were hopes that this project would deepen a strategic partnership between China and Europe.
However, by 2008 Europe had taken over the project completely. Cooperation was ended due to
several factors, including concerns over technology transfer to China, European fears that
China’s BeiDou system would be a competitor to Galileo, China’s 2007 ASAT test, and
American pressure to exclude China from the project. Thus, in spite of European desires to
cooperate with China in space for strategic reasons, Europeans were stymied not only by
American pressure but also Chinese policies that Europeans found objectionable.

Today there continues to be limited space cooperation between China and the ESA. For
example, ESA provided ground station support to the Chinese Chang’e-5 and Mars Tianwen-1
missions. The University of Geneva is scheduled to study gamma-ray bursts using the Tiangong
Space Station in 2025. However, political relations between China and the EU have been
worsening over human rights issues in China, Chinese political pressure on European states, and
especially the Ukraine war, likely limiting European-Chinese space cooperation in the short to
medium term.

China touts its international cooperation in space. Approximately one-third of China’s
2021 Space White Paper is devoted to international cooperation, noting that since 2016, 19
countries and regions, as well as four international organizations, have signed memoranda of
understanding or space cooperation agreements with China. China often refers to its launch
services, BeiDou satellite navigation system, and satellites as a Space Silk Road, under the
umbrella of Xi Jinping’s Belt and Road Initiative, implying that China’s space activities help
link mankind and benefit all states. Beijing also created the Asia-Pacific Space Cooperation
Organization (APSCO) in 2008, whose members include Bangladesh, China, Iran, Mongolia,
Pakistan, Peru, Thailand, and Turkey. APSCO is a vehicle through which China shares training,
ground stations, and satellite development projects with members, in turn gaining diplomatic
benefits as well as a market for space services and access to data that enhances space situational
awareness.

CONTEMPORARY DEBATES

Moving forward, there is some debate over American policy but little chance of short-
term substantive change. Congress has not seriously debated the Wolf amendment or changing
our relationship with China’s space program. The links between China’s military space
programs, civil space programs, and state-owned firms are still problematic from the American
perspective. Other issues include Chinese cyber-espionage, human rights violations, growing
counterspace capabilities, and the fact that space is part of the larger strategic competition
between the US and China. Some suggest tightening restrictions on China on overall

Pollpeter et al, “China Dream,” 29-30; and Aliberti, 266-269.

Times, 12 December 2022, https://www.nytimes.com/2022/12/12/science/tiangong-science-
physics.html.


See 2019 Report to Congress, 368. The APSA website is at http://www.apsco.int/.
More stringent restrictions, some of which have already been implemented, include making it more difficult for Chinese direct investment in American companies, limiting discussion on space with China in multilateral forums, erecting stronger barriers against cyber theft of American technology, and limiting visas for Chinese students and scholars. In 2023 there was even discussion of allowing the 1979 US-China Science and Technology Agreement to expire.

However, there are also voices suggesting that the United States needs to cooperate more deeply with China. Two types of cooperation are envisioned – scientific or technical cooperation in space, and policy cooperation to make space a safer place for all countries’ space assets. John Logsdon notes that renewing the Wolf amendment each year means there is not even a debate in the United States on cooperating with China. The US needs to begin probing whether collaborative work might be beneficial to both parties. Damon Coletta is more forthright. He argues that securing American power requires a strong focus on science, including scientific collaboration between American and international scientists. American export restrictions isolate the US from China and other countries, including US allies. Coletta compares such policies to import substitution, which ultimately leaves a country with lower levels of technology. Refusing to cooperate on basic space science projects with the Chinese ultimately harms American science and thus international leadership.

Similarly, the Secure World Foundation argues that US export controls did not hurt China, but instead damaged the American space industry. It asserts “By isolating China from…cooperative efforts in space, the United States has pushed China to launch its own space capabilities. Furthermore, this forced separation has allowed China to use its space program to create its own relationships with countries the United States has long ignored, particularly in Latin America and Africa.” The Foundation recommends that the Wolf amendment be modified to allow for limited cooperation with China, with priorities being space science, data sharing on orbital debris and weather, and robotic space exploration. In a very similar vein, the National Research Council argues that including China as an international space partner is in the interests of the United States. China’s financial and technical capabilities can enhance human space exploration. Cooperation with China can bring transparency, mitigate China’s development of

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49 See Are we Losing for the views of space experts and members of Congress on continued restrictions on China.
50 Daniels, 10-11.
53 Damon V. Coletta, Courting Science: Securing the Foundation for a Second American Century (Stanford: Stanford University Press, 2016), 134. For a broad discussion of scientific cooperation in space, see all of chapter 6.
55 National Research Council, Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration (Washington, DC: The
its own technology, and result in cost sharing on expensive projects.\textsuperscript{56} Cooperation with China could also help the United States understand China’s space bureaucracy, procedures, and capabilities.

Some advisors to President Biden have advocated limited cooperation with China. Basic scientific research may be an attractive initial agenda as it involves little danger of technology transfer and scientific discoveries would be beneficial to all.\textsuperscript{57} The 1995 docking between an American Apollo spacecraft and Soviet Soyuz capsule and the joint conducting of experiments by astronauts and cosmonauts are often pointed to as an example of space cooperation between rivals that can both advance science and ease political tensions.\textsuperscript{58}

Others are less interested in scientific cooperation and emphasize instead political cooperation that can make space safer and reduce the chances of war, as well as potentially improve political relations between China and the United States. For example, Peter Loftus in \textit{Air and Space Power Journal} argues that “space presents an excellent opportunity for cooperation between Washington and Beijing, with potential engagement including standardized rules for space, cooperation on space governance, an agreement banning kinetic strikes in space, and agreement not to disrupt spy satellites.\textsuperscript{59} In \textit{War on the Rocks}, Craig Kafura proposes a resumption of the US-China Civil Space Dialogue and Space Security Exchanges, neither of which has met since 2017. Such dialogues, in addition to forcing US government agencies to develop a common view of space norms, would be useful for helping Beijing and Washington understand each other, preventing accidents in a crowded domain, and minimizing conflict if space accidents do occur.\textsuperscript{60} Dealing with space debris is of common interest to both China and the United States as both sides have suffered from the effects of debris. For example, in 2022 a Chinese satellite collided with a piece of Russian space debris and was destroyed. In 2009 an American Iridium satellite collided with an obsolete Russian satellite.\textsuperscript{61} Still other

\textsuperscript{58} See, for example, Joan Johnson-Freese, “China’s Space Ambitions: It’s Not All About the U.S.,” \textit{Georgetown Journal of International Affairs} 15, no. 1 (Winter/Spring 2014): 146.
\textsuperscript{60} Craig Kafura, “Renew Space Dialogue with China,” \textit{War on the Rocks}, 10 February 2022.
analysts focus on the importance of diplomatic engagement between Russia, China, and the US to limit the weaponization of space.62

CONCLUSION

In sum, economic statecraft toward China’s space program was somewhat cooperative from the Reagan administration through the Clinton administration, although there was always conflict within the executive branch and between administrations and Congress. By the time of the George W. Bush administration, economic statecraft toward China was mainly punitive, dominated by the desire to protect American technology and slow China’s growth as a space power. Today there is some debate between those who want to maintain (or harden) American policies and those who seek some degree of cooperation, although there is little political will in the US to change policies considering growing competition with China. This case generates lessons on economic statecraft. First, policymakers split in ways similar to broader debates in the international relations literature. Those that take on a realist perspective see conflict between the US and China as inevitable across a broad range of domains, including space. The best policy prescription is to protect one’s own technology to the greatest extent possible. Those who take the opposite perspective suggest that economic and space cooperation can lead to political benefits. Cooperation in the technical sphere may stimulate cooperation in the political sphere. At the very least, limited cooperation in space can result in scientific breakthroughs and a much better understanding of how the Chinese think and operate.

Second, the application of economic statecraft in the United States is contentious because it creates winners and losers, both economically and bureaucratically. Restrictions on satellite launches in China hurt US satellite manufacturers and benefitted rocket manufacturers. Imposition of export controls also damaged economic ties between the United States and European allies, leading some European manufacturers to seek to build ITAR-free products unconstrained by US export controls. Bureaucratic agencies contended with each other over the regulation of space exports, most notably the State Department and Department of Commerce,63


while conflict over economic statecraft was reflected in rivalry between the executive and legislative branches.

Finally, the outcomes of economic statecraft can be difficult to measure. When the United States allowed American satellites to be launched on Chinese rockets, did assistance from American companies after launch failures significantly enhance Chinese missile capabilities? The experts were divided. If the United States had allowed China to join the coalition building and operating the International Space Station, would China have more or less technological knowledge than it does now after striking out on its own? We can’t know for sure. Ultimately however, it is difficult to identify discernible changes in Chinese space policy that can be linked to American statecraft. China has maintained a consistent space program shaped by its economic capabilities, security considerations, and quest for commercial gain.

As a result, future acts of international statecraft will remain contentious. Economic statecraft provides the hope of advancing important national interests without resorting to violence. Nevertheless, the complexity of the outcomes and the domestic costs for certain actors
mean that it will be controversial. This controversy is broadly seen across numerous sectors of the economic relationship between China and the United States and is only intensifying as China is perceived by Americans as a greater threat.

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Protecting the Cosmos: Defining Celestial Bodies in the Outer Space Treaty

David Epstein

Lack of a clear definition of the term “celestial bodies” as used in the 1967 Outer Space Treaty risks exporting legal and political conflict into the cosmos. *This essay is updated from a previously published version and appears here by permission of the Journal of Space Law at Ole Miss.

The fundamental precept of the Outer Space Treaty is that the exploration and use of outer space are “the province of all [hu]mankind”1 and “shall be carried out for the benefit and in the interests of all countries.”2 While the Treaty provides that “there shall be free access to all areas of celestial bodies,”3 Article II of the Outer Space Treaty states that “outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”4

The United States has signaled, through its national law5 and through the development and execution of international agreements such as the Artemis Accords,6 that it interprets Article II to mean that it is permissible, particularly for private enterprises and individuals, to extract and utilize resources from space, including the Moon and other celestial bodies, without running afoul of the provisions of Article II of the Outer Space Treaty or any other international law or obligation. As of March 2024, over 30 nations have signed the Artemis Accords, indicating their agreement with this interpretation.7 However, this understanding merely scratches the surface of the implications and meaning of Article II.

Deconstructing the language of Article II suggests that it may have truly been intended to restrict national – versus private – appropriation. Moreover, as we consider space with far

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1 The author would urge that future developments in space law should employ the inclusive term “humanity” rather than the more limiting, exclusionary, and etymologically archaic “mankind” in reference to the human race and human civilization.
3 Id. at Art. II.
4 Id. at Art. II.
6 The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids, NASA,https://www.nasa.gov/specials/artemis-accords/img/artemis-accords-signed-13Oct2020.pdf [hereinafter Artemis Accords]. The original signatories were representatives from Australia, Canada, Italy, Japan, Luxembourg, the United Arab Emirates, the United Kingdom, and the United States; these original parties have (as of this writing) since been joined by Angola, Argentina, Bahrain, Brazil, Bulgaria, Colombia, Czech Republic, Ecuador, France, Germany, Greece, Iceland, India, The Isle of Man, Israel, South Korea, Mexico, New Zealand, Poland, Romania, Singapore, Spain, Ukraine, Rwanda, The Netherlands, Saudi Arabia, Nigeria, and Uruguay.
more knowledge than we had when the Outer Space Treaty was negotiated, we must consider what is meant by the term “celestial body,” and even the term “outer space” itself. At first blush, the language of Article II suggests that nothing in space, including an orbital slot, or even the energy generated by our sun, may be “appropriated.” Yet it would be absurd to apply that literal meaning to Article II. Are parties to the Outer Space Treaty obligated not to “appropriate” even a miniscule speck of cosmic dust? If the resources contained in a so-called “celestial body” are extracted to the point where the celestial body disappears, does that cross a threshold into appropriation?

This paper suggests that we need to consider the implications of Article II carefully and the various ways it can be interpreted. It will review the history of Article II as well as the concept of “celestial bodies” and “outer space,” existing proposals to address these matters, and challenge participants in this discussion to apply a common-sense approach to the meaning of both terms to explore possible further solutions.

On June 13, 2010, in what was described as a “breathtakingly beautiful” streak of light across the sky over the South Australian outback, the Japan Aerospace Exploration Agency’s (JAXA) Hayabusa spacecraft became the first ever human object to land on an asteroid – a near-Earth object named Itokawa – and return to Earth with a sample of “1,500 tiny particles.”

On average, the particles were just “one-tenth the width of a human hair.” Scientists describe Itokawa as “a ‘rubble pile’ loosely held together by gravity.”

The Outer Space Treaty states that the “exploration and used of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries … and shall be the province of all [hu]mankind.” Additionally, the OST calls for “freedom of scientific investigation in outer space, including the Moon and other celestial bodies.” Finally, the OST notes that “outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or

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9 Wendy Zukerman, Spacecraft is First to Bring Asteroid Dust to Earth, NEWSCIENTIST, (Nov. 16, 2010).
11 Wendy Zukerman, Spacecraft is First to Bring Asteroid Dust to Earth, NEWSCIENTIST, (Nov. 16, 2010).
14 Outer Space Treaty, supra note 3.
15 Id. at art. I.
16 Id.
occupation, or by any other means.”

Under these provisions, one can argue that Japan must share these 1,500 particles with the rest of humanity. Of course, JAXA shared its bounty with allied nations and scientific results were made publicly available. And indeed, no State Party to the OST objected to the mission, just as no nations objected when the Soviet Union, the United States, and China returned sample material from the Moon. Certainly, it would feel absurd to argue that the collection of 1,500 particles smaller than a human hair for the purposes of scientific discovery collected from a pile of rubble held together by gravity violates the substance or purpose of the Outer Space Treaty.

In December 2020, JAXA completed another sample return mission, Hayabusa 2. Similarly, the United States, an OST signatory, launched an asteroid sample-return mission which successfully touched down on and collected a sample from its target asteroid. Each of the asteroids targeted by Japan and the United States are named objects and range in size from 330 meters to 1 kilometer in diameter.

One can imagine, just a decade or so from now, not a return mission that retrieves a scientific sample, but an operation to mine an asteroid solely for commercial benefit. It could even be that the asteroid would be mined out of existence. Can this be permissible under the Outer Space Treaty? Limiting the definition of “celestial bodies” based on size (or whether an object is named) should be considered as non-dispositive or incomplete criteria. This paper analyzes the language of Article II, considering what is meant by the concept of appropriation and argues that: 1) Article II was not intended to reach private non-State entities; 2) the Outer Space Treaty does not prohibit the appropriation or extraction of resources from extraterrestrial objects that do not fall within the meaning of the term “celestial bodies;” and that 3) that term itself should be limited and clearly defined. The paper will explore some prior approaches to these same questions and ways in which they require further elaboration. The focus of this paper is on the term “celestial body” with some consideration, too, to the extent of the application of space law in general and, thus, the definition of “outer space” itself.

The Outer Space Treaty employs the term “celestial bodies” repeatedly throughout its text. However, the term has never been concretely defined in an academic, scientific, or legal context. While the lack of any definition has not, heretofore, caused any difficulties, advances in technology will soon empower governments, public and private enterprises, and even private citizens to engage in extraterrestrial activities that will be impacted by how the term “celestial

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17 Id. at art. II.
bodies” is defined or interpreted. How we think about and define “celestial bodies” will impact the application of and limitations imposed by Article II.

Steven Gorove posed the question this way in 1969: Does the prohibition extend to the collection of dust particles or other special elements during flight in outer space? Does the prohibition extend to the appropriation of cosmic rays, gases or the sun's energy, or to the collecting of mineral samples or precious metals on the moon or other celestial bodies? Should the answer depend on the type of resource involved, or on its availability in unlimited (cosmic rays, meteorites, gases) or limited (minerals, metals) quantities or perhaps on its location? Further, does the concept extend to objects that come to Earth naturally as opposed to those brought back by human intervention? Additionally, are any intangible cosmic phenomena, such as Lagrange points, to be included as a “celestial body?” All of these questions remain unanswered.

Part II of this paper reviews space law in general and focuses on the language contained in Article II of the Outer Space Treaty. Part III analyzes the term “celestial bodies” from a historical standpoint and within the context of the Outer Space Treaty, also explaining why a definition is important. Part IV reviews different past proposals to define “celestial bodies,” and Part V provides the author’s proposed solution.

THE SPACE TREATIES

Generally

In October 1957, Sputnik 1 became the first human-made object to reach space. Shortly thereafter, the United Nations (UN), “[r]ecognizing the common interest of [hu]mankind in outer space . . . and that it is the common aim that outer space should be used for peaceful purposes [and] [w]ishing to avoid the extension of present national rivalries in this new field,” created an ad hoc committee to, among other things, report on the “nature of legal problems which may arise in the carrying out of programmes to explore outer space.” The Committee on the Peaceful Uses of Outer Space (COPUOS) was made a permanent body in 1959. COPUOS was the backdrop for negotiation and implementation of the treaties which today govern space activities.

23 Id. (“With respect to location, it could be argued that if any parts of outer space, including the moon and other celestial bodies, were found on the earth, they would not be subject to the prohibition of national appropriation since they would become part and parcel of the earth. Under a strict interpretation it may also be argued that the prohibition extends to the resource irrespective of its location”).
24 Sputnik 1, NASA.GOV, https://www.nasa.gov/multimedia/imagegallery/image_feature_924.html
26 Id.
Five treaties related to sovereign space activities were negotiated in the COPUOS, colloquially known as the Outer Space Treaty,\(^{28}\) Rescue Agreement,\(^{29}\) the Liability Convention,\(^{30}\) the Registration Convention,\(^{31}\) and the Moon Agreement.\(^{32}\) The Moon Agreement has been ratified by only eighteen States,\(^{33}\) and none of the major space-faring nations, including China, the United States, or Russia, has done so.

Negotiated during the Cold War essentially by the world’s two superpowers, the four widely ratified treaties reflect a remarkable – and to date successful – détente. The overriding concern was, as the name of the COPUOS suggests, peace. The key principles of the *Magna Carta* for peace in space are peace, collaboration, and freedom,\(^{34}\) while more tangential matters, including cultural heritage preservation and private resource mining are unaddressed.

That said, the activities of private entities are not entirely overlooked. Article VI of the Outer Space Treaty makes it quite clear that States bear “international responsibility for national activities in outer space . . . whether such activities are carried on by governmental agencies or by non-governmental entities.”\(^{35}\) The Article further indicates that States must assure that all “national activities are carried out in conformity with the provisions set forth” in the OST.\(^{36}\)

*Article II*

Article II of the Outer Space Treaty states in full: “Outer space, including the Moon and other celestial bodies is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”\(^{37}\)

Sovereignty

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\(^{28}\) *Outer Space Treaty*, *supra* note 3.

\(^{29}\) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Apr. 22, 1968, 672 U.N.T.S. 119.


\(^{32}\) Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereinafter Moon Agreement].


\(^{34}\) Article I of the Outer Space Treaty encompasses three foundational aspects of all space activities: the exploration and use of space is the “province” of all humankind; space, including the Moon and other celestial bodies “shall be free for exploration and use by all States;” and “States shall facilitate and encourage international co-operation” in scientific investigation. *Outer Space Treaty*, *supra* note 3, art. I. Article IV avers that “the Moon and other celestial bodies shall be used . . . exclusively for peaceful purposes.” *Id.* art IV.

\(^{35}\) *Id.* art VI.

\(^{36}\) *Id.*

\(^{37}\) *Outer Space Treaty*, *supra* note 3, art. II.
The international community seems largely to agree that no sovereign may make a claim to extraterrestrial territory. Indeed, it is a principal so embedded in the bedrock of space exploration as to be considered by many to be not just a treaty obligation but customary international law. Nevertheless, an argument can be made that this provision does not apply to non-State entities.

First, the Article plainly indicates that space shall not be subject to national appropriation. Second, the primary restriction is against appropriation by claiming sovereignty. Arguably, then, if a non-State entity asserts proprietary rights, it is not a “national appropriation,” nor is it “by claim of sovereignty.” This interpretation might be further supported by the United Nations Declaration of Human Rights, which, in Article 17 plainly states that “[e]veryone has the right to own property alone as well as in association with others.” While not binding international law, the Declaration could be viewed as customary law at this point that applies to space activities through Article III of the Outer Space Treaty, which requires States to “carry on activities in . . . space in accordance with international law.” As such, it could arguably be a violation of customary international law not to permit private ownership in space.

As Stephen Gorove put it: “an individual acting on his [or her] own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies.” This argument notwithstanding, seemingly no State Party to the Outer Space Treaty interprets Article II in this manner. Instead, debate centers on what actually constitutes national appropriation. The “sweeping language” of Article II could have been interpreted to apply both to areas as well as resources. Interestingly, the Moon Agreement clearly states that “[n]either the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person.” The Moon Agreement goes on to seek to establish, without prejudice to the preceding text, “an international regime … to govern the exploitation of the natural resources of the moon … ” Tellingly, the Outer Space Treaty does not include this language. In other words, Article II could be interpreted to allow for the ownership of resources extracted from space, the Moon, and other celestial bodies.

It is also worth reiterating that each of the United States, China, Russia, and Japan have

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40 Outer Space Treaty, supra note 3, art. III
41 Gorove, supra at note 21
43 Moon Agreement, supra note 31, art. 11(3) (emphasis added).
44 Id. Art 11(5).
obtained material directly from the Moon or other extraterrestrial objects without objection. Therefore, there are clearly instances in which the national non-appropriation principle may not apply, such as when the objects in question are not, in fact or in law, “celestial bodies.”

By Any Other Means

The OST phrase “by any other means” appears to be affected, however, by other provisions of the Outer Space Treaty. Article VI of the OST establishes “responsibility for national activities in outer space, … whether such activities are carried on by governmental agencies or by non-governmental entities.”\(^4^5\) However, Article VI, which requires “authorization and continuing supervision,”\(^4^6\) appears to create a mere liability relationship between the state and private actors, and does not imply that the responsible nation exercises ownership, possession, or sovereignty over anything affected or undertaken by any private party. Further, pursuant to Article VIII, objects left in space remain under the ownership and control of the State that put them there.\(^4^7\) In fact, under Article VII of the Outer Space Treaty and Article III of the Liability Convention, States are “internationally liable” for damage caused to an object in space belonging to another State.\(^4^8\) Yet leaving the objects in situ, essentially results in perpetual occupation of that location. This notion could even be extended to locations that exist in an even more confounding state for legal and physical consideration, such as a Lagrange points.\(^4^9\) Given that any object sent to space would occupy or appropriate the physical space of the object itself, applying a prohibition on the appropriation of the space an object occupies by the fact of its existence would be an “absurd” interpretation of Article II.\(^5^0\) However, this approach could certainly be argued to run afoul of the non-appropriation principle encapsulated in Article II and evidences the incompatibility of “appropriation in the broadest sense of the word” and what the actual, practical, and preferable meaning of the term might be.\(^5^1\)

Additionally, while it is clear that the use or threat of force to exclude access to any part of space would be prohibited under the Outer Space Treaty,\(^5^2\) merely stating that an act by or

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\(^4^5\) Outer Space Treaty, supra note 3, art. VI.
\(^4^6\) Ibid.
\(^4^7\) Outer Space Treaty, supra note 3, art. VIII.
\(^4^8\) Id. art. VII. Liability Convention, supra note 15, art. III. To compound matters, under both the Outer Space Treaty and Liability Convention liability is not based on ownership of the object, but on a country’s status as a so-called “launching state.” Per the treaty regime, any one of four States may be considered a “launching State” for liability purposes: 1) the State which launches; 2) the State which procured the launch; 3) the State from whose territory the object was launched; and 4) the State from whose facility the object was launched. Liability Convention, supra note 15, art. I.
\(^4^9\) This is not idle conjecture, but present reality. The James Webb Telescope, for example, jointly operated by NASA, the European Space Agency, and the Canadian Space Agency, currently occupies the Lagrange point designated as L2.\(^5^0\)
\(^5^0\) Timothy Justin Trapp, June 30, 2013, 2013 U. Ill. L. Rev. 1681 at 1691.
\(^5^1\) Ibid.
\(^5^2\) Id at 1698; See also, Leslie I. Tennen, Towards A New Regime for Exploitation of Outer Space Mineral Resources, 88. NEB. L. REV. 794 at 804. (2010)
presence of an object does not constitute appropriation, such as is the case with the International Space Station.\(^5\) cannot sufficiently resolve the matter.\(^5\) Others have argued that “if States cannot appropriate the extraterrestrial realms, then *a fortiori* neither can their nationals … and State endorsement of private appropriation would be a form of national appropriation.”\(^5\) Therefore, whether by mere existence, location, national endorsement, or otherwise, “by any other means” lacks the clarity necessary to give clear effect to the terms of the Outer Space Treaty.

Virgiliu Pop argues, in fact, that this can be resolved not by determining the scope and application of Article II of the OST to private persons in the context of property rights as such, but to the objects governed themselves.\(^5\) This approach is an inspired starting point to resolve this issue, though requires additional criteria and limitations. Further, this postulation does not sufficiently take the acts and assertions of individual nations or advances in technology whether to date or into the future into account.

SCOPE OF APPLICATION IN OUTER SPACE LAW

In addition to considering what is or is not a “celestial body” we must also consider to what extent we might apply this term when finally agreed. Given the vastness of space\(^5\) we must also contemplate the limits of, or distinctions between different areas of space as we consider defining terms such as “celestial bodies” and the broader development and application of space law in general. Should we determine where space begins\(^5\) and simply apply the agreed terms *ad infinitum* (and *ad absurdum*), in turn coining a new legal maxim of *lex terre est sine fine in universo* (translation: The law of the earth is without end in the universe)? Or,

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\(^5\) See, *e.g.*, Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, T.I.A.S. No. 12927, Art. 2 (noting, “(2) Nothing in this Agreement shall be interpreted as … (c) constituting a basis for asserting a claim to national appropriation over outer space or over any portion of outer space.”).

\(^5\) Trapp, supra note 49 at 1700.


\(^5\) Id at 48.


\(^5\) A widely accepted notion for the edge of space is the “Von Karman Line,” which defines space as beginning 100 kilometers (54 nautical miles; 62 miles; 330,000 feet) above Earth's mean sea level. (See, Rodney W. Johnson, “Problems of Law and Public Order in Space,” American Bar Association Journal, JUNE 1966, Vol. 52, No. 6 (JUNE 1966), p. 556); various alternative proposals have been put forth, which often define the lower limits of outer space as being closer to the surface of the Earth. (See, Eric Betz, “*The Kármán Line: Where does space begin?*” Astronomy. [March 5, 2021] noting that the actual boundary between Earth and space could lie anywhere between 30 kilometers (8.5 miles) above the surface to more than a 1.6 million km (over a million miles) away. (See also, Robert F. A. Goedhart, *The Never Ending Dispute: Delimitation of Air Space and Outer Space,* Volume 4 of Forum for Air and Space Law. Editions Frontières, 1996).
should we adopt the proposed construct of distinct regions of space such as “solar space” (which itself is subject to debate\textsuperscript{59}), “galactic space” (The entirety of our Milky Way Galaxy outside of the Solar System), and “extragalactic space” (the rest of the universe beyond the Milky Way)?\textsuperscript{60} Therefore, the question should also be asked: where does the Outer Space Treaty’s jurisdiction end? This question affects the debate and our understanding of whether any physical object or phenomena falls within the meaning and prohibitions prescribed by Article II of the Outer Space Treaty. According to Pop, considering whether a “celestial body” is a legal “thing” requires the application of common sense and the reasonable person standard, and terrestrial \textit{corpus juris spatialis} should be also restricted to our solar system.\textsuperscript{61} The author could not agree more.

It should be noted that there is no agreed standard defining where national or international air space stops and outer space begins.\textsuperscript{62} As such, determining exactly when the application of the Outer Space Treaty’s provision begins is difficult. As noted, however, more difficult would be considering the outer limits of the application of the Outer Space Treaty.

The first, undeniably “celestial object” one encounters as we travel farther from the Earth is the Moon, so clearly and universally agreed to be a “celestial body” that it has been singled out for specific and more rigorous, though as yet unsuccessful, legal treatment. Past the Moon, however, Lagrange Points, other planets and dwarf planets, their respective satellites or companions, and the myriad other objects and phenomena encountered within the solar system require legal definition. We may also need to consider those objects that regularly traverse the solar system, or which may enter it at some point and remain for periods of time measured in geologic or galactic timescales. Surely, we cannot presume that the term “celestial body” applies to every speck of dust beyond Earth’s atmosphere AND its authority extends throughout the entire Universe. The author would contend that, so far as seems reasonable, the Solar System would be the maximum extent of the applicability of the jurisdiction of the Outer Space Treaty.

\textit{Examples of National & International Interpretations of Article II:}

The United States, UAE, Luxembourg, and Japan


\textsuperscript{61} Pop, supra note 54 at 48.

The United States is party to four of the five space treaties. Rather than ratify the Moon Treaty, however, the United States pursued national legislation and policy declarations to supplement and interpret the Outer Space Treaty and the other broadly ratified space-related legal instruments. Beginning with the Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (or the SPACE Act), the United States recognized the right of private citizens to own and trade in natural resources obtained from an “asteroid resource or a space resource.” While this legislation does require government authorization for activities covered by the law, the same distinction between national appropriation versus the permissibility of private appropriation exists as those identified above in the exploration of the relationship between Articles II and VI of the OST.

Additionally, the United States explicitly omits the term “celestial bodies” while identifying “asteroid resources,” which would seem to be separate and apart from OST terminology. U.S. space policy pronouncements also explicitly assert that, “[t]he United States will pursue the extraction and utilization of space resources in compliance with applicable law, recognizing those resources as critical for sustainable exploration, scientific discovery, and commercial operations.

Moreover, the United States crafted the Artemis Accords, which enjoy a growing number of signatory parties, and which distinguish space both physically and legally from other aspects of human activity. The Artemis Accords, and the executive order issued by then-President Trump, declare that “Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law. Outer space is a legally and physically unique domain of human activity, and the United States does not view it as a global commons. Accordingly, it shall be the policy of the United States to encourage international support for the public and private recovery and use of resources in outer space, consistent with applicable law” (emphasis added). Taken together, it would appear there are ample grounds to argue that the United States recognizes broad interpretation of Article II of the Outer Space Treaty for certain appropriation of celestial bodies, particularly when these activities are private in nature.

The United Arab Emirates (UAE) is an active and relative newcomer to space, space policy, and space law. UAE only established its national space agency in 2014 under the

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64 Ibid.
66 Executive Order 13914, Encouraging International Support for the Recovery and Use of Space Resources. (Signed:04/06/2020, Published:04/10/2020) FR Citation:85 FR 20381; FR Doc. Number:2020-07800.
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authority of Decree No. 1 of 2014.67 The UAE Space Agency swiftly established a bold program, launching The Hope orbiter on July 19, 2020, which entered orbit around Mars on February 9, 2021.68 To support its rapid entry into the community of space nations, the UAE partners with other national space programs69 and has worked swiftly to establish national space legislation and a national space policy.70 While the legislation addresses various space activities, the UAE’s stated aim of this legislation is “stimulating investment and encouraging private sector participation in space sector activities.” Additionally, the UAE views its legislation as supporting the nation’s commitment to implement the provisions of international conventions and treaties related to outer space.71 The UAE is a party to the Outer Space Treaty and, as a signatory to the Artemis Accords, the UAE is affirming that the Artemis Accords comply with these international conventions and treaties related to outer space. Finally, UAE’s National Space Policy states that, “partners, in collaboration with and with the support of the UAE Space Agency, shall embark on, or contribute to, inspirational programs, such as: … Exploration, mining, extraction and utilization of resources in space …”73 Thus UAE appears not to deem all objects in outer space as “celestial bodies” under the terms of the OST and excluded from legal use.

Another, often unexpected, space actor is Luxembourg, which has already undertaken steps to address several aspects of commercial space activities.74 Luxembourg’s National Action Plan for Space and Technology 2020 – 202475 and its legal framework reflect the nation’s understanding that, “[i]nternational space treaties remain untested regarding who would own the rights to minerals, gases and water found in outer space.”76 To begin to resolve this

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71 Id at 53.
72 Ibid.
73 Ibid.
state of affairs, in 2017 Luxembourg adopted a legal and regulatory space law framework (“2017 Luxembourg Space Law”) that “ensures stability and guarantees a high level of protection for investors, explorers and miners.” Luxembourg is clear to note, however, that the 2017 Luxembourg Space Law “does not have an objective, purpose or effect of paving the way for any national appropriation of outer space, including the Moon and other celestial bodies themselves,” but, rather, seeks to ensure “that private operators can be confident about their rights [to] resources they extract in space.” Like the UAE, Luxembourg is also a party to the Artemis Accords and ratified the Outer Space Treaty, providing further support for the notion that not only do the Artemis Accords comply with extant international treaties, but that private extraction and use of space resources is permissible under the current legal structure.

Japan’s space activity history and policy stretch back decades. Over several years, Japan developed its space policy, space law, and space capabilities while engaging in activities that could be deemed extraction, or exploitation and use, of at least part of a celestial body. However, Japan has thus far not engaged in any actions to which any parties to the Outer Space Treaty have objected. Japan is also a party to the Artemis Accords, further entrenching the notion that State Parties to the Outer Space treaty do not view the Artemis Accords or their individual space activities as violative of international treaties or law. The Artemis Accords feature quite prominently in Japan’s latest national space policy, and clearly Japan believes its capture of scientific samples does not violate the Outer Space Treaty despite the fact that its asteroid missions could easily be cast as “national appropriation … by means of use … or by any other means.” Therefore, the only reasonable conclusion one could draw from Japan’s space activities and the (non) reaction of other nations is the fact that they do not view the objects from which Japan drew samples as “celestial bodies” under the Outer Space Treaty.

The Artemis Accords

The Artemis Accords are a non-binding, “political commitment” intended to “increase the safety of operation, reduce uncertainty, and promote the sustainable and beneficial use of space for all humankind.” The Artemis Accords reinforce existing international space law and

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78 Id at 65.


81 The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids, NASA, https://www.nasa.gov/specials/artemis-accords/img/artemis-accords-signed-13oct2020.pdf. The original signatories were representatives from Australia, Canada, Italy, Japan, Luxembourg, the United Arab Emirates, the United Kingdom, and the United States.
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reaffirm that space activities are to be undertaken for “peaceful purposes” and “in accordance with relevant international law.”82 Most importantly for our purposes here, the Artemis Accords aim to promote specific interpretations of the Outer Space Treaty concerning the extraction and utilization of space resources.83 Clearly the extraction of space resources must come from somewhere; without a concrete definition, that somewhere could inadvertently be a celestial body. Moreover, Artemis strives for extraterrestrial heritage protection of “historically significant human or robotic landing sites, artifacts, spacecraft, and other evidence of activity on celestial bodies in accordance with mutually developed standards,”84 and the Artemis Accords implicitly designate the Moon and Mars as “celestial bodies” as those are the locations on which “human or robotic landing sites” as well as any artifacts, spacecraft, and other evidence of activity” are to be found.

As the Artemis Accords are open to any nation to join as a State Party, and the list of those electing to do so continues growing, the Artemis Accords have the potential to achieve much in the way of establishing not only a broad range of acceptable standards of responsible behavior in outer space, but to help resolve the many outstanding issues left unanswered by the Outer Space Treaty.

WHAT IS OR WHAT SHOULD BE A CELESTIAL BODY?

As noted, we cannot employ a single term, “celestial bodies” to refer to all matter in the universe or even the solar system. The definitive “A Guide to Space Law Terms” does not include a separate entry for “celestial bodies” but rather uses the term to help define other entries.85

N. Jasentuliyana and Roy S.K. Lee concisely articulate the surprising generality attributed to the Moon in the OST and to “celestial bodies” generally:

The Moon and other celestial bodies come under the scope of application of the Treaty. It was perhaps presumptuous and inappropriate to consider in one single instrument such separate elements as outer space (which is not a res but an infinite ocean of ether), the Moon (only natural satellite of earth) and other celestial bodies (which represent finite and microcosmic entities). It was also surprising that the Moon and all the other celestial bodies were considered together … 86

We receive little help from the International Astronomical Union (IAU) in defining “celestial bodies.” The IAU only applies the term “celestial body” to its definition of planets and “dwarf

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82 Id at § 3
83 Id at §§ 9 & 10
84 Ibid. § 9
85 A Guide To Space Law Terms (2012), Space Policy Institute, George Washington University, and Secure World Foundation
86N. JASENTULIYANA & ROY S.K. LEE, MANUAL ON SPACE LAW Vol. 1 253 (1979)(emphasis in the original, citation omitted).
planet[s]"87 in IAU Resolution B5. 88 Resolution B5 lists the planets as Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Moreover, Pluto is alternatively included 89 amongst the IAU’s definition of “celestial bodies” and excluded. 90 Further, the IAU troublingly does not count natural satellites of planets to be “celestial bodies” in their own right,91 this would exclude the Moon, which could not have been the intent of the drafters of the OST or its State parties. Limiting the definition of “celestial bodies” to the objects identified and named by the IAU, however, would be both too restrictive and confusing, while opening the rest of the solar system to a legal void and a potential free-for-all by both sovereign states and private actors.

Humanity’s Evolving Understanding of the Cosmos and Celestial Bodies

For eons, human beings have gazed at the night sky and experienced a personal, spiritual, or religious connection to certain celestial objects in our solar system. However, before the 17th century, all that was known of our solar system was the Sun, Earth and Moon, Mercury, Venus, Mars, Jupiter, and Saturn. While it was not until the 20th Century that the human race even came to know of Pluto, a portion of humanity expressed dismay at its reclassification as a “Dwarf Planet.” We should consider whether, therefore, there are specific objects that hold a special place in the hearts and minds of humanity, regardless of their location, time of discovery, or physical properties, which would make them not only “celestial bodies” for the purposes of the OST, but part of the Common Heritage of Humanity. To speak of a Common Heritage of Humanity in space as an element of defining “celestial bodies” we may wish to determine what exactly that Common Heritage is by also considering the relative cultural – or even emotional – value humanity applies to any and all objects of any mass within the solar system. Undoubtedly all would agree that Earth’s moon, the named planets, and many of the natural satellites of the solar system, as well as several other named objects should be counted as “celestial bodies.” Reasonable people could differ, however, on the exact boundaries of this list.

Excellent scholarship has been produced regarding the legal status of “celestial bodies,”92 while others have explored the question of mining in space in the context of

88 IAU Resolution B5, 24 August 2006 26th General Assembly IAU.
89 Ibid.
90 Ibid; (See also, https://www.iau.org/public/themes/pluto/ and https://www.iau.org/public/themes/naming/#dwarfplanets)
91 Ibid.
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international and domestic, national legal regimes. Still others have examined the general landscape of current space law and the perceived gaps therein. However, none of the literature has or proposes a concrete definition or mechanism to define “celestial bodies.”

The Czech scholar Vladimir Mandl first introduced the term “celestial body” to the lexicon of Space law in 1932, and it appeared at the U.N. via a General Assembly resolution in December, 1961. More challenging still is the fact that even where others have attempted to define “celestial bodies” beyond mere scientific terminology, the distinctions have been couched in notions of technical capabilities, which is itself ever-changing. Notably, definitions such as those offered by the IAU are of recent provenance and could change again in the future. As recently as August 2006 the IAU downgraded the status of Pluto to that of “dwarf planet.” However, many people alive still count Pluto amongst the “nine planets around the sun” or at least identify it as a “celestial body” elevated in the minds of much of humanity even if its designation has been reduced.

Theories on the Question of What Is Celestial Body

The common heritage of humanity or the common heritage principle is a principle of international law which holds that defined territory and elements of humanity’s common heritage – cultural and natural – should be held in trust for future generations and be protected from exploitation by nations, entities, or even individuals. As we can see from the language of the Artemis Accords, clearly Neil Armstrong’s footprint on the Moon and the Curiosity rover on Mars should be considered “historically significant human or robotic landing sites.” The recently concluded agreement between the United States and Japan makes a similar effort to protect “Lunar Sites of Historical or Scientific Value.”

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96 International co-operation in the peaceful uses of outer space, U.N.G.A. Res. 1721 (XVI).
98 Dave Matthews Band, 1994, Typical Situation, “Under The Table and Dreaming.” RCA. “Nine planets around the Sun repeat.”
99 Alshadaifat, supra note 61, FN 4 at 2.
100 infra at § 9.
101 FRAMEWORK AGREEMENT BETWEEN THE GOVERNMENT OF JAPAN AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA FOR COOPERATION IN THE EXPLORATION AND USE OF OUTER SPACE, INCLUDING THE MOON AND OTHER CELESTIAL
One of the founders of space law, Argentinian Ambassador, professor, and lawyer Aldo Cocca stated that “the international community [has] endowed that new subject of international law - [humanity] - with the vastest common property (res communis humanitatis) which the human mind could at present conceive of, namely outer space itself, including the Moon and the other celestial bodies [emphasis added].”¹⁰² Without defining “celestial bodies” or even “space” itself, is all of space or all matter in the universe to be considered somehow protected as common heritage?” Perhaps select, explicitly catalogued objects within our solar system can and should be, excluding all else. One could imagine, for example, a time when comets would be freely harvested for their water ice and other resources without objection, while humanity finds itself acutely protective of Haley’s Comet or Saturn’s Rings as part of the “common heritage of humanity.”

Terrestrial Analogs

The need to define “celestial bodies” is well established.¹⁰³ Some approaches draw on the Law of the Sea, The Antarctic Treaty, the concept of res nullius, res communis omnium, as well as numerous intermediate or hybrid combinations of the same.¹⁰⁴ One common argument holds that as the laws of the Earth derive from the facts and conditions of the Earth, space law will derive from the facts and conditions of space.¹⁰⁵ While the author embraces the unique, emerging, and evolving nature of space law, there are certain corollaries with terrestrial law that can be invoked. For example, while nobody would credibly argue that any entity could claim ownership and exclusive use of the Jovian satellite Europa, just as one would not claim that any individual could seek to claim ownership or exclusive use of all the sand on a public beach, so too would no individual or group of individuals argue that a child could not collect some seashells on that same beach nor that a scientist could not collect samples of the ice and subsurface ocean of Europa.

But where is the limit and to what degree would such a limit inform our understanding and ability to define “celestial body?” Should each of the asteroids targeted by Japan and the United States for sample-return missions be considered as the shared sand or the seashells? Such are the questions when considering celestial bodies and their legal definition, as this definition can then inform political, commercial, scientific, and security considerations and, hopefully, advance the cause of space for all of humanity rather than serve to export our

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¹⁰³ Martinez, supra note 90
¹⁰⁴ Smirnoff, supra note 91
¹⁰⁵ Smirnoff, supra note 91; Buckling, supra note 89; Yeager, supra note 89.
terrestrial conflicts into the cosmos.

That space should be used for peaceful purposes is not only a foregone conclusion, but an enshrined aspect of international law. Despite the fact that several concepts and provisions of the Outer Space Treaty were modeled on and often compared to the Antarctic Treaty, the Antarctic Treaty is insufficient to understand the OST and cannot be duplicated and merely applied to Outer Space. Other sources of inspiration for space law have come from both common and statutory law such as the Convention on the High Seas, which states that “[t]he high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty,” and goes on to guarantee the “[f]reedom of fishing.” In considering Space law in the context of maritime law, some objects in Outer Space are more akin to fish, rather than the sea itself or “any part” thereof. Pop similarly compares icebergs with comets to help illustrate this point, drawing similar comparisons to the examples above contrasting seashells with the beach, or individual fish versus the sea.

Movable versus Immovable

One argument, elegantly articulated by Pop, suggests that one should consider and “distinguish between immovables – celestial bodies – and movables in outer space literally,” and that moveability would render it appropriae, and thus outside of Article II of the OST. Smirnoff in his work also notes that the scholarly history on the subject dates to Working Group III of the International Institute of Space Law, which asserted that celestial bodies should be considered, in the legal sense, as “natural objects in outer space ... which cannot be artificially moved from their natural orbits.” While, again, this view and the arguments extending therefrom are hugely helpful, they are incomplete as we must immediately recognize the rapid

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109 Id. at Art. II
110 See Pop, supra note 54, at 57.
111 See Pop, supra note 54, at 53.
112 See Smirnoff, supra note 91, at 13.
advances in technology that would allow an ever growing number of objects in the cosmos to be moved at a later date.

Science fiction literature is replete with story lines envisioning the movement of objects with astounding mass. Archimedes asserted that with a sufficiently long lever he could move the world, and serious theorists have posited strategies to move the earth such that it maintains a favorable position relative to the sun throughout the coming eons to ensure continued habitability. So, again, if one could eventually move the earth itself, any definition of “celestial bodies” would need not only to perhaps specify a list of objects and / or classes of objects more clearly, but perhaps also take into account size, mass, and even current and future technological capabilities of humanity.

Spatial versus Functional / Object Approaches

Another discussion regarding “celestial bodies” relates to the spatial versus functional argument. We recall the metaphor above regarding the seashell on the beach versus the entire quantity of the sand. While this thought experiment helps make a point, it is limited in its practical utility. What, for example, should we do with a child seeking to take home a bucket of sand from the beach? What about two buckets? Where do we draw the line?

Again, Pop provides a helpful, though insufficient understanding of this framework. Pop explains that “[w]here there is no natural boundary, or one cannot discover it, law can set a conventional boundary. Such is the case with the age of legal adulthood.” To elucidate the point, Pop cites Gyula Gal, noting that determining the limits between outer space and air space has confounded experts for decades; Pop also notes that “setting a spatial boundary between territorial sea and the high seas” is also illustrative of the challenges, arbitrariness, and mutability, or relying exclusively on a spatialist approach.

However, noting that one can create an arbitrary boundary between different classes of things does not help determine where that boundary is or should be. Moreover, even within these distinctions, there are limitations and exceptions. Individuals reaching the age of maturity, but possessing serious, violent criminal records are often prohibited from exercising certain rights or engaging in other activities otherwise granted to all other legal adults. Individuals with severe visual impairment, despite otherwise qualifying, are not permitted to operate a motor vehicle. Which crimes would trigger the former, and what degree of visual

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114 See, e.g., Science and Futurism with Isaac Arthur, Planet Ships, (https://www.youtube.com/watch?v=oim7VvUURd8)

115 See Pop, supra note 54, at 52.

116 Ibid. See also, Gyula Gal, Thirty Years of Functionalism, 40 PROC. COLL. L. OUTER SPACE 125 (1997), p 126.

117 Pop, supra note 54, at 52
impairment would impose the latter? How would we qualify our arbitrary, determined definition of “celestial bodies?”

Pop again employs Gal to suggest we consider not the nature of the object or its characteristics, but the actions applied to such objects and how they are to be used – known as a “functionalist” approach.118 One proposed functional or objective use of a natural space object would be the reformation of the same into a space habitat or space station,119 losing its natural appearance, together with its possible legal status of “celestial body” by becoming a manmade structure, i.e., legally a space object. The author would suggest that this approach is also insufficient as (a) once an object is deemed a “celestial body” the same prohibitions would apply regardless of the use in most cases, but especially in the use and consumption of the object, and (b) if the item is not deemed a “celestial body” the use to which it is put is irrelevant. Instead, once more, we could consider the idea of functionalism as part of a greater complexity of criteria in defining what is or is not a “celestial body.”

Other Matters for Consideration: Physical Phenomena – Lagrange Points

One other area for consideration when discussing “celestial bodies” is whether or not intangible features should also be considered. What are lawyers and scholars to think of Lagrange Points?120 Currently, a number of Lagrange Points are occupied by artificial objects, such as the ESA’s Solar and Heliospheric Observatory (SOHO), NASA’s Global Geospace Science (GGS) Wind satellite, NASA’s Advanced Composition Explorer (ACE or Explorer 71), and NOAA’s Deep Space Climate Observatory (L1); and the ESA Gaia probe, the joint Russian-German high-energy astrophysics observatory Spektr-RG, and the NASA, ESA and CSA James Webb Space Telescope (L2).121 These locations are of great value as, theoretically, less energy would need to be expended to maintain an object, such as a satellite or even a space station, at those locations. In considering the idea of what is or is not a “celestial body” we must also entertain Lagrange Points. If they are to be considered “celestial bodies” their treatment will be governed by one set of principles and restrictions, whereas if they are excluded from this definition, new questions will arise as to whether they should be treated as res communis omnium, and, in that case, whether objects occupying any one Lagrange Point

118 Pop, supra note 54, at 55 referencing Gal supra note 115.
119 One example of such structures are colloquially known as O’Neil Cylinders in reference to their conception by Gerard K. O’Neill. O’Neill Cylinders could be created out of the raw materials of asteroids or other celestial objects through simply hollowing out the body or by refashioning the raw materials themselves. (See, e.g., Gerard K. O’Neill, The Colonization of Space, Physics Today, 27(9):32-40 American Institute of Physics. [September, 1974]; See also, Science and Futurism with Isaac Arthur, O’Neill Cylinders, [Science and Futurism with Isaac Arthur]).
120 A Lagrange point is a location in space where the combined gravitational forces of two large bodies, such as Earth and the sun or Earth and the moon, equal the centrifugal force felt by a much smaller third body. The interaction of the forces creates a point of equilibrium where a spacecraft may be "parked" to make observations, or engage in other activities. https://www.space.com/30302-lagrange-points.html (last retrieved May 31, 2022).
121 https://solarsystem.nasa.gov/resources/754/what-is-a-lagrange-point/
would be subject to the legal framework of “innocent passage.”

POSSIBLE DEFINITIONS AND SOLUTIONS

We cannot consider every speck of dust, natural object, or phenomenon in the cosmos to be a “celestial body.” Beginning from that premise, as well as the self-evident notion that there are objects in the solar system that are indisputably “celestial bodies,” we must determine what is and is not a “celestial body.” We must also accept that prior scholarship is a helpful guide, but insufficient. We must recognize that the proposition offered by Pop,122 that we can limit ourselves merely to the objects (or phenomena) under consideration and not the actors physically interacting with them, has been superseded by national legislation and international agreements, we are forced to engage in a formulaic application of science and law. Some areas for consideration follow.

Current or Near-Term Anticipated Technology

Just as with the beach and seashell analogy described above, looking at what current or near-term anticipated technology might achieve could be a basis for aiding in defining “celestial bodies.” Several private enterprises have declared their intentions to exploit the resources of the solar system both for profit and to support humanity’s expansion into the cosmos, which appears to be permissible if not endorsed by several nations’ commercial space legislation, and international agreements, as described above. Any limitations to these plans lie not with the technical capability to achieve these objectives given sufficient time, but, rather, the legal framework when considering mining and resource exploitation in outer space. While the Outer Space Treaty would seem to prevent any and all such extraterrestrial mining undertakings, there could be a solution if we limit the definition of “celestial body.” If “celestial body” is read to exclude any objects that could be captured, manipulated, or consumed in their entirety within a reasonable period of time, say within the technological capabilities we anticipate being possible within the next 100 years, these proposed activities would not run afoul of the OST.

We must also appreciate the fact, however, that allowing such limitations to the definition of “celestial bodies” alone would not be sufficient, and could undermine the other purposes of the Outer Space Treaty, namely, the peaceful use of Outer Space and the avoidance of the export of terrestrial conflict into Outer Space if it triggered a resource free-for-all that saw nations, entities, and individuals competing over each and every resource as it became accessible. Individuals and entities would need to agree how even these excluded objects would be claimed for ownership, appropriation, and use.

122 See, Pop, supra note 54
The above criterion of a technology-based, size and mass-derived definition of what is or is not a “celestial body” is, itself, arbitrary. Much like the arbitrary but agreed upon age of maturity for the purposes of certain rights and responsibilities in the myriad terrestrial jurisdictions, national legislation and international agreements could seek to define “celestial bodies” in an arbitrary, but agreeable fashion. In addition to the size and mass as mentioned above, earth-based authorities could establish a list of those objects deemed part of the “Common Heritage of Humanity” and therefore “celestial bodies” within the Solar System, to the exclusion of any and all other objects of any mass. Clearly this list could be subject to revision, much like Pluto found itself expelled from the IAU’s list of “planets” not so long ago.

However, objects or “celestial bodies” would not need to fit into nice and orderly categories but could be individually selected. The author would also propose that any celestial objects heretofore undiscovered or unidentified would not meaningfully be called a “celestial object” protected from appropriation and use in any event, so the list could be exhaustive and would likely get parred down over time rather than expanded. Therefore, in addition to other considerations, we could add an arbitrary agreed date of discovery to the definition of “celestial bodies,” and exclude any and all objects of phenomena discovered thereafter.123

Such a list could recognize that there are certain objects that, due to their role in humanity’s history, either as inspiration for religion, culture, literature, or otherwise, possess a special place and are, thus, the preserved “celestial bodies” of the OST. Most legislative or deliberative bodies would likely include in this list all the named planets, many if not most or all of their natural satellites, as well as numerous asteroid belt and Kuiper belt objects. Beyond this list, however long it may ultimately become, extraterrestrial objects, material, and phenomena might then be available for legally recognizable appropriation and use. Such a formula may be deemed to suit the needs of terrestrial authorities hoping to encourage scientific and economic activity in outer space. While the current international relations climate or the general scope of this issue may make a universally agreed list unlikely at present, beginning to develop such a list via national legislation or via the Artemis Accords could, in time, lend itself to achieving an internationally recognized and agreed inventory of celestial bodies.

CONCLUSION

Humanity rightly sought to preempt the exportation of earthly conflict into the cosmos. In crafting the Outer Space Treaty, the authors of space law’s Magna Carta identified the pressing issues that could, would, and today imminently confront nations and private actors

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123 The author would suggest July 20, 2019 to commemorate the 50th anniversary of the first human to set foot on the moon.
Epstein

alike. As technology advances, however, greater clarity is required to refine and define the terms of the OST further in such a way that its purpose – peaceful use of outer space for all humanity, whether scientific or commercial – can be realized. The solutions offered in the past provide laudable guideposts, too, to advance this discussion, though national and international actions, as well as technical and scientific discoveries, reveal that further discussion must continue to define and apply the terms and applicability of the Outer Space Treaty more fully. The above examination of the issue aims to advance that discussion further and provide some additional elements for consideration in determining what is a “celestial body.” Building off the works of the likes of Gorove and Pop, the above analysis and considerations are designed to fill in the outstanding gaps in this field, while remaining flexible in the face of future developments. Take, for example, the possibility that at some future date humanity will discover biology on an otherwise unremarkable object. Whether an asteroid or, more likely, a Kuiper Belt Object, this mass, whatever its size or other characteristics, can quickly be included in the finite list proposed above for protection and preservation, without otherwise altering the proposed “celestial bodies” classification system. To begin, each of the named planets and dwarf planets, along with their largest natural satellites, should be included in such a listing. So too, should the most recognizable comets, such as Haley’s and Hale-Bopp be accepted, despite the fact that the latter will not return to the inner solar system for millennia. Beyond that, the catalogue would be for humanity to decide.

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Finding a North Star: Lessons in Space Law for the Nuclear Regime

Elsbeth Magilton

This paper applies lessons from the Artemis Accords to the nuclear arms regime—specifically asking whether strategic soft law agreements could create a stop gap for the shortcomings of nuclear arms control. Soft law can lead to more consistent communications, helping build predictability and trust, which is a recipe for a more secure world. *This essay is updated from a previously published version and appears here by permission of the Minnesota Journal of International Law.

In the past ten years the world has seen some major shifts in global thinking. From a rise in nationalism across many states, to the rattling of previously thought unshakable global institutions. The immediate impacts on global structures challenge what we know about peace, conflict, and stability. There is a rising sense of instability and tension, particularly in the realms of outer space and in nuclear weapons.

The basis of both space and nuclear legal frameworks stem from a post-World War Two (WWII) era of international collaboration and both are rooted in utilizing an international order to avoid catastrophic human destruction. While the Outer Space Treaty (OST) didn’t take shape until more than 20 years after the end of WWII, it is born of the Cold War between the United States and the Union of Soviet Socialist Republics (Soviet Union) with the goal of not only preserving space, but also securing peace.

In the modern decade there is expansive growth in the space industry, and the legal and regulatory structures that support and maintain it. While many states are creating or expanding their domestic legislations and working collaboratively with other nations, there is a sense that no large new treaty or other form of multilateral agreement would be successful. States see the value in international collaboration in space, but there is a growing resistance to limiting activities via new obligations requiring a lengthy domestic ratification process. On the nuclear arms front, there is a decline in collaboration and mutual understanding of what is means to be a responsible nuclear state. Tensions are rising and international trust and communication is failing.

But all is not lost. While there is generally mutual agreement that a second Outer

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1 A longer version of this paper, under a different title, will appear in a forthcoming issue of the University of Minnesota Law School International Law Journal. Both publications have given their permission to permit dual-publication of two versions of this paper.
2 Elsbeth Magilton is the Executive Director of the Space, Cyber, and Telecommunications Law programs at the University of Nebraska College of Law. Elsbeth is also a 2023-2024 Scowcroft National Security Fellow at the Eisenhower Center for Space and Defense.
3 Author’s note: My background is in space law, and though I’ve spent many hours with colleagues at U.S. Strategic Command and in deterrence conferences and symposiums, I have no formal background in nuclear law and policy. I want to thank my friends who study political science, particularly Dr. Tyler White, for encouraging me to look at nuclear disarmament issues for the first time in my work. I also wish to thank my research assistants, Zach Hellen, a J.D. student in the Space, Cyber, and Telecommunications Law program, and Brooklyn Terrill, a J.D. student and Schmid Library Research Fellow, a program managed by Professor Stefanie Pearlman. Finally, as with all my articles and papers, I thank my family for always being my soft place to land, especially my spouse, Morgan Magilton, and our children Maxwell and Eleanor Magilton.
Space Treaty is unlikely in coming decades, the world is still actively working together in space. Innovative diplomatic and soft law tools are at work bringing states together to preserve access to space, mitigate debris, and generally advance human capacities to operate in space. Many legal scholars are dismissive of soft law approaches, and they may be right to feel that way. Soft law instruments are only quasi-legal with no binding force. However, they do serve the purpose of rapport and trust building over time, creating a continuity of discussion that may influence space stewardship, and lay the groundwork for future potentially binding legal instruments. These tools may be able to provide a model for the nuclear arms realm.

This paper explores the feasibility of applying the soft law approaches found in space law, with particular focus on the Artemis Accords, to the nuclear regime. The Artemis Accords present a recent case study in a soft law approach for influencing norms of behavior in space. The paper starts by outlining the instruments of international law and describing the general, though complex, decline in multilateral agreements. Next, it covers the status of present agreements in the nuclear and space fields. Finally, it explores how lessons may be drawn from space law, specifically the Artemis Accords, and applied to the nuclear arms regime.

INSTRUMENTS OF INTERNATIONAL LAW

When testifying to Congress in 2015 then Secretary of State John Kerry said, “I spent quite a few years ago [sic] trying to get a lot of treaties through the United States Senate, and frankly, it’s become physically impossible. You can’t pass a treaty anymore.” Kerry was criticizing the United States Senate for its unwillingness to participate in the treaty process, allowing treaties to languish in committee. In fact, the United States has come to rely predominantly on executive agreements over treaties. This is particularly notable in the past 20 years, and a good number of legal scholars have explored the structural issues in the United States that have led to the domestic decline of treaties.

The general design of this paper is not meant to deeply explore the United States treaty process or how international law functions. Instead, it is focused on how soft law

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Lessons in Space Law

solutions may be tenable. However, in making that point, it is still valuable to review how international agreements and international law may be created and how it functions in broad terms.

Treaties

Article 2, Section 1(a) to the Vienna Convention on the Law of Treaties has been widely accepted as the instrument governing the law of treaties since its adoption by the International Law Commission. It defines a Treaty as an “international agreement concluded between States in written form and governed by international law…”9 Treaties may be considered multilateral, being between more than two states, or bilateral, being between just two states or organizations.10 Treaties may sometimes take on other names, such as a Convention, a Memorandum of Understanding, or other names agreed to by the states.11 Once the text of a treaty is fully negotiated the parties’ signatures authenticate it. The signatures only verify that the text accurately represents the agreed to stipulations. Most agreements have some kind of intent to require ratification or acceptance of terms stipulation – how a nation state creates that acceptance is subject to their own domestic processes.12 Which brings us back to Kerry’s point, domestic processes are sometimes a significant barrier to treaty ratification.

Customary International Law

It is also useful to lay some groundwork for the discussion of customary international law as another method for creating international law. Customary international law dictates that states should behave in accordance with legal rules evident in established practices. Article 38 of the International Court of Justice Statute, the article which directs the Court to decide cases submitted to it through treaties or custom, refers to “international custom, as evidence of a general practice accepted as law.”13 There isn’t a magic formula for showing “general practice” and the phrase has long been fodder for legal scholars and law school competitions alike, but there are thankfully some established parameters. For example, the state whose interests may be affected must participate in the practice. Additionally, the practice should be broadly characteristic of all the states and not only to those states in a particular region.14

Soft Law

Growing in acceptance is what legal scholars refer to as soft law. Despite its name, soft law is more of a social norm than a legal one. Soft law is commonly understood to refer

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9 Article 2, Section 1(a) to the Vienna Convention on the Law of Treaties
10 Lowe, How International Law is Made, Oxford Public International Law, 27 September 2007 (Book)
11 Read, "International Agreements," Canadian Bar Review 26, no. 3 (March 1948): 520-532
12 Lowe, supra note 8
13 Statute of the International Court of Justice, https://www.icj-cij.org/statute
14 Lowe, supra note 8
to a written instrument containing principles, norms, standards, or other statements of behavior. Soft law agreements are viewed as political agreements that could lead to law, but are not law, thus making them potentially easier to negotiate. Violations only give rise to political consequences. The sustainability of these commitments is debatable, but it is plausible that soft law norms may establish practices, which could harden into becoming customary international law or lay the foundation for subsequent treaties.

A DECLINE IN MULTILATERALISM

In his 2018 Professor George Nolte described the cycle of treaties as, “the establishment of basic rules after the Second World War, a blossoming of treaties during the 1990s, and signs of crisis, and perhaps even decline, after the turn of the century.” While this exert notes a potential decline in treaties, Nolte’s outlook is not entirely pessimistic, and he goes on to reject a “doomsday mood” as premature. While world events continue to paint a bleaker picture than the one Nolte evaluated in 2018, so too this paper doesn’t aim to spread doom and gloom. International cooperation continues to flourish in many contexts, and the reasons for treaty decline are complex and numerous.

Taking an objective view then, we still see a decline when focusing on Article II treaties in the United States. These are international agreements following the process specified in Article II of the United States Constitution, which require the President to obtain the consent of the United States Senate. The number of treaties submitted to the Senate dropped to historic lows during the Obama administration and stayed there during the Trump administration. There are a variety of theorized and substantiated reasons for this – from the Senate majority refusing to work with then President Obama, to the Trump administration likely not prioritizing international agreements. It may also be that the drop-off is an indication of decreased demand. On topics such as tax or extradition, the United States has already completed such treaties with most nations.

The relative decline is also not entirely limited to the United States. Internationally,
since the 1950s the rate of wars and conflicts that result in a peace treaty have been dropping. This may be the result of a growing international framework for the law of armed conflict, but it may also be that states are unwilling to first acknowledge they were in a state of war – because war looks different these days. International conflict over the past 50 years is significantly different than throughout history. The use of cyber and space tools and assets have significantly changed how states interact both in peace and in times of conflict. Authoritarians are pushing their own norms more aggressively in recent years, based on their own definitions. New space and cyber tools provide an opportunity for reevaluation of principles and the definition of war – you need not resolve a war with a treaty if you never defined it as a war in the first place. Some countries are using that window to advance their own standards outside of a formal legal agreement.

It is with this context we look to the space and nuclear regimes. The United States is a significant world power with global influence, and it is experiencing a sharp decline in treaty participation. Globally, authoritarian governments are working to influence norms and principles outside the recognized legal framework. Resisting a fall into a “doomsday mood,” the present paradigm is still concerning.

THE NUCLEAR FRAMEWORK

Building on the notion of a general decline in multilateralism, there seems to be some consensus that the long-standing nuclear legal regime has reached a watershed moment. From instances of noncompliance of bilateral agreements to growing resentments over historic multilateral treaties, nuclear weapons hold the world in a precarious balance. Just one state can change the course of the world. This section profiles four legal instruments of note, the Treaty on the Non-Proliferation of Nuclear Weapons, the Treaty on the Prohibition of Nuclear Weapons, the Strategic Offensive Reductions Treaty, and the New START Treaty with the goal of recognizing how these instruments may be in jeopardy, but also noting where they continue to provide insight into future opportunities.

The Treaty on the Non-Proliferation of Nuclear Weapons
The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) aims to prevent states from growing an existing, or obtaining a new, nuclear arsenal. The NPT is considered

24 Id.
26 United Nations Audiovisual Library of International Law, Treaty on the Non-Proliferation of Nuclear Weapons, Introductory Note,
a cornerstone of the global nuclear framework and as “grand bargain” between nuclear powers.\textsuperscript{27} States join the NPT as either a ‘nuclear weapon state’ or as a ‘non-nuclear weapon’ state. Under the NPT the United States, Russia, China, France, and the United Kingdom are the only recognized nuclear weapon states, having built and tested at least one nuclear device before 1967. Of course, though, other states have nuclear weapons. In fact, one-third of all nuclear armed states are not members.\textsuperscript{28} To stay in line with its purpose, the NPT can’t allow for new nuclear weapon state members - acknowledging new nuclear state status would be remunerating their nuclear proliferation, in direct opposition to the intent of the treaty.\textsuperscript{29}

The effectiveness of any treaty is dependent on states seeing membership as necessary, and while it may be a “grand bargain,” there are challengers calling the necessity of the NPT into question.\textsuperscript{30} There is a growing resentment from non-nuclear states that nuclear states are not actually moving toward disarmament. Throughout the life of the NPT it has commonly been interpreted as allowing the nuclear weapon states to retain their arsenal, so long as they share nuclear energy technology with non-nuclear weapon states.\textsuperscript{31} As time marches on and complaints about the lack of disarmament go unanswered, there is a declining sense of necessity for non- nuclear states.\textsuperscript{32} The NPT’s structure creates a “haves” and “have-nots” approach to nuclear weapons, which some scholars argue was never sustainable to begin with.

In addition to the dissatisfaction of non-nuclear weapon states is the issue of compliance. In 2022 the five nuclear states in the NPT released a joint statement on “preventing nuclear war and avoiding arms races,” declaring their commitment to the NPT.\textsuperscript{33} However, at the treaty’s 10\textsuperscript{th} Review Conference that year the states failed to reach consensus on goals regarding weapon free zones.\textsuperscript{34} This failure to reach an agreement underscores the

\textsuperscript{29} Pretorius, \textit{supra} note 24.
\textsuperscript{30} Lee, Manseok, and Michael Nacht. “Challenges to the Nuclear Non-Proliferation Treaty.” Strategic Studies Quarterly 14, no. 3 (2020): 95–120.
\textsuperscript{32} Borger, Sample, ‘All You Wanted to Know About Nuclear War, but Were Too Afraid to Ask’, Guardian, 16 July 2018, \url{https://www.theguardian.com/world/2018/jul/16/nuclear-war-north-korea-russia-what-will-happen-how-likely-explained}

\textsuperscript{33} Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races, January 3, 2022, \url{https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/03/p5-statement-on-preventing-nuclear-war-and-avoiding-arms-races/}

\textsuperscript{34} Rosa, Gabriela, Arms Control Association, Updates from the 10\textsuperscript{th} NPT Review Conference, August 26, 2022, \url{https://www.armscontrol.org/blog/2022/updates-10th-NPT-RevCon}
fear of a weakening nuclear regime, with some even contending the NPT is in a “deep crisis.”

The Treaty on the Prohibition of Nuclear Weapons

In response to the criticisms of the NPT, the Treaty on the Prohibition of Nuclear Weapons (TPNW) has emerged. The TPNW outright prohibits nuclear weapons, leading towards their total elimination. Many scholars are optimistic of what is termed a humanitarian approach to nuclear disarmament. Others have expressed concern that the TPNW is a risky distraction. Though no nuclear weapon states signed the treaty, it received majority support in the United Nations. The intent, presumably, is to put pressure on nuclear weapon states and their allies by “naming and shaming” them. It’s established that a treaty cannot bind third parties who haven’t expressly agreed to it, but proponents of the TPNW argue that the coming together of a majority of countries who follow a practice can create social norms against nuclear weapons.

The Strategic Arms Reduction Treaty (START) and Strategic Offensive Reductions Treaty (SORT)

In 1994, the Strategic Arms Reduction Treaty (START I) was the first agreement that required the Soviet Union (later the Russian Federation and the other three independent states resulting from the dissolution of the Soviet Union) and the United States to require reductions of strategic nuclear weapons. START I was initially successful, calling for on-site inspections and other monitoring protocols. Running parallel to START I was START II. In 2002 the United States and Russia signed START II, which sought to establish a limit on strategic weapons and further required reductions – only it never entered into force. Reminiscent of Secretary Kerry’s comments earlier, after the United States Congress never voted to ratify the agreement, Russia declared it was not bound by it.

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39 Ruhle, supra note 36

40 The Lisbon Protocol later included all five states: Russia, Belarus, Ukraine, Kazakhstan, and the United States.

With START I still in place but with the START II process in shambles, the United States and Russia entered the Strategic Offensive Reductions Treaty (SORT). SORT required the decrease of strategic weapons and kept START I in place. SORT set no protocols for determining compliance, as it was decided the states could rely on the START I verification process. Confusingly, however, START I expired three years before some SORT limits took effect. In response, the two states created the Bilateral Implementation Commission, and later the Consultive Group for Strategic Security to address implementing the agreement and to explore arms matters. Though the success of these working groups and commissions is unclear, they provide an opportunity to examine how bilateral agreements may impact discussions. Russia and the United States were consistently brought together to negotiate in these working groups, and communication is beneficial to continued engagement.

Continued Bilateral Efforts: New START Treaty
The SORT was superseded in 2011 when New START was entered into force. Drawing on the provision of their first successful bilateral agreement, START I, the United States and Russia agreed to a new set of verification measures in New START. Though the process was not without significant tension, New START was set to run through 2026. However, in 2023 the United States announced that Russia was no longer in compliance with its obligations. As a result, the United States has refrained from facilitating Russian inspections of United States facilities or sharing data, but consistently notes that it “remains ready to work constructively with Russia to fully implement the treaty.”

Acknowledging that this paper has only provides a summary of these agreements and that the successes and failures of agreements are the result of many variables, security begins and ends with mutual understanding. Finding points of consensus is extremely difficult, and compliance is never assured, but communication and transparency provide some measure of ongoing security. While seemingly in jeopardy, these efforts foster discussion on a state-to-state level, which may create conditions to identify agenda items for future reduction debates.

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42 Kimball, supra note 39.


THE PRESENT SPACE LAW FRAMEWORK

Scholars generally concur: a new Outer Space Treaty is unlikely in the modern decade. As commercial and military uses of space expand rapidly global powers show a resistance to any imposed limitation on their operations in space. New nations are entering the space-faring age and it is likely they are also unwilling to agree to limitations above and beyond the landmark treaty. However, space is inherently global. A nation’s satellites orbit the entire globe, all day every day. Like nuclear, the decisions of one state have significant security impacts on the entire world at once. Unlike nuclear, space has long been an area for global cooperation and engagement. It has not been without its tension, of course, but space exploration has historically been a positive spot in international discussions. It is with this change in tone that this paper turns to space law. This section takes a deeper look at the state of space agreements and the use of bilateral or soft law avenues in outer space.

The Outer Space Treaty
Signed and entered into force in 1967 the Outer Space Treaty (OST) is largely focused on the peaceful use of outer space. OST is largely considered the cornerstone of international space law and is generally viewed as successful. Signed during the of “Space Race” between the Soviet Union and the United States, the treaty relieved some tension regarding the use of weapons in outer space. Though the Soviet Union and the United States were not the only two original signatories, they were the most active space states at the time. The United States and the Soviet Union were also critical players in the construction of the treaty language itself. In 1966 the two states both submitted their own drafts of treaty language to the United Nations General Assembly. Over six months, mutually agreed upon language was created. This significant focus on the United States and the Soviet Union, as well as the emphasis on peaceful uses of space and the restrictions on weaponizing space, have led some scholars to think of the OST as purely another nuclear treaty, and minor one at that.

However, that view is reductive of the impact the OST has had on global space operations outside of the nuclear context. While it's accurate that OST bans the stationing of weapons of mass destruction in outer space and prohibits military activities on celestial bodies, it covers activities beyond nuclear weapons, impacting the commercial and civil space communities significantly – from state liability for commercial actors to considerations

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45 O’Brien, supra note 4.
47 Burbach, “H-Diplo ARTICLE REVIEW 1021,” review of Merely a ‘Scrap of Paper’? The Outer Space Treaty in Historical Perspective., by Stephen Buono, H-Diplo, February 24, 2021,
of what commercial activities may constitute appropriation.\(^{48}\) It is important to not lose sight of the OST’s purpose beyond serving as an arms control or nuclear treaty. While security is baked into it, the OST serves an array of purposes within space law, making it an incredibly unique instrument. It is serving double, maybe triple, duty in space.

With this important nuisance noted, the OST has largely been successful in limiting the weaponizations of space. As Nikita Chiu points out, “Since these treaties were concluded, to date, there have not been any atmospheric tests or nuclear detonations in outer space, nor have there been any installations of WMD detected in orbit.”\(^{49}\) This achievement is particularly notable when again considering the timeline of the OST. Throughout the 1960s the fear of nuclear weapons in orbit was sincere – and it is noteworthy the United States and the Soviet Union were able to work through the United Nations to prevent the nuclearization of space.\(^{50}\)

**The Use of Multilateral Agreements following The Outer Space Treaty**

Following the OST are several multilateral agreements that further refined and defined the language of the OST. In total there are five United Nations Treaties on Outer Space and five “principles” which constitute declarations of meaning. This section takes a brief look at just three of these instruments, The Moon Agreement, The Principles on Remote Sensing, and The Principles on Nuclear Power Sources.

Generally, The Moon Agreement reaffirms that celestial bodies, namely the moon, “should be used exclusively for peaceful purposes, that their environments should not be disrupted, that the United Nations should be informed of the location and purpose of any station established on those bodies.”\(^{51}\) The Moon Agreement is largely clarifying terms within the OST. It has been ratified but most space faring nations, except the United States who argues that the agreement opposes its interest in free enterprise. The subject and politics of the agreement aside, The Moon Agreement is an interesting example for the purposes of this paper, being a large-scale multilateral agreement in which one of the largest relevant states is not a member.

Principle VI of the Principles Relating to Remote Sending of the Earth from Outer Space encourages the use of observational power of space assets in international agreements – such as the verification measures in several of the nuclear agreements.\(^{52}\) Again, like the OST, space instruments are serving a dual purpose. Supporting nonweaponized activity in space,

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\(^{48}\) Kimball, Daryl, Arms Control Association The Outer Space Treaty at a Glance, October 2020, [https://www.armscontrol.org/factsheets/outerspace](https://www.armscontrol.org/factsheets/outerspace)


\(^{50}\) Chiu, *supra* note 47.

\(^{51}\) United Nations Office of Outer Space Affairs, The Moon Agreement

while additionally providing avenues for increased security.

The Principle on Nuclear Power Sources resolution adopted by the general assembly acknowledges that nuclear power sources are particularly suited for some space missions or even essential given their compact size and long life. The principles further outline requirements for technical safety assessments and other measures of technical expertise regarding both nuclear and space technologies. The need for technical expertise is a frequent contention in the terrestrial nuclear regime, drawing a parallel between these principles and several of the nuclear arms control agreements.

These instruments are far from a conclusive list of all agreements pertaining to space, but looking at the totality of space law, no new treaty has emerged from the United Nation’s Committee on the Peaceful Uses of Outer Space (COPUOS) since 1979. Why no new space treaties, after a flurry of them in the 1960s-1970s? That decade saw a boom of technology, and with it an immediate need for some kind of framework and rules for security. Additionally, at the time, the COPUOS delegates recognized the technical expertise of the United States and the Soviet Union and gave their drafts significant weight. With new players to the space field, came new opinions, needs, and factors. This crowded and complex new situation makes traditional methods of legal agreements a considerable challenge, leading to new avenues for collaborative space operations.

**National Space Law, Commercial Contracts, and Intergovernmental Agreements**

Much of modern space law lays outside the United Nations and the multilateral treaty structure. States must develop some measure of national space law to govern their space-related activities to comply with their international obligations under the OST. Most space faring states adapt national legal frameworks based on their specific needs and the range of space activities conducted in their state. There also exists a massive body of commercial agreements that impact outer space operations and the companies working in space. In addition to these commercial contracts are civil contracts and international ones applying to specific space missions undertaken by states.

A good example of this is the Intergovernmental Agreement (IGA) governing the International Space Station (ISS). The international cooperation on the ISS is governed by the IGA, a series of Memoranda of Understanding, and assorted agreements made when the needs

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The precise mission of the ISS is not analogous to many other global challenges, but it does create a proof case for the possibility of long-term collaboration on an active level. With daily international interaction taking place both on the ISS and on the ground to support operations, the ISS requires constant communication between partners. This may be the key to its success in bringing varied parties together, even while they experience conflict on Earth.

The Artemis Accords

In 2020 the United States began a push for a series of agreements called the Artemis Accords (Accords). The Accords underscore existing law from the OST, while also reinforcing United States interpretation of international law - advancing United States thinking about operations in space globally and seeking to define ambiguous language. The Accords cover a variety of topics including the need for peaceful purposes in space activities, transparency, the sharing of scientific data, protecting space heritage, space resources, and orbital debris.\(^57\) Though the United States has referred to the Accords as “a bold, multilateral vision for the future of space exploration,” the individual agreements are signed bilaterally between the United States and its partners.\(^58\) The agreements bolster existing multilateral instruments, while also perhaps attempting to set some norms of behavior.\(^59\)

In this effort, the Accords lay out a few controversial solutions to areas ripe for conflict or international disagreement in space. One notable issue is the notion of “safety zones.” The OST clearly bars state appropriation of celestial bodies, but for space mining activities the question of the extracted materials becomes cloudier. The Accords provide that

\(^{56}\) St-Arnaud, Farand, Uchitomi, Frank ‘The Legal Framework for the International Space Station’ a presentation made to the UN Committee on the Peaceful Uses of Outer Space Legal Sub Committee, April 17, 2023, https://www.unoosa.org/pdf/pres/lsc2013/tech-05E.pdf

\(^{57}\) United States Department of Space, Artemis Accords, https://www.state.gov/artemis-accords

\(^{58}\) Littlejohn, Jennifer, ‘Space Unites Us’ United States Department of State, May 5, 2023, https://www.state.gov/dipnote-u-s-department-of-state-official-blog/space-unites-us

“the extraction of space resources does not inherently constitute national appropriation”, provided that “contracts and other legal instruments relating to space resources should be consistent with the [Outer Space] Treaty.” Presumably seeking to support the United States commercial industry interested in space mining, the Accords then go on to establish the concept of safety zones, where a state must not interfere with other state’s resource extraction activities. The Accords don’t go into the specific logistics into designating territory or “zones,” only limiting them by the scope and timeline of the existing space activity’s operations. One can imagine that such a practice may favor states with ample resources – creating a “first in time, first in right” approach to resource extraction or other activities on celestial bodies. Further, the Moon Agreement (which the United States is not party to) expressly states that the Moon "and its natural resources are the common heritage of mankind," and commits states to creating regimes for governing space resources. Such conflicts in language or notions of territorial delegations could easily lead to international tension – so why have 27 countries, several of whom are party to the Moon Agreement, signed?

The Accords initially targeted allies, as its first signatories included the United Kingdom, the United Arab Emirates, Luxembourg, Japan, Italy, Canada, and Australia. The Accords encourage the notion of cooperation and state a desire for establishing joint-efforts, including mention of the United States Artemis mission. However, there is no tangible “carrot” for the signatories, beyond affirming OST principles and showing an understanding for the United States’ interpretation of them. For some states, it may be that signing is meant to show appreciation for their relationship to the United States. It fosters a sense of collaboration and is a show of trust within the United States – who is an advanced and predictable partner in space activities.

Additionally, an interpretation of international law that benefits the United States space industry also benefits the commercial sectors of other signatories. The more lenient interpretation of appropriation and the policy focus on commercial endeavors would benefit space companies in any country. The ownership rights to the “fruit of your labor” are a tried-and-true incentive model for humans, underscoring the classical notion that to claim property...

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62 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 18, 1979, 1363 U.N.T.S. 22
63 United States Department of Space, Artemis Accords, https://www.state.gov/artemis-accords

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has always been an economic incentive for human expansion.\textsuperscript{64,65} Is the “carrot” for the Accords a bet on the signatory’s own commercial space industry or a showing of good faith with the hope that it leads to engagement with the United States industry? Regardless, as more and more states join the Accords, their popularity grows.

It is too early yet to determine if the Accords have truly made space a safer and more collaborative domain. There is genuine concern that if China and Russia are not a part of the process, the Accords will contribute to the escalation of competition and rivalry in space.\textsuperscript{66, 67} In 2023, China announced its creation of the International Lunar Research Station Cooperation Organization (ILRSCO) in support of the China-led International Lunar Research Station (ILRS). ILRSCO is somewhat analogous to the Accords, and its political groundwork – the notion being to create an international collaborative group working on the Moon.\textsuperscript{68} Russia is working with China on the ILRS, as well as a growing number of other countries. While the Accords and the ILRSCO may easily operate parallel to one another, it may also represent a “bifurcation in lunar governance and approaches to lunar missions, where you are either Team Artemis or Team ILRS.”\textsuperscript{69}

Given this bifurcation, it cannot be said that the Accords are the global success story they sometimes proport to be (at least not yet). Though that is not a signal of failure. Due to the Accords, significant dialogues are happening collaboratively on the world stage garnering public attention. Both the Accords and the ILRSCO represent new agreements, where none had come for many years. Like many issues of international law, both walk the line between friendly cooperation and escalating competition – but at least that line is up for discussion. The Accords, primarily underscoring established law in the OST, move the ball forward just slightly, keeping discussion of issues like resource allocation, jurisdiction, and common heritage productive. If these issues are to be solved, they had to be put forth beyond debates


\textsuperscript{65} But in the reverse, that’s just what has some people worried – colonialization and human land grabs also have a rich history of harming marginalized populations. When it comes to the Moon there may not be an indigenous population to be harmed or displaced, but there are state’s less situated to compete for operational “safety zones.” Those nations are likely to miss out on valuable access to space as more space-advanced nations begin operations.


\textsuperscript{67} Wang, NASA’s Artemis Accords: The path to a united space law or a divided one?, THE SPACE REV. (Aug. 24, 2020), https://www.thespacereview.com/article/4009/1.

\textsuperscript{68} Jones, Andrew, China to establish organization to coordinate international moon base, April 28, 2023, https://spacenews.com/china-to-establish-organization-to-coordinate-international-moon-base/

on the U.N. committee floor. Criticism of the Accords is just as healthy as praise because it keeps the dialogue in motion. Perhaps this is the victory of soft law. While lacking in weight, its ease is its superpower. Creating consistent and constant communication helps build predictability and trust, which is a recipe for a more secure world.

DRAWING THE ANALOGY: WHERE SPACE AND NUCLEAR FRAMEWORKS ALIGN AND DIVERGE

Reviewing the nuclear arms regime and space law there are some analogies that can be drawn between the two. Identifying these overlaps in function and purpose enables the discovery of useful lessons from one to the other. The first and most obvious of these are the players: the United States and Russia are the historical and modern powerhouses both in space and in nuclear weapons. While a focus on these nations remains at the forefront of both areas today, the arena looks different than it has in the past. The global scope is bigger, as smaller or less-resourced nations are actively pursuing space operations or seeking nuclear resources more aggressively for energy.

Looking back to the OST and its dual role as a space operations and arms control treaty there are some observable ways space law impacts nuclear arms control. For instance, the nuance between weaponization and militarization being front in center, shows a clear delineation in the purpose of activities. This is mirrored in the nuance between nuclear arms and nuclear energy and the balance of those dual uses. The dual use of space and nuclear technology is also reflected in how the agreements support one another – space treaties can assist with compliance monitoring of nuclear treaties. This space-based enforcement of nuclear treaties can help to alleviate less politically practical inspection methods, such as traveling to nations with fragile security. Ongoing norms in space are instrumental in supporting arms control measures.

Legal instruments regarding space also require a need for technical expertise, like nuclear agreements. Building a nuclear facility or objects meant for space is extremely complex and specialized work. It is one of the reasons that displaying capability in either, is a signal of strength and prosperity. A national workforce that can build nuclear weapons or rockets is an educated and well-funded one. This complexity also drives a need for technical expertise in agreements. Verification mechanisms, present in both space and nuclear arms agreements, require specialists who know what they’re looking at. Facilitating reviews of the building processes, storage, and safety requires collaboration in identifying and agreeing upon who is an expert and qualified to verify terms are being met.

Nuclear arms control agreements and space law are also negative, or limiting, agreements. Rather than saying, "here is what can be done” they focus on “here is what may not be done.” This is reasonable, for if the emphasis was on prescribing what can be done in space,
the list would be infinite. The implication that anything unlisted would not be allowed in space would be severely limiting in a domain so large. Turning to nuclear, the reasoning for the limiting approach is inherent: the desire is to reduce the number of nuclear weapons that exist, not to encourage new ways to use them. The negative approach feels practical in these instances – it addresses very specific limitations (as in, you may not create new warheads) and outlines actions meant to restrain operations (as in, you must reduce your warheads by a certain number), without touching the wide array of what is left outside of that specificity.

This restrictive approach remains the norm in nuclear arms, but in space there is an apparent shift to permissive ideals. This is present in the domestic laws within the United States, but also notable in the Accords. The Accords name activities and seek to protect them, such as resource extraction.

A shift from restrictive to permissive thinking notably coincides with the accelerated use of soft law mechanisms in space. Nuclear arms agreements and space both deal with the challenges of dual use technologies and the need for extremely specialized expertise. Could a shift to soft law thinking revive nuclear arms discussions in the same way?

APPLYING THE SOFT LAW LESSONS OF SPACE LAW TO THE NUCLEAR REGIME

The Artemis Accords fall into the soft law category as a non-binding normative instrument that lays out a set of understandings, principles of behavior, and standards. While there are no binding measures, the Accords further the legal perspective of the United States and show a growing trend towards permissive views on space operations. The crystallization of the standards and norms the United States hopes to eventually codify, may help override the views of present dissenters by laying the basis for forming new customary international law.

Looking back to the TPNW, there is international interest in developing norms of behavior regarding nuclear weapons. Further, looking to the SORT, working groups and commissions have been agreed upon in the past by the United States and Russia. So, clearly, there may be some opportunities for soft law in nuclear arms control. This section will look directly to creating norms and to the power of communication channels instigated by soft law mechanisms.

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70 United States domestic law is working towards more permissive models in space governance, for example, in remote sensing. See, NOAA Eliminates Restrictive Operating Conditions From Commercial Remote Sensing Satellite Licenses, Office of Space Commerce, NOAA Satellite and Information Service, August 7, 2023, https://www.space.commerce.gov/noaa-eliminates-restrictive-operating-conditions-from-commercial-remote-sensing-satellite-licenses/

Developing Customary International Law to Support Non-Proliferation

International law may be formed through state practices that rise to the level of custom. Article 38 of the International Court of Justice Statute, refers to “international custom, as evidence of a general practice accepted as law.”72 For a practice to rise to the level of customary international law the state practice must be consistent, and the practice must occur out of a sense of legal obligation – often referred to as opinion juris.73 In many cases lawyers have successfully argued that many treaties and agreements have become customary international law, obligating states to its terms and/or definitions whether or not they are signatories.74 This can be an immensely powerful tool, then, when it comes to areas in which there are former treaties, but progress to making new agreements has stalled.

The consistency of observation of the general principles of the OST is well recognized – which is broadly true of the nuclear arms regime as well. However, whether the primary nuclear arms agreements have transcended to customary international law is less relevant than in space agreements – as only a limited number of states have nuclear weapons, compared to the number of states engaged in space operations. Further, the specificity of the nuclear state actors the NPT applies to, for example, removes most any argument of opinion juris for most of the active practices. The remaining “have-nots” are, of course, still legally obligated to some limitations, but again whether these instruments have become custom isn’t relevant to recent violations – the breaching state(s) are parties. So why then is the discussion of customary international in space potentially useful to the nuclear arms regime?

The Accords leverage the OST’s broad principles and operationalize them.75 These soft law agreements don’t create obligations so much as they construct definitions and elaborations on existing principles. The political and diplomatic move to bring nations into the United States space system with a non-obligatory agreement, that so frequently refers to the beloved OST, has no doubt played a part in their popularity.76 As more nations sign, more states develop a sense of legal obligation to these definitions – by which they may craft their own practices. It is a slow game, but in their own way the Accords are slowly building on to the OST; something that would have proved impossible on the floor of the United Nations.

There is an opportunity for the nuclear arms regime to learn from this. First identifying what has worked with the major nuclear players. Second, looking to ways to move the ball only slightly forward – as in, what definitional or marginal terms push the

72 Statute of the International Court of Justice, https://www.icj-cij.org/statute
74 See, Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America) Merits, Judgment, I.C.J. Reports 1986, p. 95, para. 177
76 Walker, supra note 84
goals forward without rocking the boat too hard. There may be an opportunity to bring the major nuclear weapon states more meaningfully back together without the baggage of the arguments over the existing agreements. The Accords are a way to say, “we all love the OST and respect it; let’s build on that.” Which, while it caused controversy and criticism (which is largely unavoidable), it was not so far as to make states reject it outright. In nuclear arms there may be room to say, “we all appreciate the NPT; let’s build on that.”

However, using customary international law to create new law is a long process, and ripe with uncertainty. Further, where nuclear arms are so fundamentally dangerous, friendly agreements are harder to come by. It’s much easier to agree to space missions on the Moon that don’t inherently threaten other nations. Competing space operations may prevent a state from completing the same work or limit future space access, but they do not threaten to end life on Earth. So, while customary international law may be “a tool in the toolbox” for diplomats and law makers working within the nuclear arms control regime, it is unlikely to experience the same success the Accords have experienced thus far.

**Developing Soft Law to Support Non-Proliferation**

The Accords are a controversial initiative, but they have largely well received. This is partially because the United States is an excellent partner to have, as one of the most active nations in space. The Accords are an opportunity to revisit old allies and partners and reach out to new ones outside of the traditional walls of U.N. Utilizing distinguished figureheads in space and celebrating the notion of partnerships, they also facilitate trust. The importance of the U.N. structure and the formal treaties is not in question, but the Accords operate outside such formality. They serve as a secondary mechanism for dialogues on space operations. This is where soft law can shine: its non-obligatory nature makes finding assent easier and it keeps relevant conversations happening. The process of making soft law may be where the nuclear arms regime can glean its greatest lesson from space law.

There is a general fear that the former nuclear arms structure is weakening, and norms are degrading. That shift is alarming and scary as the world aims to work toward total disarmament. If coming to a new agreement is not an option, which seems likely, keeping channels open is better than nothing. If agreements are heading toward deterioration, retaining communication keeps us safer than channels going dark. While soft law agreements may not be able to go as far as states desire, and may not even provide new additional safety measures, they can play a role in keeping communication channels open and functioning.

In the same way that the Accords provide the United States a less formalized way to communicate with partners and celebrate alliances and partnerships, soft law mechanisms in nuclear arms may re-open or keep-open channels of communication with critical states like

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Lessons in Space Law

Russia and China. Learning from the Accords, it is important to start small and view this style of agreement for what it is, a trust builder. A future new nuclear arms agreement may not be capable of overhauling the regime, but it may be able to promote global values of nonproliferation and influence other actors. In this way, using soft law as its being used in space via the Accords, may be extremely useful to nuclear arms goals.

To do this, the United States must determine some general principles that are most critical – reaffirming and building on existing principles. An agreement must garner a feeling of partnership and mutual respect for long held traditions. This could range from what constitutes an inspection, to the facilitation of working groups like those instigated through the SORT, to underscoring existing nonproliferation obligations. The aforementioned 2022 joint letter between the five nuclear states in the NPT, reaffirming their commitment to the treaty, could serve a launching point. The goal of an Accords style soft law agreement is to foster positive and friendly communications in an operation domain, starting from mutually understood principles. Leveraging positive communications and agreements of the past, like the Accords do with the OST, is a pathway to future agreements because it generates expectations and predictability.

Expectations and predictability are a pathway to trust. In an arms regime lacking in trust, as it appears to be now, soft law agreements may be a guiding star back.

CONCLUSION

This paper has argued that the nuclear arms regime could learn from modern space law, by utilizing the soft law model laid out by the Artemis Accords. To do this the functions of international law and the status of multilateral agreements in both space and nuclear arms were detailed. In exploring the analogies between space law and nuclear arms agreements, the Artemis Accords, and their creation, was described. While the comparison is imperfect, there are lessons from the Accords, and the creation of soft law, that arms control methods may benefit from. The creation of customary international law may play a role, but more significantly the quiet superpower of soft law is communication. The Accords have relied on long held principles from the OST, included notable and distinguished individuals, and invited other nations to be a part of space traditions. They’ve worked to generate a feeling of inclusivity over obligation, and progress over restrictions. Whether or not this shift in tone lasts, soft law keeps the dialogue moving and makes it easier for states to come together than more formal tactics do. Even when communication is contentious, it creates predictability, which is a pathway to trust. When global nuclear security is at risk having open channels of

communication makes the world safer than not. Soft law, as used in the recent Artemis Accords, may be a viable model for facilitating that communication.

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Feature Article

Consulting to Avoid Kessler

Madison Walker

The consultation obligation of Article IX from the Outer Space Treaty may be used to create a framework for sharing space situational awareness data, globally, with the intention of facilitating enduring coordination agreements for collision avoidance.

Over 45 years ago, Donald Kessler warned of a time when on-orbit artificial satellite collisions will be the main cause of debris creating events without any intervention from ground activity.1 Today we live that reality, and every year, Earth’s orbits get increasingly crowded. This trend will continue until a calamitous debris-generating collision makes it impossible to use this resource. Such an event is a real possibility if measures to reduce the risk of collision are not put in place.

One way to reduce the risk of collision between operational satellites is to mandate the sharing of space situational awareness (SSA) data globally through consultations between states when the potential for harm is high enough to warrant such a consultation. Adopting such a system would allow states to minimize liability and maximize confidence in SSA data accuracy. Yet, it is not enough to say that we should do something. There must be an explanation as to why states and their operators would engage in this solution. The why, in this case, can stem from Article IX of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty), which obligates states and their operators to engage in consultations if there is the potential for harmful interference.

The drafters of the Outer Space Treaty meant to create workable frameworks to enable the peaceful use and exploration of outer space by all nations.2 At the same time, the drafters wanted to ensure the Outer Space Treaty, and its subsequent treaties, remained relevant despite technological advancements or changes to the space field.3 One of the frameworks

3 Committee on the Peaceful Uses of Outer Space Legal Subcommittee, ninth session, “Summary Record of the One
written into the Outer Space Treaty is found in Article IX. Article IX requires that states act with due regard by not harmfully contaminating the outer space environment or interfering with the activities of other states. If there is potential for harmfully interfering with other states’ space activities, then states must engage in prior consultations.

The consultation obligation in Article IX is unique in an already unique treaty system. It places a concrete obligation on states to consult before engaging in harmful but not necessarily illegal behavior. This paper will explain how the existing obligations of the Outer Space Treaty, specifically those in Article IX, can be used to create a framework that will lead to a workable space traffic coordination system. By discussing the plain meaning of Article IX, alongside a subsequent agreement made by the state Parties—namely the International Telecommunications Union’s Radio Regulations (ITU RR)—subsequent state practice regarding collision avoidance, and the intention of the drafters, I will demonstrate the utility of Article IX for the future of space traffic coordination.

INTERNATIONAL LAW OVERVIEW

International law is complicated and rarely straightforward. An overview of international law is necessary to put this article into context. First, the primary subjects of international law are states, meaning states are the entities given rights and obligations by the international system. Individuals or corporations are objects, meaning they are only subject to international law through their states or specific treaties. As for what makes up international law, there are three main sources of law and one subsidiary source. The three main sources are international conventions, international customs, and general principles of law recognized by civilized nations. The subsidiary source is “judicial decisions and the teachings of the most highly qualified publicists of the various nations.” This article will rely on international conventions (i.e., treaties) and the subsidiary source.
The clearest form of international obligations is found in treaties. Treaties are written instruments wherein language has been carefully negotiated and explicitly agreed to; however, these very same careful negotiations often lead to vague language that is open to interpretation. In these instances, we must turn to the Vienna Convention on the Law of Treaties, a treaty that codifies international customs regarding the rules for interpreting treaties. Articles 31 and 32 provide most of the rules for interpreting vague treaty language. Article 31 provides the general rules of interpretation whereas Article 32 becomes usable when Article 31 fails to provide a sufficiently clear answer. Article 31 provides that treaties should be “interpreted in good faith in accordance with the ordinary meaning...in their context and in the light of its object and purpose.” The context referred to here is taking into account subsequent agreements or practice of the State Parties, as well as “relevant rules of international law applicable...between the parties.” If this analysis leads to an ambiguous or absurd result, then the supplementary sources in Article 32 come into play. These sources are the preparatory documents (called the travaux préparatoires) and the circumstances surrounding the conclusion of the treaty.

After determining what a state’s obligations are, how are they held accountable? The rules here are provided by customary international law articulated in the Draft Articles of State Responsibility (ASR). For a state to be held responsible, it must have committed an internationally wrongful act. An internationally wrongful act is an action that violates binding international obligations and is attributable to the state. Full reparations must be provided to return the harmed state to the condition it was in if the internationally wrongful act had not occurred. The International Court of Justice, whose jurisdiction is not compulsory, is a court that settles disputes between nations when internationally wrongful acts are alleged.

A clear obligation is essential in proving an internationally wrongful act because of the Lotus principle. The Lotus principle articulates an essential undercurrent of international

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law, that a state action is legal if that state did not agree by action or decree that it is explicitly illegal. In other words, international law is a primarily consent-based system with very little ability to bind states without their consent.

Many general rules of international law apply to outer space, the Outer Space Treaty, and its subsequent protocols. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies--known as the Outer Space Treaty--is the foundational document of international and domestic space law. All other treaties regarding the obligations of states in outer space expand on the principles of the Outer Space Treaty. The obligations in these treaties are relatively unique, and three in particular are worth highlighting. First, states are held directly responsible for the actions of their nationals and corporations. No one has to prove the act is attributable to the state because of the direct attribution language in Article VI of the Outer Space Treaty.

Second, to be held liable under the Convention on International Liability for Damage Caused by Space Objects (Liability Convention), a state only needs to be found at fault. Fault is a lower standard than an internationally wrongful act because one does not need to prove that there was a violation of an obligation, only that the operator acted negligently and caused the damage. Also, the Liability Convention has arbitration procedures whose jurisdiction is compulsory for States Parties.

Finally, states must consult with one another before engaging in activities that could cause potentially harmful interference. Prior consultations are a rare phenomenon in international law. Yet the drafters deemed it necessary to require some form of consultation before an operator harmed other operators because of the unique legal status of outer space. The Outer Space Treaty and its subsequent treaties mandate cooperation, responsibility, and liability to ensure that all states can peacefully use and explore outer space. Consequently, the treaties make it easier to hold states accountable for improper, not just illegal, behavior.

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20 The S.S. Lotus (Turkey v. France), Series A- no.10, Publications of the Permanent Court of International Justice 5, 18 para 44 (P.C.I.J. 1927). [The Lotus case has been used in countless articles and textbooks describing the meaning of the judgment and its place in international law].


23 “Outer Space Treaty,” art VI.


25 “Convention on Intentional Liability for Damage Caused by Space Objects,” adopted September 1972, ARES/26/2777, art XIV.
ARTICLE IX OF THE OUTER SPACE TREATY OVERVIEW

Article IX of the Outer Space Treaty is unique even for the Outer Space Treaty and its subsequent treaties. It contains four obligations: international cooperation, acting with due regard, avoiding harmful contamination of the outer space environment, and engaging in prior consultation before proceeding with activities that would cause potentially harmful interference. These obligations are meant to be read together rather than as discrete and separate. It is clear from the ordinary meaning, in the context of the treaty, that Article IX creates a coherent set of obligations. The construction of the document manifests this point. Article IX is the longest substantive article in the Outer Space Treaty. In addition to its length, it contains no paragraph breaks. Generally, the structure of other articles of the Outer Space Treaty is an obligation per paragraph break and a few paragraphs per article. There are no paragraph breaks in Article IX. The context leads to the conclusion that the obligations are meant to work together.

Beyond the drafting, we must look at the object and purpose of the treaty. One of the penultimate objects of the Outer Space Treaty is for every state to be able to engage in the peaceful use and exploration of outer space. Article IX was created specifically to enable that use and exploration. States cannot use and explore outer space if they are being harmfully interfered with or if the outer space environment is harmfully contaminated. Then again states cannot use and explore if they must never contaminate the environment or interfere with the activities of others (ex: spectrum usage). The balance of these interests is what it means to act with due regard. Balance of interests becomes infinitely easier when states act in accordance international and mutual cooperation. Acting with due regard ensures maximum peaceful use and exploration of outer space by all nations.

The drafters echo the logical analysis above in the travaux préparatoires of Article IX. When discussing what would become Article IX, the drafters made clear that the obligations

26 Marchisio, 169-88 quoted in Gabryonwicz, vi.; “Outer Space Treaty,” art IX.


28 Gabryonwicz, 5-6, 12-13, 19.


30 Gabryonwicz, 19. [In the due regard column both the USSR and US representative use the prior consultation requirement to define due regard]
should enable each other. 31 The draft discussions took place in the context of a series of experiments conducted by the United States. 32 There was concern these missions would cause harm to other operators and the environment without any prior consultation or agreement. 33 That concern drove states to require prior consultation before harmful actions were taken and oblige states to try to not act in a harmful manner in the first place. 34

ARTICLE IX: THE CONSULTATION OBLIGATION

Article IX’s obligations possess another unique quality, the consultation obligation is a conditional one. The duty to engage in consultations only applies when a certain set of circumstances arises. In order to examine what a state’s Article IX obligations are, one must know when the duty is triggered. One’s obligation to engage in consultations arises when there is “reason to believe that an activity or experiment planned by it or its nationals in outer space…, would cause potentially harmful interference with activities of other states Parties in the peaceful exploration and use of outer space”. 35 Two conditions must be present to trigger the consultation obligation. One, there must be potentially harmful interference to the peaceful activities of another state and two, the state planning said potentially harmful activity must have reason to believe that it is, in fact, potentially harmful.

The Condition

Potentially Harmful Interference

So, what is “potentially harmful interference”? The meaning of due regard can provide a general answer. Subsequent agreement by the States Parties involved can demonstrate acceptance of the general definition provided by due regard. Finally, subsequent state practice can help define the term potential.

Harmful Interference

Due regard is not a defined term in any treaty regarding outer space, yet legal experts have defined the phrase in the context of the high sea. The definition given by arbitrators in

31 Gabryonwicz, 5-6, 12-13, 19.
33 Gabryonwicz, vi.; Cheng, 256-57.
34 Cheng, 257.
35 “Outer Space Treaty,” art IX.
the *Chagos* case is less of a set definition and more of a balancing test.\(^{36}\) A multitude of factors must be considered when determining whether one is acting with due regard. One must look “upon the nature of the rights held…their importance, the extent of the anticipated impairment, the nature and importance of the activities contemplated by [the other state], and the availability of alternative approaches.”\(^ {37}\)

The formulation in *Chagos*, later quoted in the *South China Sea* arbitration, is reflected in a subsequent agreement by the Parties of the Outer Space Treaty, the ITU Radio Regulations, the most recent iteration adopted in 1995.\(^ {38}\) ITU RR 1.169 defines the term harmful interference in the spectrum context. It states, “interference which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radio communication service operating in accordance with Radio Regulations”\(^ {39}\) is harmful interference.

The ITU RR reflects the due regard balancing test and crafts two standards for spectrum sharing. It designated navigation and safety services as a high priority activity. No extent of impairment on safety and navigation activities is permitted because the right to travel safely has an extremely important nature due to its effect on human life. When less important activities are at issue, there is room for impairment, the extent to which is capped by frequency or severity.

In the context of conjunction avoidance, there is less grey area. The right at play is, as always, the right to peacefully use and explore outer space. The difference here is the extent of the impairment. If a conjunction were to occur it would render the satellite inoperable and create space debris that threatens the rights of hundreds of operators. The challenging part of determining when to share SSA data globally to prevent conjunction is determining what “potentially” means.

**Potentially**

When does the potential for harmful interference come into being in the context of

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\(^{39}\) “Radio Regulation Articles,” 22.
conjunction avoidance? One could argue it is ever present, and thus all SSA data should be shared globally all the time. That is overreaching and not supported by subsequent state practice. Subsequent state practice surrounding the global sharing of SSA data does provide a more realistic standard. The United States and Europe are the leaders in globally sharing SSA data.

The United States, currently through the Combined Space Operations Center (CSpOC) and in the coming years possibly through the Department of Commerce (DoC), tracks space objects, and when there is a possibility of conjunction, it sends the operators involved a conjunction data message (CDM).40 The CDM, theoretically, prompts the operators to analyze the situation for whether a maneuver is necessary.41

As for Europe, the European Space Agency (ESA) receives CDMs from CSpOC and combines them with its own data. Then the CDMs deemed high risk are analyzed further.42 ESA requires maneuvers when the chance of conjunction is 1 in 10,000.43 Thailand uses a similar system. CDMs are received then they are analyzed for high-risk conjunctions. Thailand’s standard is also 1 in 10,000 “and [a] miss distance < 1 km.”44 The industry standard to initiate coordination maneuvers is also 1 in 10,000.45 In addition to the threshold analysis, it is apparent that not every CDM is acted upon, no matter the state. The issuance of a CDM is not the threshold for potentially harmful interference. It is too low. Rather, the second layer of analysis done by ESA, Thailand, and commercial operators defines potential, using the information from a CDM and comparing it to a threshold that represents a high enough risk to prompt consultations and thus the sharing of SSA data.

Reason to Believe

40 “Collision in the Joint Space Operations Center.”
41 “Collision in the Joint Space Operations Center.”
43 Merz, 2.
Not to say CDMs have no part in interpreting Article IX. The other condition that must be satisfied for the consultation obligation to be triggered is that the state must have “reason to believe” that there is the potential for harmful interference. This condition can be very subjective, as noted by Dr. Bin Cheng, but in the context of collision avoidance, subsequent state practice has created an objective, actual notice mechanism that establishes a reason to believe. CDMs were created and standardized by states to make it as easy as possible to notify operators of potential harmful interference. In 2013, the Consultative Committee for Space Data Systems published recommended standards for the structure and the required information of CDMs. The standards are non-binding, but the CCSDS has an international membership that came together to create these standards. The creation and implementation of these standards by a wide range of states show that using CDMs as a way of notifying operators that there is a possibility of a collision is an adequate notification of the potential risk.

Logically this makes sense, CDMs are physical documents that show the operator had actual notice of the potential harm. Further, it is a document given to all affected parties, so the evidence of potential harm is not under the complete control of one party. The above-described nature of CDMs reduces the subjectivity of the phrase “reason to believe”.

Agreement on the use of CDMs, also denotes that operators should not always know of the potential for harm. Rather, when the chance of collision is high enough to prompt a CDM the operator now has a reason to believe that there is a potential for harm.

The Obligation

Now that we have established the set of conditions that trigger the obligation, we must examine the obligation. The obligation triggered by the set of conditions discussed above is “shall undertake appropriate international consultations before proceeding with any such activity or experiment.” In other words, a state must undertake international consultations with the party affected before proceeding with its activity and that consultation must be appropriate.

Prior Consultation

Requiring consultations before action in international law is rare because of the Lotus principle. Yet there are instances where states have obliged themselves to consult before engaging in activity that while not explicitly illegal, could be harmful. International scholars have coined the term prior consultation to describe this rare

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46 Cheng, 258.
47 “Conjunction Data Message 508.0-B-1.” Consultive Committee for Space Data Systems, June 2013. https://public.ccsds.org/Pubs/508x0b1e2c2.pdf.
48 “Conjunction Data Message 508.0-B-1,” pg. iv.
49 “Outer Space Treaty,” art IX.
phenomenon. A prior consultation is something more than notification, less than consent. Put another way, a consultation requires a back and forth but need not result in an agreement. Article IX of the Outer Space Treaty does require prior consultation, specifically in the form of sharing information in advance.

An example of this specific mechanism used in the context of outer space activities can again be found in the ITU RR. Generally speaking, in order to get a protected frequency allocation from the ITU, states must attempt to conclude coordination agreements to ensure a limitation of the creating of potential harmful interference. Coordination begins with publication of information pertinent to the intended spectrum use. Once the information given has been published and given to the potentially affected states, the states involved engage in negotiations. If negotiations do not result in an agreement, this does not prevent recordation of the frequency by the ITU, but rather it is recorded with limited protection and an indication of the states that disagree with the assignment.

Supplying data information and negotiations are required, but an agreement is not necessary to gain frequency allotment from the ITU. These procedures are robust, and prior consultations for outer space activities are not a one size fits all solution. Thus, the treaty mandates that states engage in “appropriate” consultations.

**Appropriate**

The ordinary meaning of appropriate is “suitable or proper in the circumstance.”

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51 Kiris, 906.

52 Committee on the Peaceful Uses of Outer Space Legal Subcommittee, fifth session, “Summary Record of Sixty-Eighth Meeting,” held on October 21, 1966, AC105_C2_SR68, 1, 5, [https://www.unoosa.org/pdf/transcripts/legal/AC105_C2_SR068E.pdf](https://www.unoosa.org/pdf/transcripts/legal/AC105_C2_SR068E.pdf). [USSR Representative talks about the requirement to provide information for potentially harmful interference, specifically talking about that is limited to information regarding the potential harm that could be caused]; Cheng, 257-58.

53 “Radio Regulation Articles,” art 4.2, 4.4.


55 Griffin.

56 Griffin.

57 “Outer Space Treaty,” art IX.

subjective nature of the modifier for the required consultations is proper because of the subjective nature of due regard and the variety of space activities. The drafters meant for states to have meaningful back and forth under the Article IX framework without being so rigid that the framework was unworkable.59

As stated above, an appropriate prior consultation for outer space can involve information sharing.60 Further, data requests from affected nations are found in different agreements and norms. These data requests take different forms depending on the process and interest involved. For example, the Remote Sensing Principles in Article IX allow possibly sensed states to make a request to sensing states.61 The requests are generally blanket requests given the sensed state generally has no way of knowing it has been sensed. The sensing state or entity then shall turn over the data “to the greatest extent feasible and practicable.”62 The limiting language allows for states to hold back sensitive data as well as charge for access to said data. This is a far different standard than the ITU data sharing and requests. The rights and interests involved are far different than frequency allocation, and thus the appropriate process is much different.

The ITU RR, which is binding, also allows for limited information requests by affected operators. After the initial information has been published and negotiations have begun, affected states can request further pertinent information required to come to an agreement.63 In short, data request and information sharing is an appropriate form of prior consultation for outer space activities.

As for a more specific definition of appropriate prior consultation in the context of conjunction avoidance, subsequent state practice provides some guidance. CDMs notify operators of potentially harmful interference, and once the operators have the information, they determine whether the potential is present via threshold analysis. The next step, in theory, is that a conversation between operators ensues. This conversation should end in an agreement on what maneuvers will be taken and when. An understanding is necessary before maneuvers are made to ensure the situation is not made worse by said maneuvers.

Many states do require coordination agreements as part of their licensing process. Yet, these agreements are a promise to consult, not prior consultation. For example, the U.S. Government, through the Federal Communications Commission (FCC), has a soft

59 “Summary Record of Sixty-Eighth Meeting,” 7.
60 “Appropriate Definition & Meaning.”
63 “Radio Regulation Articles,” art 9.44.
requirement for operators to make plans on how they will take on these collaborations when the time comes as part of the licensing. The requirement is not a real-time requirement but rather a promise to coordinate when the time comes. That precise time is not set out by the regulation. Further, there are no consequences for failing to follow the coordination procedures submitted before license approval. The defects of the FCC regulation echo in requirements around the world. Further, many nations have no such requirement for licensing.

Yet, the CDM process and the theory behind the coordination agreements demonstrate an appropriate prior consultation process for collision avoidance; supplying information to operators through CDMs prompting a back and forth (with predetermined procedures) is, in theory, a workable framework, even if compliance is sparse. Despite a lack of compliance, state practice demonstrates a recognition of the need for prior consultations but a failure to properly supervise its operators. Russia and China do not engage in prior consultation on a global level, but the reasoning for this is not straightforward. Looking at the available information, a clear picture of appropriate prior consultation, in the context of collision avoidance, looks like advanced information supplied by CDMs followed by threshold analysis that prompts a conversation where maneuvers to avoid collision are discussed.

The Right

Along with the consultation obligation of Article IX, there is a consultation right. A state “which has reason to believe that an activity or experiment planned by another State Party in outer space..., would cause potentially harmful interference with activities in the peaceful exploration and use of outer space… may request consultation concerning the activity or experiment.”

Under Article IX, the right to request similarly allows for information requests under limited circumstances. The limiting language is the set of conditions that must be present for the obligation to trigger already discussed. The right is only available when there is a reason to believe that there will be potentially harmful interference with peaceful activity. This limitation prevents states from requesting SSA data without reason.

When it comes to conjunction avoidance, the right is reciprocal. This means that if another state’s satellite could collide with the requesting state, then the requesting state’s satellite could harmfully interfere with the other state as well. The practical consequence of

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65 “Outer Space Treaty,” art IX.

66 “Outer Space Treaty,” art IX.
this is that the right to demand consultations becomes an obligation to do so in the context of collision avoidance.

Limitations of the Standard

The language of Article IX is not limitless in its application. Article IX applies to the activities of states. The ordinary meaning of activities is “the condition in which things are happening or being done.” The plain meaning of the term activity is broad. The use of this term is intentional, so the Outer Space Treaty could continue to apply to a wide range of outer space missions and technological advancements. Yet, there is one area that does not fall under the term activity, space debris. Space debris is a huge issue facing the global space industry, especially the SSA data-sharing community. There is no binding definition of space debris, but the Inter-Agency Space Debris Coordination Committee (IADC) defines it as “all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional.” NASA defines it as, “Orbital debris is any man-made object in orbit about Earth which no longer serves a useful purpose.” If something is nonfunctioning or not useful, then it is not in the condition of doing something or making things happen. Consequently, sharing data around space debris or inactive satellites would most likely not be covered by an Article IX framework.

POTENTIAL SOLUTIONS

There are two problems with the current SSA environment this application of Article IX seeks to solve: first, transparency and trust in globally available SSA data and second, compliance with coordination and communication standards. Applying Article IX in the way this paper suggests can be made actionable on the international and domestic levels to solve both problems.

The first issue of transparency and trust in SSA data stems from the data siloes and the main source of SSA data coming from the DoD, via the CSpOC. Due to obvious national security concerns, the CSpOC cannot be fully forthcoming in the sources of the SSA data being shared. This is one of the chief criticisms of the current SSA data sharing environment and reminiscent of the early days of the United States providing GPS data to the world but at...
selective resolutions and availability. In the case of GPS, intentional degradation of data is far less concerning, from a mission safety perspective, than in the case of SSA data.

Intentional degradation of SSA data and the subsequent lack of trust in that data is a danger to the sustainability and continued use of the space environment. The United States is attempting to fix this issue via domestic means by switching this responsibility to the Department of Commerce. If SSA tracking and data sharing is in the hands of Commerce, it will not only free military resources for other tasks but also allow for more transparency in the data that is the foundation of CDMs. Using commercial assets and an open-source format will allow for better accuracy and transparency in SSA data. As such, this will lead to more trust and buy-in into the system. This transition is a good first step but is slow going and does not go far enough. Space situational awareness for the purposes of mission safety is a global problem; it requires a global solution. An open-source data repository that can be verified by global stakeholders is a more comprehensive solution to the trust in data problem.

The appropriate forum for this repository is shaped by the second problem of coordination compliance. As mentioned previously in this paper, collision coordination plans are mandated by the FCC licensing process. A plan is required, but the execution or adherence to this plan is only recently starting to be enforced. Yet the enforcement is not predictable and neither is the expectation, as there is no standardization of what form collision avoidance communication should take.

The lack of international standard and domestic enforcement combined with the above data issue prompts this paper’s proposal of a nonexclusive centralized framework where data verification and consultation standards are entrusted to a permanent Committee on Space Research (COSPAR) group. The COSPAR group would be the organization responsible for the application of the proposed Article IX framework. It would articulate and consolidate the appropriate form of prior consultation for collision avoidance in a form similar to that of the International Civil Aviation Organization (ICAO) and recommend practices. The ICAO Council, which is made up of Member States and stakeholders, is responsible for standardizing best practices for civilian airlines.

The reason for this is the safety of the flight. Enforcement of the standards is the responsibility of various domestic licensing apparatuses of different countries; for the United

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71 “Outer Space Treaty,” art IX.
73 Gabryonwicz, 10, 13, 15. [Stating that the Australia, Canadian, U.S. Delegation stated that a COSPAR group would be the appropriate forum for consultations]
States this is the Federal Aviation Administration (FAA).\textsuperscript{75} In order to fly into the United States, the FAA must license the airline. Domestically, this is a straightforward process, but, similar to the space domain, air travel is not a purely domestic process. For international operators, the FAA has a two-tiered system of licensing. The first tier is for operators from nations that the FAA trusts have enough oversight to enforce the ICAO SARPs.\textsuperscript{76} Category one operators receive a far simpler licensing process due to this trust. Category two is for nations that do not receive this level of trust; for those operators in the second tier, they must go through the full FAA licensing process.\textsuperscript{77}

The carrot of access to the American market and stick of regulatory burden encourages large scale conformity to international standards. A similar process should be employed through a COSPAR group for space-related mission safety. One reason a permanent council for this purpose was not established initially is probably because the mission safety concern, i.e. potential for harmful interference, was much lower in the early days of space activity. This low occurrence rate meant the consultation could be done on an ad hoc basis. However, in our current time of 40,000 trackable objects on orbit, this is no longer the case. A permanent COSPAR to set these procedures and enforce Article XI framework is needed. As for enforcement of the COSPAR standards, the United States could use either Department of Commerce or the FCC as its enforcement arm. Currently, the FCC would be the most effective enforcement arm given they already have a licensing process for foreign operators wanting access to the United States market. This vehicle could be easily modified to enforce international satellite safety standards.

The benefits from standardization would be a clear articulation of what behavior a reasonable responsible space actor engages in, in the context of collision avoidance. This provides protection from responsibility and liability. The standardization would help define what these articles and obligations mean and provide clear parameters for what is a violation and what is fulfillment of these obligations. Engaging in the proper consultation process shows the operator, and by extension the state, fulfills its Article IX obligations and thus, at least on that basis, provides protection against accusations of an internationally wrongful act. Beyond that, a written standardized communication format can provide evidence to defend against an allegation of fault under the Liability Convention.

An interesting part of researching this paper was realizing that the subsequent state practice in this area is extremely similar to this paper’s proposal. The biggest difference is


\textsuperscript{77} “International Travel.”
that consultation would be compulsory if the threshold is met. States already know this is needed on a global level but are reluctant to mandate operators engage or have true transparency in data. The global political situation and the idea that engaging in consultations is an above-and-beyond behavior rather than a requirement contribute to these attitudes. Putting the COSPAR group in charge would help ease the political concerns. The COSPAR group would follow the tradition of space-focused UN bodies and be as apolitical as it is possible for a UN body to be. Membership could be determined on a rotating basis with permanent members. Permanent membership could be based on domestic SSA capabilities. The implementation of the system would reframe states’ outlooks. No longer would sharing SSA data or engaging in consultations be something to be commended, but rather it would constitute the bare minimum required by the Outer Space Treaty.

CONSEQUENCES OF NOT ADOPTING

As discussed above, in the context of subsequent state practice, many of the pieces necessary for a global SSA data-sharing system are already in place. The structure is there, but the compliance and communication are not. Interestingly, Russia, who proposed something similar to this paper in 2017, is the most uncooperative when it comes to consulting with international operators after a high-risk CDM is issued.78 Yet even nations like the United States with better compliance are not supervising their operators appropriately in this area. SpaceX had a close call with an ESA satellite in 2019.79 The risk of conjunction was 1 in 1,000, which is ten times higher than ESA and industry thresholds for a required maneuver.80 Upon obtaining this information, ESA attempted to consult with SpaceX.81 What happened next is in dispute. SpaceX claimed miscommunication, while ESA claimed SpaceX declined to engage in consultations beyond saying they would not move.82

The examples with Russia and the SpaceX/ESA situation demonstrate the need for a centralized global system where participation is mandatory. If SpaceX and ESA satellites

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79 O’Callaghan.

80 O’Callaghan.

81 O’Callaghan.

82 O’Callaghan.
Avoiding Kessler

collided or any one of Russia’s close calls ended in calamity, regardless of whether the Liability Convention was triggered, the United States and Russia, respectively, could be held liable.

Refusing to engage in an appropriate consultation when aware of potential harmful interference violates Article IX of the Outer Space Treaty. Committing an internationally wrongful act triggers the requirement for full reparations under customary international law and would be more than adequate proof of fault under the Liability Convention by virtue of it being a lower standard of culpability. An active COSPAR group would offer Russia and the United States a way to avoid liability under this theory. Not only would they fulfill their Article IX obligations by engaging, but the transparency and centralization in a UN body would make Russia more likely to engage in the first place and avoid the alleged miscommunication from the SpaceX case. The framework presented in this paper is not what must happen, rather it is a proposal for how to use the Outer Space Treaty language to create a reasonable framework that allows states to share SSA data more comfortably and have a clear standard that fulfills their Article IX obligations.

CONCLUSION

States Parties to the Outer Space Treaty have an obligation to engage in consultations if their activities have the potential to cause harmful interference with the activities of another state. Nations are aware of their Article IX obligations in the context of satellite spectrum allocation. The ITU Radio Regulations employ a due regard standard and set out prior consultation requirements. If states can recognize the importance of coordination to avoid harmful spectrum interference, surely states can recognize the need for binding coordination procedures for collision avoidance. Spectrum interference, while damaging, does not permanently disable a satellite; satellite collisions do.

In fact, states are aware of the importance of international communication and coordination when it comes to collision avoidance, as seen by conventional state practice. In fact, much of the infrastructure and processes proposed by this paper are already in place and generally agreed upon. All states need to do is (i) recognize that prior consultation for collision avoidance maneuvers is mandated by Article IX of the Outer Space Treaty and (ii) empower a UN body to be a centralized source of SSA data and standardize these consultations.

Adoption of such a system would help states minimize their responsibility and liability, not to mention the probability of collision between their satellites. Further

83 “Collision in the Joint Space Operations Center.”
international cooperation and faith in SSA data would increase. The framework proposed in this paper may not fit the bill of particulars, but establishment of some system in this vein would provide great benefit to states, their operators, and the global space industry.

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The Unified Command Plan for A New Cold War

David Stilwell

To my former colleagues in DoD: stop chasing Pakistan. And stop trying to get China to talk to you. You can be forgiven for these—you’ve been conditioned to look at the world as independent and unrelated regions, each with its own unique challenges, with everything going to CENTCOM to execute the top priority task of preventing another terrorist attack on the homeland. Even at the national level your political masters bought into the End of History argument in 1991, which made it difficult to appreciate the growing threat from China across UCP lines that separate the INDOPACOM’s PRC from CENTCOM’s Pakistan, Afghanistan, Tajikistan, Kyrgyzstan and Kazakhstan. In short, CENTCOM needs to think of itself as the Team on China’s Western Flank.

Defense of the Homeland (implied: preventing another terror attack) was rightly the highest priority immediately following 9/11, but it drove a previous CENTCOM commander to advocate for cooperation with China to counter Uyghur “terrorists” (even though the Uyghur East Turkestan Independence Party was never designated a terrorist organization) long after PACOM commanders concluded that China was a much greater threat to the US than ETIP. It’s as if our 4-star COCOMs don’t talk to each other.

For the last 30 years, since the end of the first Cold War, and since the national security apparatus shifted its attention almost entirely to the Middle East, this partitioning of the globe (and the consciences of senior leaders) seemed harmless. But nobody outside now-INDOPACOM noticed a significant change in the language of Chinese leadership that should have put all in the Pentagon, and the Beltway, on notice that there was a serious challenger waiting in the wings. Until Xi Jinping abandoned China’s successful “hide and bide” strategy, Beijing was reserved in expressing the long-term aspirations of the Chinese Communist Party. So we were lulled into complacency despite PRC pronouncements beginning in 2008 that the global financial crisis green-lighted the PRC’s move to “the center of the global stage”. This is when Beijing’s disinformation campaign of “the US in decline” and advocacy for Dr Graham Allison’s Thucydides Trap theory originated. The New Cold War began 14 years ago but it took a Pandemic and a Balloon to get us to take the threat seriously.

How is this possible? We simplified global problems by reducing them to artificial regional boundaries, without consideration to how the regions interact. And after 2001 we prioritized CENTCOM over all others, assigning promising officers to the primary theater where promotion potential was highest. In doing so we failed to develop an integrated global awareness, and without that, we missed the obvious challenges and opportunities where those artificial regional boundaries touched. With the happy exception of two Service Chiefs, we now
Unified Command Plan

have a senior officer 3- and 4-star cohort with almost no recent experience in the
INDOPACIFIC and definitely no long-term experience in the region. We stared at the
immediate without a thought to the future and we are now led by a senior officer cadre who
have mastered the last war (Counter Terror, Counter Violent Extremism) but are ill-equipped to
deal with great power competition. A quick look at how State and Defense divide the world into
intellectually bite-size chunks demonstrates the simplistic approach the UCP takes to a complex
world (See Figures 1-2).

What the UCP has failed to do over the last 30 years is to integrate those regions;
instead, each has focused on either Counter-Terror or Great Power Competition. Given the
global nature of the China challenge, and that it is weakest on the CENTCOM-INDOPACOM
border, now is the time to address this shortfall.

Consider the case of Pakistan and India. Pakistan was assigned to CENTCOM, while
India is in INDOPACOM. Although the long-term conflict between Pakistan and India (both
nuclear powers) has great potential to damage US interests, the ability of US Combatant
Commanders of the two regions to speak intelligently about the India-Pakistan situation is
limited. State department includes both India and Pakistan in the South and Central Asia (SCA)
bureau, but there is little cross-talk between State and Defense. Meanwhile SCA’s awareness of
and interest in the PRC is also limited.

Worse still, Pakistan figures far more prominently in Pentagon discussions than India,
where 1.4 billion democratic Indians hold infinitely more potential to cooperate on shared
security interests as a counterweight to the PRC and as an economic partner replacing post-
COVID China. Even so, in October DoD approved $500M in upgrades to Pakistani F-16s—
these are a direct threat to Indian security and a boon to PRC intelligence collection. And while
Quad (US, India, Japan, Australia) discussions focus on PRC’s repeated border aggression
against India, we continue to bolster Pakistani offensive capabilities while Pakistan’s erstwhile
ally China builds roads and pipelines for Pakistan in disputed territory in Kashmir. No wonder
Delhi questions our sincerity.

The declaration of an “All Weather Relationship of Strategic Cooperation” between
Pakistan and China should have told CENTCOM leaders to be measured in the relationship.
Back when combat operations in land-locked Afghanistan were at their peak, we needed access
to Pakistani airspace, something for which we paid dearly in economic and political capital.
When Islamabad made that too difficult, DoD shifted to the Northern Distribution Route. That
should have marked the end of this very lopsided US- Pakistan relationship, but the chasing of
Pakistan continues.

And it’s not just the India-Pakistan seam that should cause a re-think. China and
Pakistan’s “All Weather Partnership of Strategic Cooperation” should have at least started a
conversation in the Pentagon about moving Pakistan into INDOPACOM’s AOR. Or better yet,
the Administration should have directed DoD and State to align regional commands/bureaus
while creating a mechanism to significantly blur the geographic and cognitive lines between
China and Central Asia, acknowledging that the PRC’s explicit goal of global hegemony begins in its near abroad. China is an expanding global threat, but our outdated maps refute that development.

Strategically, Islamabad went all-in with China with the $60B China-Pakistan Economic Corridor (CPEC) a decade ago; CPEC is how Beijing intends to bypass strategic chokepoints in the Straits of Malacca and the South China Sea and gives the PLA an overseas Navy base to ensure access to Arabian Gulf energy which it desperately needs. CPEC saddles Pakistan with an impossible debt burden that it has tried to ameliorate with the IMF (pushing good international financial aid through Islamabad to Beijing) while providing Pakistan precious little. CPEC would see Pakistan’s Arabian Sea port of wadar turned into an energy transshipment hub, with PLA Navy port facilities as well (if the Djibouti and Cambodia models hold).

Beyond Pakistan, Central Asia presents opportunities that an integrated look at the world (or at least Asia) would make clear. The PRC’s Shanghai Cooperation Organization seeks to establish a collective security mechanism on China’s weak western flank; however, it is doomed by the multiple geopolitical contradictions represented by its membership. A single US Counter-Terrorism-focused command is not equipped to leverage the opportunities provided by the obvious seams in an SCO that puts open conflict between Pakistan-India and China-India on full display.

Kazakhstan recently shifted allegiance from Moscow to Beijing, likely due to higher payouts for elites in Astana. If NATO’s courting of Ukraine drove Moscow to open hostilities in February, how much more would losing its traditional sphere of influence in Central Asia to long-time rival China? It wasn’t that long ago that Moscow invaded Afghanistan to prevent this sort of destabilizing influence on its southern frontier. The history of that conflict (yet another stunning Russian defeat) is documented well in the movie Charlie Wilson’s War—worth a review as the Great Game in Central Asia (this time between Russia and China) shifts to a new phase. Central Asia is not exclusively a CENTCOM problem; it is equally impactful to EUCOM and INDOPACOM, and yet we operate off a UCP that limits our ability to take advantage of the opportunities presented by this region.

This is not Charlie Wilson’s War. It is the New Cold War, a global multi-domain competition. If Integrated Deterrence is going to mean anything, the Pentagon and the Interagency need to acknowledge 14 years of very clear signaling from Beijing that a Rejuvenated China seeks to replace the US “at the center of the global stage”. DoD must scrap the old UCP and create something that looks a lot more like the Single Integrated Operational Plan, expanded beyond nuclear conflict. The National Security Strategy touts the idea of Integrated Deterrence—here’s an opportunity to take a great leap in that direction.
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Stilwell

**UCP Lines Need to be Blurred**

![Map of UCP Lines Need to be Blurred](image)

*Fig. 1*
*Source: Author*

**New UCP Lines**

![Map of New UCP Lines](image)

*Fig. 2*
*Source: Author*
USAFA 64th Academy Assembly
Banquet Keynote on NASA Transformation

*In October 2022, at the 64th annual Academy Assembly, focused on “Waging Peace on the Final Frontier,” the former deputy administrator of NASA the Honorable Lori Garver spoke at the Air Force Academy’s 64th Academy Assembly banquet keynote on the implications of NASA transformation for international security. She was introduced in a pre-recorded video by Susan Eisenhower, honorary founder of USAFA’s Eisenhower Center, and interviewed by USAFA Institute for Future Conflict Fellow Madison Walker.

MS. WALKER: So, after all of that amazing introduction, I think we're going to go ahead and get started with the fireside chat. So, our first question, from that stunning introduction that we heard, you obviously had a big hand in commercializing NASA and one of the most public and important figures in that space is SpaceX. Now, they have involved themselves in the Russian-Ukrainian war without DoD involvement. So, the real question is, how does the government, in general, ensure compliance from these private companies that we have funded, empowered and, quite frankly, come to rely on?

LORI GARVER: Alright. Well, thank you for that. First of all, thank you for that introduction, both Susan [Eisenhower] and [Cadet] Chaudhary. It's wonderful to be with you all here. And Madison, just a great kickoff question because really, I think the vision, as you heard Susan Eisenhower say about her grandfather, is you got to start with the end state in mind. Strategic planning is really critical.

And when I was interested in getting a more competitive industry involved in space launch, it was for very obvious reasons. It seemed to me, you know, we all, no matter what we're going to do in space across [the] military, civil, and commercial world, need to be able to have access to space. I think of space as just another vantage similar to the oceans, when we first had the ability to cross them or the air when we first flew. Now, we will have new vehicles that have a more regular ability to be able to transport people and their stuff, satellites, spacecraft, etcetera, to space. And the obvious way to do that when you live in the United States is through competition with our private industry.

We had in the United States--between military and NASA--primarily been launching for over fifty years with government owned and operated systems, but of course we already had some privatized systems. So, all this is basically to tell you, don't blame me for Elon Musk, for goodness sakes!
And I do think that it was obvious in 2008, when I started in the Obama administration, that's my second tour of NASA, that to replace the shuttle, which was set to retire in two years, that this was the obvious path and SpaceX was likely to be the choice. SpaceX had already won an early competition to launch cargo, and so they were very likely to be a competitor and one with a good chance in commercial crew. Although the majority of people in the selection committee I think preferred the Boeing pitch, they would disavow that now, and having the private sector was never really as controversial as having the private sector that was owned by a very flamboyant billionaire. And this has brought in, frankly, a number of unforeseen issues.

The latest and perhaps most meaningful, certainly right now, is this issue of Starlink and Ukraine. And so, when you ask something like how does the government manage them, part of this is for all you young future leaders to consider these things at the beginning and work backwards. So, that's what strategic thinking is, sometimes we call it right to left thinking. In the end state, you want to set up the relationship so that you do still have some tentacles into their behavior. Frankly I think we—I use we as NASA—it’s a very hard habit to break if you ever have the privilege of working somewhere like NASA. But we, NASA, did not think early on that it would be billionaire owned companies when we were doing commercial policy.

When we first began this in my first tour at NASA in the 1990s, Lockheed, Boeing, Northrop Grumman, they all had an interest in bringing down the launch costs, but then SpaceX, very quickly, you know they've only been around twenty years, moved into the lead, dropping the price by suing people to get payloads on their rockets…but really by delivering. Starlink was even less thought of by the government at the time. I think I didn't even hear about Starlink until after I left the administration in 2013.

Thousands of satellites launched and, you know, I do not know these current details. I haven't talked to Elon personally in a couple years, and yes, our last communication was a dust up on Twitter, but if these satellites are as useful as we are fearing, I'm confused about why the government isn't paying for them. In my view, you shouldn't have a private company just on their whim creating something [so critical to national security] that the government has no association with, and it would be I think in our best interest to be able to take this on.

This is an expense that is pretty minor in the big scheme of things. If it's of value, we want to have some ability to manage it. We want to be able to leverage commercial capabilities for our access, and this is a capability to do that. I feel like that is what policymakers should be saying.

MS. WALKER: Well, thank you for that. I think it will definitely be a topic for the rest of the conference and also in the years to come. But I definitely want to discuss one valuable takeaway from the first part of your answer in the context that the Space Force is coming up on its third-year anniversary. So, it doesn't quite have its bureaucratic culture formed, yet. It's not
starting from a blank slate, but it may not want to copy exactly the Air Force bureaucratic model. You had a large hand in changing bureaucratic culture at NASA, so do you have any lessons learned for Space Force going forward?

LORI GARVER: Oh my gosh, yes. I think one of the reasons there are...so there is a lot of excitement, enthusiasm for Space Force...is because it is new and it is at the beginning where you can really establish your culture. And I don't think that NASA as a bureaucracy is too changed by what we did. I mean NASA has been in my view very flexible over the years. You think of an organization that was established in the Cold War to beat the Soviet Union. In 1990 (sic.), with Susan Eisenhower's help, we, and I was at NASA at that time leading the policy office, welcomed the [former] Soviet Union to the space station. We merged our human spaceflight programs. And if you think about that change of culture, to me that was huge.

And I'm often asked, why would you have imagined NASA could embrace the private sector the way they have? And I said, my goodness, they embraced the [former] Soviet Union. You know, we're a capitalist society. This [with the private sector], I didn't think was going to be that big a deal; they embraced it—as can be seen [by] anyone who watched and continues to see the now fifth commercial crew flight to the International Space Station.

Even I—when I watched that first launch in 2020—when the Tesla's pulled up, I said I don't think I would have allowed that. That's really out there. But how far we have come isn't really overcoming bureaucracy as much as culture. And so, I think the Space Force has the opportunity to set both.

First, NASA is carrying around, as are all the services other than the Space Force, the huge infrastructure with it. [A] large standing army and costs and things like that for NASA [have] held it back. We geared up for Apollo—a program from zero—and in ten years performed. But from there, we were left with this infrastructure, which then you had to pay for...for programs that aren't as large. Our budget has never reached quite half what it was during Apollo. It is about half today. So, even programs like the Space Launch System today, one of the reasons it is so expensive is because we are carrying those continued costs.

Space Force doesn't have that. And most people do view the heyday of NASA in those early years. It's hard not to if you think not even just about human spaceflight because we launched, you know, the Mariner program and we had the Voyagers, and the human spaceflight program: Mercury, Gemini, and Apollo. Within the first decade of human spaceflight, something like thirty-five people went to space and twelve of them walked on the moon. I mean, incredible. So, we're not going to live up to that. But we're certainly not if we don't turn the page.

And that's harder sometimes. I say in the book [Escaping Gravity (2022)], if you think about renovating a house versus building a new one, there are times when renovating is harder—it's more expensive. Space Force can take advantage of all the new technology. Does everything have to be brick and mortar anymore? These are things that are very different choices, and I
think there's a lot of excitement around the Space Force because people are aware of that. And it would be a mistake—that it does not appear to me from the outside you are making—to not try and build that. They can then be a vision for the rest of us, for government programs, for, you know, major acquisitions, programs for things that we need to develop. You can partner to gain capabilities and, again, not develop an infrastructure that is so lasting [so permanent] that it outlasts its usefulness.

MS. WALKER: Thank you so much for that. But you also mentioned Apollo; and I think you always have to have an Apollo question in a space talk; and that's because Apollo was a miracle, right? It's not just because we got to the moon by the end of the 1960s, but also it was through a government bureaucracy. It was a feat of technology and also a projection of power. Now, we live in a very different world. Is it still important for the United States to project power by doing U.S. missions under the flag through the DoD and NASA?

LORI GARVER: Well, I would say yes, it is. It's still important. And again, I was touched by Susan's remarks. Getting to know her many years ago was very special, and I think that [President] Eisenhower really did set a standard—by allowing the Russians to go first with Sputnik. And a lot of people have not appreciated this. So, I'm so glad it's come out. I talked about it in the book, and I was breathing a little sigh of relief, there, that her research tracks with what I wrote.

I feel like Apollo was born of the Cold War, but it was not a military mission. It was a civilian challenge. It was something that the United States wanted to do, to show that democracies were the best at advancing science and technology, specifically over the Soviet Union and communism. And it did that. We did that in partnership with the private sector.

We even had other countries involved. We don't talk about it much, but we did, and today that is as important as ever. I don't necessarily think they are the same types of challenges. To me it’s really about setting a meaningful goal that does seem unbelievable, and then achieving it. We haven't done that in a while.

I know the space station is an amazing thing. Human spaceflight is a wonderful, meaningful thing, and you have to be around any astronauts to see people, not just young people, light up around them. There is something intrinsically felt about these explorers, but we have a lot of new challenges today.

One of the things about Escaping Gravity, and the reason I named my memoir that, is it took a lot of people with a single goal. They knew: to overcome gravity was a big deal in the beginning, and a lot of people had to work on it together. But their vision was aligned. Right now, I think, our challenge is to have a vision aligned around and setting that right goal.
For me the answer is something like being able to meaningfully address climate change and address the harm it is doing to people on this planet. We have a unique opportunity from the vantage of space and in the atmosphere to help with this. I am a fan of Artemis. I think returning to the moon with a diverse group of people in a way that is sustainable, where we can go with other nations, and then go beyond that, is meaningful.

It's really a question to me of how do you do it? You must do it in a way that the world sees it as leaving something positive for the rest of us. And, somehow, Apollo was able to do that, but we do live in a different time. So, that is one answer. But to me the short answer would be yes. It is important that we do great things. We are a great nation. How do we get to be a great nation? You do great things.
LT GEN SHAW: Thank you. Well, good evening. And I can't tell you what an honor it is to be here for the Truman Lecture to cap off what I have heard has been a tremendous couple days of Academy Assembly…talking about space in all of its dimensions. I look forward to spending a few minutes explaining a few things that we've been thinking about in the U.S. Space Force and US Space Command, and then hearing what is on your minds and having a conversation, a little bit of Q&A.

Well, thank you for that wonderful introduction. I really appreciate it. General Clark, sir, always great to be back here at the United States Air Force Academy. You know, it's amazing what stays with you as you do more and more laps around the sun, as I've done. I can't remember all the floor plans of the twenty-plus homes that my wife Tonia, who's here with us tonight…[applause] … that we've had in our Air Force and Space Force journey, but I can still remember every cadet room that I had. I can picture it in my mind. And I arrived here … we're going back a ways, gang … I arrived here in July 1986.

I can still smell the grass on the parade field doing PT for basic cadet training. I can still smell the wet canvas out in Jacks Valley—you all know what I'm talking about on that. And so, in some ways it's like completing another orbit to be able to come back here and spend a little time with all of you.

So, 1990 was a red class, alright, so thanks for the [red] curtains here. Appreciate it. Thank you for making me feel welcome here tonight. I do have a few things, thoughts I want to share with you before I get started. I always have to start with the question that we seem to get the most in the various encounters that I have with folks, whether it's the general public, or even inside the Pentagon … we still get this question: What is the difference between US Space Force and US Space Command?

Now, most of you should know the answer to that question, but let's review, just to make sure we've got it straight. And remember the year 1986? That year that I showed up here, 1986, was when Congress passed the Goldwater Nichols legislation, which established joint warfighting commands and established the Combatant Commands that we have today. So, we
do have inside the Department of Defense…we have the services: the Army, the Navy, the Marines, the Air Force and now the Space Force. The chiefs of those services work for the secretaries of those services. The purpose of the services is to organize, train, and equip and present forces to joint combatant commanders and joint commanders for use in warfighting.

You all knew this. We have combatant commands. How many do we have now? Eleven, U.S. Space Command (USSPACECOM) is the eleventh Combatant Command. And those are joint commands. In the headquarters I work in we have folks from all the services. People come in and say, why is there a Marine here in this headquarters? I thought this was Space Force. We have to explain to them what a joint warfighting combatant command is. And the commanders, the four stars of those commands, they work directly for the Secretary of Defense. So, I get to spend a lot of my time on VTCs and sometimes in the room with the Secretary of Defense as the deputy when my boss gives me those meetings to cover. And it’s kind of an interesting perspective to be there. So, I like to think that I have one of the best possible jobs to have in the space arena in the Department of Defense today. Because I’m a member of the United States Space Force. Pretty excited about that.

I did transfer into the Space Force. [One day], I get this phone call … I’m the 14th Air Force Commander out at Vandenberg … now Vandenberg Space Force Base, California. I get the phone call from a Colonel in General Officer matters at the Pentagon, and I knew this call was coming, it wasn't a surprise, but you still have to go through the formal phone call. He said, “Sir, would you like to resign your commission in the US Air Force and accept a commission in the US Space Force?” It sounded like I was joining the French Foreign Legion at the time, is what it sounded like. “Yeah” I said, “why not? Sounds like fun.” That’s exactly what I said. And it's been interesting to be a Guardian here these past two years. But I also get to serve as a Guardian in United States Space Command alongside warfighters from other branches of our Armed Forces. And I get to come to work every day, and my focus is not on programs. It's not necessarily on budgets. I get to focus on, *How to defeat our adversaries in the next war?* How do we make sure that our space capabilities are available to joint warfighters around the globe, and how do we protect and defend those space capabilities on orbit? So, it has been a fun ride. It’s a terrific job to have. And I sometimes measure, by the way, how excited I am about a job by how quickly I get up in the morning to go to work. And in this job, I'm getting up pretty darn quick.

We'll talk a little bit more about Space Force and Space Command, but let me get to what I think is the heart of the intellectual thought I wanted to propose to you today. And that is this: welcome to the Third Space Age.

Now most of you have been thinking about space the last couple of days, so hopefully everything you’ve thought, maybe this will fit into it, this template that I'm going to describe to
you. I believe that we have entered the Third Space Age. When was the first space age? Well, it starts at the beginning. We can discuss where those beginnings were. Was it Sputnik? Was it even further back? Was it when we first started thinking about putting satellites into orbit? But it extends, I think, right about to the end of the Cold War. And in this era, it was defined mostly by the sectors of national security and civil space.

By civil space, I mean mostly the Mercury, Gemini, and Apollo programs that happened…that were part of a contest…a contest with the Soviet Union, which we started out not looking so good in, folks. The first picture of the far side of the moon was not taken by an American spacecraft. The first person in orbit was not an American. The first woman in orbit was not an American. We started out slow, but we finally got geared up and made it, and we were the first to the moon. At the same time, there was a lot of effort in national security. And it played a major role, I think, in containment of the Soviet Union and ultimately the winning of the Cold War. And that ranges from what we now can say openly, but we could not say, even when I worked for the National Reconnaissance Office as a captain, couldn’t talk about it publicly. Its origins were in the Cold War.

When Gary Francis Powers was shot down in his U2, we no longer could overfly the Soviet Union with aircraft safely, reliably, and consistently. We had to find another way. The National Reconnaissance Office came into being as a way to understand what was going on in the rather hermetic Soviet Union.

And then we could even fast-forward in the 1980s to the Strategic Defense Initiative, which was really focused on space technologies. We actually never fielded a lot of the capabilities that we were planning, but SDI sure captured the Soviet Union’s attention. This probably contributed to the early collapse of the Soviet economy and the end of the Cold War. That's the first space race, folks, mostly national security and civil sectors.

The second space race started somewhere … you know, history doesn't like to give us really bright lines, right? But if we have to look for a time, it's probably 1991, 1992, the collapse of the Soviet Union and then a rather remarkable agreement in 1993 between the President of the United States and the President of Russia to cooperate in space. Up to that point, they'd been developing their space stations on their own. We were looking to develop our own space station with our allies, and we agreed to cooperate. And then, in a remarkable fashion, civil space turned into an international endeavor in low earth orbit that started out with the former Soviet space station Mir, and then culminated in the International Space Station in the early 2000s, which to this day represents multiple nations, including the Russians.

***What else happened in that second space age? I would call it linear development in many sectors. It was expansive, but it was linear. There was very little commercial in the first
space age. Yes, we got our MTV through satellites, but there was very little. And it continued in a linear path. We increased geosynchronous satellite communications. We brought GPS into the game, which was a big game changer. It actually started in the Cold War, but then got pushed into the commercial and civil sector where everybody could use it. And we started to develop other commercial capabilities in that second space age, but they were rather linear in nature, just a continuation of what we’d been doing, but on a broader scale.

And then when it came to national security, what did we do? During the Cold War, we actually faced threats in space. If we were going to have a strategic confrontation with the Soviet Union, there were going to be satellites held at risk that supported that strategic confrontation. That went away when the Soviet Union went away, and we entered the second space age, a period of a rather…fairly benign domain. We were not under threat. And we developed our capabilities accordingly. They weren't necessarily built to withstand threats, but they were built to be as capable as they could to support terrestrial warfighting. And I spent the lion's share of my career doing that. Making sure the GPS was as accurate and available as possible to any warfighter, whoever they were, in the Middle East, out on the high seas, in the air; that SATCOM was as versatile and capable and omnipresent as it could possibly be; that missile warning transitioned from just detecting strategic threats to our homeland to detecting tactical ballistic missiles and other kinds of events that could be seen from space. Such things marked what we did in national security in the second space age.

And from the intelligence perspective, the National Reconnaissance Office (NRO) came out of the closet, didn't need to be secret anymore. A lot of their capabilities stayed classified, but they did much the same that we did on the military side, and that was to just make their capabilities better and better, better to understand what was happening on the surface of the Earth.

But then things started to change. And we started to see signs that we were shifting into another age. The first sign was in 2007. We saw China blow up one of its own satellites in fairly high Low Earth Orbit; thousands of pieces of debris from that event are still on orbit that we're still tracking today. But I think the real kind of shifting point happened between 2015 and 2019. We saw shifts happening in nonlinear fashion across all of the sectors of space. Let's start with commercial shifts such as the first time that SpaceX landed a booster that was reusable, which came back and landed at LZ1 at Cape Canaveral. It was also the year that they announced that they were going to start building the Starlink constellation, which was a revolutionary, nonlinear change in satellite communications. We weren't doing communications only from geosynchronous anymore. It was going to be a constellation of proliferated satellites in Low Earth Orbit. And we saw an explosion.
We had seen an increase in the second space age, but starting just a few years ago, we saw an explosion in commercial imaging from space with multiple companies producing large numbers of satellites capable of producing imagery that the NRO would have been really jealous to have had in the 60s and 70s. Pretty, good stuff. That's the commercial sector change.

On the civil sector, we made the announcement that we're going back to the moon. Low earth orbit was kind of an intermezzo period with the International Space Station; we're going back to the moon and we're going to go back there permanently to stay, and then from there to Mars. And NASA made these announcements and announced these programs just within the last few years. That was a nonlinear change in civil space.

And then from a national security perspective, we realize now the Chinese could have done this after they did their test in 2007. They could have said, you know, this is a bad idea… this idea of space weapons could be a problem … we're going to stop all of our space weapons programs. It could have been similar to something we kind of did back in the 1980s. We actually did blow up one of our own satellites using an F15 in 1985, and we saw all the debris that it caused—which is much lower orbit by the way, so it has long since come back. We said that's a bad idea. They didn't do that. They continued to develop counter space capabilities to come after our space capabilities. That drumbeat continued. Russia did the same thing … continued to develop new and more diverse kinds of counter-space capabilities. And so, we came to the realization we're going to have to do something about this.

We stood up [what is now called] the National Space Defense Center in 2015 out at Schriever Space Force Base, in eastern Colorado Springs. And then in 2019, as you know, we stood up U.S. Space Force and U.S. Space Command. Now, we used to have a United States Space Command, from 1985 until 2002. It started in that first space age, continued into the second space age, but we actually stood it down in 2002, after 9-11 and the establishment of the Department of Homeland Defense and Northern Command. We moved those functions because it was [then] a benign domain. It could be managed a bit more easily; we moved those functions into U.S. Strategic Command.

Well, there was a realization that because of those events I've described to you, we needed to have a US Space Command again. We needed a combatant command focused on the space domain exclusively as its mission, day in and day out, there to protect and defend our capabilities in space and to make sure that we deliver those space capabilities to the terrestrial domains. So, we stood that up in 2019. And then we stood up a Space Force just a few months later.

The idea of a Space Force, by the way, was not new in 2019. It wasn't new in 2017 or 2016. It's been around for a long time. It really goes back almost to the beginning of the
second space age and the end of the Cold War. The idea that we would have a separate branch of service or a corps that would be responsible for space...we just finally reached a tipping point in 2019 where we needed to do this because the threats were getting worse and our needs to be able to address those threats were growing. I'd suggest to you that the joint warfighter today relies more on space than she or he did yesterday and will rely more on space tomorrow than she or he does today.

And that curve does not seem to be changing its inflection anytime soon. We're getting better and better at using space capabilities across our joint force and, by the way, the same goes for our entire society. We're getting better and better and more dependent on space in our society writ large than we ever have before, and that doesn't show any signs of slowing down. It's for those very reasons that our adversaries have developed counter-space capabilities. Just imagine for a second, run a thought experiment. You're on the general staff in China or Russia and you're thinking, how do we beat the United States? You know they've got terrific technology. They've got the ability to project power across the planet. They have the best leaders. And the best personnel. Across the entire planet, when it comes to their military, by the way, I believe we do and that extends through all ranks...particularly our SNCO ranks, by the way, compared to the others. How do you beat the US?

Well, you know what? They're really reliant on space, and the further away from their homeland they have to operate, the more they need space to do what they need to do. Oh...and look! They don't seem to have built these satellites...these space capabilities...to be prepared for threats. We didn't. So, is it illogical, is it surprising to us that our adversaries would develop counter-space capabilities to come after us?

I'll give you a quick analogy. Really, our satellites that we have in Geosynchronous Orbit that we put up over the last thirty years are analogous to super tankers or mega container ships on the high seas. They're very capable, but they were built for efficiency, and they were built to deliver their effects, deliver their cargo across a benign domain to a far shore. That's how we built them. And they did that job very, very well. Who wants to be on the bridge of a super tanker when it comes under attack by torpedo or anti-ship missile?

Actually, you all are so smart, you could probably figure out some tactics to fool the enemy a little bit, but it probably is a losing venture in the long term. We've got to change our thinking, and that's what we're doing. How do we defend those capabilities and how do we actually change our architectures to be ones that are not those super tankers or mega container ships, that are fast freighters, and a lot of them. Probably, [this] is where we’re headed.

So, that's why we have a Space Force; that's why we have a US Space Command; and that's in the national security sector. What's interesting, the most important dynamic for you to take away on this third space age is the conjunction of the space sectors. Now, I choose the
word conjunction deliberately. It's actually a great space word. Some of you were *Schoolhouse Rock* fans, so you're thinking of it a different way. But the word conjunction actually goes back to ancient Greek astronomy and describes when two objects in the night sky came close to one another, as in *Jupiter and Saturn are in conjunction*. The conjunction of the space sectors…they're closer and more interdependent in our society today than they have ever been.

Let me give you a few examples. One of them was in the headlines today, and I'm sure some of you talked about it in the Assembly [64th Academy Assembly]. It used to be [that] the commercial sector didn't need to worry much about being attacked by a potential adversary out there. They never thought about that. They were just going to operate and stay out of everybody's way in space. Well, it turns out that when that commercial capability is being operated, and the services for that commercial capability are running against your warfighting plans, that becomes a target. That's exactly what the Russians are looking to do against Starlink and some of the commercial imaging satellites that we see out there today.

Now, I can understand that. My counterparts…and, by the way, we should always be thinking about what our counterparts are thinking, right? That should be one of the first things you're doing in your profession is trying to get inside their head and understand what they're thinking. My counterparts in Russia do not like Starlink. They do not like Maxar. Because it’s exposing them and showing not only Ukraine, but the world, what they're doing. It's not allowing them to maintain secrecy in their operations and it's exposing a lot of what they're doing. They don't like them. Those [systems] are going to come under threat. So, the commercial space sector now has to think about security. There's a conjunction in those sectors.

What about commercial and civil? Well, also a remarkable thing that happened near the beginning of the third space age was NASA giving contracts to commercial companies to take people into space. This was unthinkable just a decade ago. Why would we do that? We've never done that before. NASA builds its own rockets, its own capsules, and puts people into space. We're going to outsource this? We're going to contract this out? It looks to have been a brilliant move. It [has] actually freed NASA to really look at now getting back to the moon with Artemis and Orion and let SpaceX, and hopefully Boeing here soon with Starliner, be the ones to take astronauts to the space station, and it's having a spinoff effect as we're seeing in terms of space tourism too. It's having a spinoff effect into the commercial sector. So, there is a conjunction there between the civil and the commercial sectors.

And there is a conjunction between the national security sector and the civil sector. Actually, there always has been. It's just tighter and getting bigger than it ever [has been] before. At the very beginning of manned space flight, the Department of Defense was there. It
wasn't a civilian naval craft that pulled Alan Shepard out of the water after Mercury. It wasn't
civilian or contractor craft that pulled the Apollo astronauts out of the water. It was the
Department of Defense. And what we've been doing even more recently through the entire
second space age in the era of the shuttle and the space station is that the Department of
Defense has been fulfilling the role of warning NASA if there's a conjunction between any of
their craft in space and any debris or other satellite or other objects that are in orbit.

That's a mission being conducted today by a US Space Command unit out of
Vandenberg Space Force Base. We have a squadron that's devoted to watching what's going
on, cataloging everything that's in orbit and analyzing that to see if there are threats to the ISS
or to other satellites. They issue out messages to potential owner-operators where they may be
in danger of a conjunction and many of them will maneuver to avoid a possible collision.
NASA just did this with the ISS this past week, just in the last few days, did another one.

So, that [has] always been there, but as NASA and our allies that have joined NASA go
back to the moon, you can bet the Department of Defense is going to be part of that. We’re
already part of possible recovery of the astronauts for the commercial crew if there's a problem
on launch or if they come back and don't land where they're supposed to. It's the Department of
Defense that's going to go get them. As Artemis goes to the moon, they're going to need to
know if there [are] any objects in their way in the entire cislunar environment, and we're going
to be there to help them with that as well.

So, the question is, what aren't we thinking about in this conjunction of the space
sectors? Where is there going to be continued synergy, continued need for partnership in ways
that we've never done before, in tighter and tighter ways, in order to continue to do what we
need in space and to stay ahead of our adversaries? If the space domain of the first space age
was like the Arctic Ocean, fairly sparse, and the only kinds of things going on in the Arctic
Ocean were probably national security related or a little bit of exploration, the space domain of
today, at least the earth-moon gravity well, is like the Mediterranean.

There's a lot going on and a lot of different actors of a lot of different sizes. And yes,
there can and will be mischief going on in that environment. Let’s talk a little bit more now
about what our job is at Space Command, day in and day out. You'll notice that I have behind
me a picture of what we consider to be our relevant strategic space as it is right now. And it's
kind of inverted from most pictures you will get. We're looking back from the moon, down
back to the earth. The actual assignment to United States Space Command of what we’re
responsible for…and we do have an Area of Responsibility, by the way, it's the first one ever
assigned to any military organization in military history that is not on the surface of the planet.
It's not a geographic Area of Responsibility. It's an astrographic one, the first one ever. And
it's defined as starting at 100 kilometers above mean sea level and extending outward indefinitely. If you do the math, that is a very large Area of Responsibility. It is the entire universe minus the planet Earth and a little bit of atmosphere.

General Dickinson likes to remind Admiral Aquilino, who is the Commander of US Indo-Pacific Command, that he has the second largest AOR in the Department of Defense. But let's be a little realistic. We're not exactly looking at security issues around Alpha Centauri…yet. But we are interested in this strategic space here. You know, you can't treat the earth-moon gravity well as…you can't divide it up. It's a continuous astrographic feature. It doesn't have a bright line that says, all activity stops here, and you don't have to worry about anything beyond here. It's continuous. And there are actors operating within this entire gravity well. There are Chinese satellites on the far side of the moon providing communications to their rover that is on that far side of the Moon and back to Earth, orbiting the LaGrange point, a stability point in the earth-moon system. You can put a satellite in an orbit around that [point]. Folks, the earth-moon gravity well is our strategically relevant space to us, it’s the one we’re focused on at U.S. Space Command.

And the biggest challenge we have is understanding what is going on in that immense volume. Indo-Pacific Command talks about a tyranny of distance. We talk about a tyranny of volume. There's a lot of places you can hide in this space right here. And we need to understand what's going on to make it transparent, not only for national security reasons but also to incentivize economic development and to make safe the civil activities we're going to see as Artemis goes back to the moon. It's a pretty exciting time for all of us. So, I'll close my official remarks here and say when we look at the historical patterns we've seen, it's important to realize that in this new space age, we have to think about things a little bit differently, and it makes us think about the context, think about how the dynamics have changed, anticipate those dynamics, and find ways to take advantage of them and seize opportunities.

My career [of] military service started when I became a cadet here in July of 1986, at the tail end of the First Space Age. I've spent most of my career in the Second Space Age and only the last few years into the Third Space Age. Those of you, when you commission, and whether it's into the Space Force or the Air Force, space will be important to what you do and more important every day that you're in your job and in your career. I think it's pretty exciting to think you're going into the Third Space Aage. You'll see what plays out in that, and who knows what comes after. In the words of the poet from Europe, we have “so many light years to go and things to be found.” That's the Swedish rock band, Europe. “Final Countdown,” 1986. Alright, with that, I hope that I gave you something to think about, and I really look forward to hearing what's on your minds.
Operational Energy Solutions for a 21st Century Battlefield

Nestor Levin

Development of alternative energy storage and distribution capacity for the modern battlefield is a major national security interest.

In 2022, the world has become increasingly multipolar. The technological, military, and economic gap between the United States and its competitors is shrinking. According to a 2017 CNA Military Advisory Board report on Advanced Energy and U.S. National Security, “a U.S. energy stance centered on fossil fuels should not delay our … investment in advanced energy systems at home and abroad.” The DoD is the single largest energy consumer in the US and world’s largest petroleum consumer.

Such overreliance on hydrocarbon-based energy sources introduces threat vectors on the tactical, operational, and strategic levels. The massive American military apparatus dangerously relies heavily on extensive networks of logistics and infrastructure to supply oil and petrol. If the DoD moves away from hydrocarbon overreliance and instead adopts advanced energy systems while sponsoring their development and procurement, namely in batteries and micro grids, it will be in position to act more swiftly, resiliently, and decisively.

DoD Interests

The importance of operational energy needs for the US Department of Defense cannot be understated. The global geopolitics of the 21st century have shown that energy is a vital pillar not only towards military operations, but national strength and prestige. According to General David Petraeus’s forward-thinking memo to US forces in Afghanistan, he stated that operational energy “is the lifeblood of our warfighting capabilities and a key enabler…” Petraeus’s message was clear. Not only was the military duty-bound to increase its performance within the energy domain of supplying its forces but also by raising overall efficiency and diversifying energy sources and distribution. If applied in a broader context from this 2011 memo, these principles of diversification, energy sustainability, and resilience can be applied to the entire DoD as emerging threats creep in on US national security interests from multiple vectors of attack.

It would be prudent, in this case, to see the need for a revamping of the DoD’s approach to operational energy and recognize that the 21st century, while having more potential threats and means to carry them out against the United States, also has the technological means to combat these threats vis-à-vis advanced energy. As Italian general and air warfare visionary [Giulio Douhet] stated during the cradle of airpower, “Victory smiles upon those who anticipate the change in the character of war, not upon those who wait
to adapt themselves after the changes occur.” To secure American national security against an array of threats in the near-future, change must begin now in the pursuit of ways to create a more agile and resilient fighting force posture.

According to the Office of the Assistant Secretary of Defense for Sustainment, operational energy is defined as “The energy required for training, moving, and sustaining military forces and weapons platforms for military operations.” Effectively, operational energy is the means in which warfare can be carried out as it encompasses the energy required to sustain aircraft, naval and space assets, ground vehicles, permanent and contingency bases, forward operating posts, and even individual troop equipment. It is known that on average during the post-9/11 military, 75-80% of US government energy use is allocated to the DoD, with bases and installations alone accounting towards 30% of DoD’s consumption. Aircraft fuel furthermore accounts for 75% of all Air Force energy consumption, which is 71% of all operational energy needs; aircraft fuel is the largest fuel consumer category within the DoD.

With the massive levels of energy consumed by the world’s largest military, only about 9% of installation energy use comes from renewable or advanced energy sources. Although the Pentagon has promised to increase this to 25% by 2025 in accordance with congressionally mandated clean energy requirements as outlined in EISA Section 33, progress has been limited. Therefore, it is in DoD interest to pursue meaningful actions to meet this goal of greater advanced energy use, given the effects it can have on the military at-large.

Simply put, the DoD can reap the rewards of a better equipped fighting force for the 21st century. Pursuing advanced energy implementation and integrating it into the current force structure will involve overhauling operational energy sources and supply chains. However, the outcome of this will lead to the following benefits:

- Promotion of energy independence
- Reduction of logistical weak points
- Preparation for conflict with China and Russia in INDOPACOM and EUCOM
- Extension of operational reach through greater sustainment capabilities
- Increase of force resilience
- Increase of tactical adaptability

The current DoD force support structure, though having the sturdiest logistical system of any military on Earth, is still susceptible to inefficiencies, which can become larger problems
if the United States has to contend in multiple theaters against near-peer competitors with capable weaponry. For example, over 70% of the tonnage used to position the Army onto the battlefield is hydrocarbon fuel. Some 85% of the Air Force’s fuel budget is used by airborne tankers to deliver 6% of annual jet fuel usage. Furthermore, to display just how bulky and outdated such a system is relying on hydrocarbon energy across the spectrum of force readiness, over 50% of fuel sent in-theater is used by support vehicles delivering the fuel amongst other supplies, not front-line units. In fact, the cost associated with this supply chain is many times more than the fuel itself, driving up the costs of conflict. It is estimated that some 15 gallons per day is used per soldier on the battlefield, according to a 2007 study on the Iraq/Afghanistan conflicts.

With such enormous inefficiency hindering a more streamlined cost to war, this can be self-damaging, especially when a scenario for conflict arises in multiple theaters simultaneously, spreading US forces thin. And though much of the energy the military requires is dedicated towards jet fuel and other platforms, which require energy density too high for current advanced energy technologies, the difference can be made “in the gap,” or in other words, everywhere else, such as the 25% of the fuel needs of the Air Force outside of sustaining its aircraft. This would include more than half the needs of the Army, Navy, Marines, and Space force. The shift to advanced energy would make a large difference: it would be a force-multiplier on the battlefield.

Operational Threats with Case Studies

Given the DoD’s need and interest established above, it is necessary to also place emphasis on the operational threats that exist today, which can impact the current DoD energy infrastructure. Such operational threats can also be highlighted through case studies. Following are three key threat areas, each with their own salient examples.

First, land-based or sea-based hydrocarbon supply chains in Europe and the Pacific present a weak point that can be exploited by adversaries. As described earlier, the logistical supply chain transporting fuel and energy to sustain the operational energy demands of US forces is bulky and vulnerable. The Russian invasion of Ukraine in 2022 displayed the logistical ineptitudes of the Russian military infrastructure, and specifically, the vulnerability of fuel resupply. Columns of Russian armor and vehicles found themselves stuck on major roads without fuel, such as the 40-mile long convoy stuck for days without fuel north of Kyiv.

This highlights Gen. Petraeus’s statement and analysis of the connection between energy and combat power. Ukrainian light troops managed to ambush multiple resupply convoys, targeting trucks specifically. Without these trucks, Russian tanks would not pose a threat and instead be stuck in the mud. A parallel can be made here to American forces in the Iraq and Afghan wars. Some estimates show roughly 1 in 8 American convoys were hit.
either by IEDs or light ambush from insurgents. Most of the cargo of these convoys was fuel, as much as 80%, and during the Iraqi “surge” between 2007-2010, hundreds of casualties resulted from these attacks. Moreover, forces had to be diverted from offensive operations to defend convoys.

In the Pacific, Chinese capabilities have increased over the past decade to a frightening degree. Chinese long-range missiles are allegedly capable of taking out US ships, both combat and supply ships. Furthermore, fuel depots are also at risk. In an invasion of Taiwan scenario, US airpower and naval power will be challenged not only from the combat environment itself, but in sustaining their forces with operational energy. Bases from Okinawa to Guam can be potentially cut off from fuel resources.

The second significant operational threat is that of the geopolitical ramifications of an over-reliance on non-diversified energy. Diversity in energy sources is a great strength and way to neutralize weak points in American national security. Petrol states and nations that rely on their status as oil exporters derive influence and power from their ability to hold other states hostage. One only needs to observe the impact of the OPEC oil embargo, which wreaked havoc on the US economy in the 1970s contributing towards “stagflation.”

Currently, US diplomatic relations with Saudi Arabia are dictated by their wealth of energy. Russia, has notoriously exerted its will on Europe by being its largest oil and natural gas supplier, as evidenced by the controversy over the Nordstream II pipeline to Germany. Russia is the third largest energy producer in the world, with 70% of its exports being accounted in the energy sector. A global transition towards advanced energy, as is already underway in limited fashion, will be detrimental towards these petrol states’ power. European adoption of new energy sources and systems will directly lead to lower oil demand and imported fossil fuels, which will free it of Russian fossil fuel dependence. Russia losing substantial revenue from this will directly impact its ability to sustain a large modern military and hamper its capabilities.

Finally, the third main operational threat is the collateral and cyber-attack potential on US military infrastructure and facilities, particularly attacks that disable an installation’s ability to operate without energy. There is tactical risk associated with bases in austere and deployed environments, where if no fuel is delivered, these locations become exposed and vulnerable. On an operational level then, significant risk arises in achieving timely objectives as a result of infrastructure attacks. Even on a strategic level, a fossil fuel dependent military will become less combat effective in the medium term. The scale of this problem is evident in that $8.2 billion in one year (FY 2017) was spent to provide 85 million barrels of hydrocarbon fuel towards operational energy to sustain 500 domestic and 750 foreign bases and location assets. Furthermore, it is not unfathomable that a cyber-attack by a capable entity could cause severe harm to a large-scale electric grid. In the event of such an attack, US military infrastructure, at home and abroad, would be impacted—standard backup diesel generators can only operate for so long.

In the 2018 National Defense Strategy, the overall threat from a multipolar world with
an array of threat vectors, as well as a highly visible challenge from near-peer competitors Russia and China, have made the need for a highly modern combat force apparent. The United States is emerging from a state of “strategic atrophy,” as the conflicts of the future will not see US troops enjoying total air superiority or being able to operate logistical supply lines without disruption. The game has changed.

Batteries

To address the national security concerns raised above, the DoD and US policymakers have the military and economic means to elevate US military performance in the area of advanced or alternative energy, which will be examined in further detail later. Now, however, the way in which this can be accomplished in a most efficient manner is two-fold, under the umbrella of key technologies. These key technologies are batteries and micro grids. Guided research and development, cooperative engagement between various institutions and agencies, implementation across the military’s branches, and seamless integration into combat and support forces are all required to translate these technologies into viable solutions for the energy security needs of the DoD and US population as a whole.

Batteries: Simple in Their Basic Concept

Essentially, as energy storage devices, they store chemical energy before converting it to electrical energy, which powers our multitude of systems. Electrons flow from a cathode electrode to an anode through an electrolyte, and during this process, chemical reactions remove electrons. The resulting ions travel through the electrolyte, and the electrons travel across an external circuit which generates a voltage potential and thus, electricity. Recharging a battery simply redirects the flow of electrons back towards the cathode so that the discharge process can be repeated. This process is straightforward; however, the key in battery innovation is developing batteries that can operate in an array of conditions, as efficiently, and as economically, as possible. Military grade batteries require certain capabilities that demand better performance overall. Though developing this technology further would induce upfront costs, it would be fiscally and strategically responsible in the longer term.

Battery power has been increasing in an exponential manner over the last thirty years. With demand soaring in the commercial market due to more production of electric vehicles, Tesla being a prime example, and renewable energy systems such as photovoltaic and wind power, the United States must ensure it does not fall behind in this “green energy” race. The manufacturing capacity in Gigawatt-hours per year has rapidly increased between 2017 and 2020 alone in East Asia (notably in China, Japan, and South Korea). Furthermore, the ability for batteries to compete against fossil fuel energy demand is also increasing. The cost
of lithium-ion battery power is on the decline worldwide from $1000/kWh in 2008 to $200/kWh in 2022. At the same time, the energy density of batteries, long considered a limiting factor of their utility, has increased from an average of 100 Watt-hours per liter to 400 by 2022, according to the US Department of Energy.

The two main challenges to large-scale fiscal shift towards battery innovation by the DoD instead of remaining in the status quo are on the micro and macro scales. On the microscale, much research has been dedicated towards improving battery discharge and charge rates, increasing the number of cycles or lifespan, and using materials and new reactions sustainable under austere environments. This is of great interest to the DoD due to the implications of such research. In the Russo-Ukrainian war of 2022, much of the Russian military’s shortcomings are attributable to its materiel maintenance and acquisition. Evidently, Russian contractors and acquisition personnel chose to outfit vehicles with batteries of short service lives leading to no power in many vehicles that were subsequently rendered inoperable and abandoned. It is therefore important to pursue military-grade batteries of higher quality since battery costs will continue to decrease in the coming years.

Currently, research in academia and industry is working on these microscale technical issues. For example, The National Renewable Energy Laboratory is looking into maintaining high capacity in batteries for storage by including a metallic lithium reservoir that can discharge into a cathodic electrode to combat the loss of cycle-able lithium. Beyond this research into traditional lithium and novel silicon-based batteries, solid-state batteries along with phosphoric, silver oxide, and zinc-based batteries are consistently being developed, with funding being one of the bigger limitations and barriers. Other research is at work to ensure functionality and thermal stability at a wide range of temperatures.

The macroscale issues associated with wide-scale battery implementation tie into upfront costs associated with transitioning and maintaining material supply chains. However, research has shown promising signs. Given that permanent facilities such as buildings consume 50% of global electricity demand, the DoD can benefit by prioritizing its bases and installations. Much of the cost issues involved in scaling up battery technology are better investigated in tandem with solar photovoltaic energy capture and other thermal systems integrated into a micro-grid, where solar and storage capabilities offer appreciable advantages to traditional diesel. This larger scale advanced energy technology system shall be explored next.

Simply put, battery storage as a source of renewable energy is a highly viable option for major DoD investment. Unlike the recent $400/gallon costs associated with transporting diesel to front line troops, on-site battery capabilities and significant investment into their widespread implementation across numerous platforms and installations can see a 28-58% cost reduction by 2030. Higher battery efficiency and lower costs achieved through R&D investment contribute towards a more viable and widespread model for alternative energy proliferation in DoD use. Although there are technical challenges to improving battery functionality, the solution is one of applied effort into pre-existing avenues (the means the United States and DoD have to enable change).
Micro Grids

Micro-grid systems provide a suitable way to provide advanced energy power while addressing both cost and resilience. As already described, various DoD bases and installations consume much of the energy used by the DoD. Therefore, it is prudent to consider adopting micro-grid systems across the board for US military needs.

Micro grids are essentially localized grids, which are able to be disconnected from the larger grid and operate autonomously. Another term for this functionality is commonly known as “islanding.” In this manner, micro grids provide an unmatched level of grid resiliency, and they are able to combat disturbances, whether natural disasters in austere locations or attacks, to the benefit of DoD.

Since traditional grids operate on the principle of interconnectedness, issues with one portion of the grid affect another. Micro grids localize damage or disruptions. This kind of damage mitigation is vital for successful military operations. Although micro grids are designed to enact islanding protocols during crisis moments, properly sustained models with renewable energy supply and storage capability can allow long-term self-reliance. The cost aspect is evident in the use of distributed energy sources such as photovoltaic (PV) or solar power, fuel cells (FC), and wind power—all integrated with battery storage and discharge capabilities delivered to desired loads via direct (DC) current. Because these energy sources are localized to the required area, they are known as distributed energy resources, and without the inherent dissipation and energy loss associated with transmission, micro grids provide lower cost power at a more efficient rate in many situations.

Cost and resiliency are the major measurements of micro-grid success over traditional systems. From these attributes, DoD capability can be extrapolated to be more efficient, effective, and adaptive in hostile situations. In aggregate, the DoD can potentially save up to $1 billion across the DoD per year. A single larger size base can save $8-$20 million over a twenty-year lifespan. This kind of margin would offset any short-term costs. A recent case study of a Californian telecommunications facility has yielded promising data to support this.

A micro-grid system that can disconnect from a main grid through “islanding” and which is a hybrid, that is, solar and storage with diesel, has 1.8 net days of resiliency on average more than installations depending just on diesel, once an electrical grid failure has occurred. Some of the higher estimates put the resiliency gain to six days of fully independent energy generation, using a hybrid system. Although only $104,000 cost savings were associated with the micro grid in this project compared to the $519,000 savings of a grid connected system, micro grids allowed for a 91% utility energy savings margin.

Further studies have shown promising results in large scale implementation of microgrid systems. A detailed study by the Los Alamos National Laboratory has found that DC
micro grids are highly efficient and low-cost platforms for mass implementation. Specifically, distributed energy in the form of PV + FC + Battery DC micro grids, maintains an advantage over other electrical systems in certain circumstances at about $1/W lower with appropriately sized energy assets. However, a 2-3% efficiency increase in a DC micro grid is observed compared to traditional AC grid structure given the assumption that energy is not exported out of the island. Moreover, engineering costs are also advantageous given universal control systems and switches.

A further examination of micro-grid superiority reveals that traditional diesel generators are archaic in the modern day. Many generators are idle, unmaintained, and susceptible to failure, as has been the case in the Caribbean during hurricane events. In various models, micro grids show an ability to be adapted towards different loads and needs. For example, a model built around a large school showed total bill savings through reduced demand cost and energy expenses offset lifetime cost of the system as well as upfront installation. The effect of resilience was a 13x increase in energy storage capacity of the system. With all the above parameters, the survivability of the micro grid, allowing for steady-state operations with little loss of critical load or voltage drops during a disturbance, points to an exciting opportunity for the DoD to adopt this technology system across its force structure.

To summarize, the game-changing nature of micro grid systems, the dual effect of distributed energy sources paired with battery storage, can be used to effectively manage mission essential loads and energy demands in the event of a disturbance whereby the grid will switch to islanding and be able to sustain supply and demand needs.

**Instruments of Power**

The United States has the ways to address national security vulnerabilities associated with energy through two key technology solutions: battery power and micro-grid systems. The good news is that the United States and DoD possesses the means to implement those solutions in a timely manner. These means exist in two main domains: the military and economic instruments of power.

Thankfully, the DoD has recently been made aware of its need for new and vigorous developments in alternative energy technology, particularly operational energy. The Office of the Assistant Secretary of Defense for Sustainment (OSASD) was formed only recently, in 2018, as part of a restructuring and reorganizing of logistics and materiel commands for the DoD. This was in part a direct response to the 2018 National Defense Strategy, showing that adversarial capabilities were increasing, opening vectors of threats upon the homeland. According to 10 USC §2926 of the US Legal Code addressing operational energy concerns, the Assistant Secretary of Defense for Energy, Installations and Environment shall “oversee the operational energy activities of the Department of Defense, including the activities of the
working group established under subsection (d), and oversee the investments of the Department in such activities.” Thus, a legal chain of accountability has been created with a clear organization and mission. Much too often, policies of research and development (R&D) and modernization become muddled without clear guidance, proper responsibility, and lack of accountability. However, a clear line of effort and chain of command established in recent years has allowed for better oversight by the DoD over projects related to improving energy security.

In fact, many steps are already being taken to pursue the interests of advanced energy methods. A change in philosophy has been adoption of resilience as a guiding principle. According to a 2013 memo by the Acting Deputy Under Secretary of Defense for Installations and Environment, before energy was officially included, “Climate change increases the likelihood of such events [Hurricane Sandy], and the DOD must be prepared for and must have the ability to recover from utility disruptions…. The necessary planning and capability to ensure we have available, reliable, and quality power to continually accomplish DoD missions from our installations in the face of such disruptions can be described as power resilience.”

In this respect, battery and micro-grid innovation represent the best and most attainable avenues of innovation and integration. There is already historical precedent in place, modeling the various lines of effort the DoD can take. For example, a 16.4 MW photovoltaic array went operational at Davis-Monthan AFB (AZ) in February of 2014, showing a genuine consensus amongst Defense leadership that energy was a vital concern and worth spending on novel conservation efforts.

At least $1.6 billion has been invested into energy RDT&E since 2019. These funds are allocated to small troop units, permanent and contingency bases, vehicles, autonomous systems, and battery systems, which alone received $430 million in the 2009-2012 timeframe. However, with respect to battery and micro-grid initiatives, the DoD has also begun funding and pursuing these technologies. The DoD sponsors a wide range of organizations and projects within the private sector, in academia, and in industry, towards technology acquisition and sustainment. It is an iterative process to develop innovative technological solutions, and therefore, a high degree of end-user to design mutual connection must be maintained through better streamlined processes.

According to the Fiscal Year 2020 Operational Energy Budget Certification Report by the ODASD, streamlined processes have emerged for renewable energy acquisition towards operational energy need. A new basic framework of “Branch, Program title, Initiative title, Project description, Strategy Objectives, and Budget” allows for simple uniformity across all the service branches amongst the defense acquisitions community. For example, the following projects are currently in the 2022 budget:

- Beyond Lithium-ion Energy Storage 16 ($4.5 million enhancing warfighter capability)
Energy Solutions

- High Voltage Modular Lithium-ion Battery 17 ($6.8 million enhancing warfighter capability)
- Energy Efficient Devices Technology 84 ($27.5 million enhancing mission effectiveness)
- Battery Development and Safety Enterprise ($6 million enhancing storage power controls and distribution).

Other government initiatives include the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs overseen by the National Science Foundation. Often described as America’s seed funds, they support small business applicants seeking to develop innovative technology. The funds allow startup technology companies to become established and pursue their projects without the strain of early financial debt. Pairing the private sector and commercial businesses with accountability towards the DoD, which provides funding, is a highly effective way of inducing rapid and impactful change.

The 21st century paradigm of technology procurement has flipped. In previous eras, impactful innovations such as GPS and computing started out in DoD research labs and were eventually ported over to commercial applications. This is no longer the case, as defense acquisition personnel increasingly seek out commercial innovation, which often leads to lengthier acquisitions cycles. Having streamlined systems with consistent technology readiness level reports, iterative communication between businesses and government, and dedicated personnel to manage these relationships all mitigate friction in this process. The DoD can afford to pursue early adoption and procurement of products from startups that do not yet have viable consumer market demand, functioning as a pilot customer. The vast resources of the DoD enable it to handle more risk of early development failure and endure higher starting costs, problems that typically kill early technology companies in the regular market. This DoD-business partnership also provides feedback for wary investors to step up and propagate what amounts to a new technology sector of the economy, bolstering other lines of effort towards the procurement and broad application of, in this case, battery and micro-grid innovations.

More specific initiatives include the Battery Network Manufacturing R&D Program as well as the Battery Innovation Center, the latter enabling effective means of quick battery capability testing with a designated facility. In the vector of micro-grid implementation, more than twenty pilot projects have been started at various installations under the Smart Power Infrastructure Demonstration for Energy Reliability and Security program (SPIDERS). These projects include Fort Carson, Camp Pendleton, Maxwell AFB, and other projects across all branches. These projects are examples of test beds, where systems can be tested and validated at differing conditions.

The Environmental Security Technology Certification Program (ETSCP) has
implemented the Installation Energy Test Bed, funding thirty-two projects on DoD installations for demonstrative and proof of concept purposes. These micro grids also implement a test for novel battery storage systems with more capacity and longer lifecycles. As an example of the success of this program, Marine Corps Air Ground Combat Center Twentynine Palms employs a micro grid capable of operating 10 MW off-peak and 26 MW during the summer. The Marine Corps Air Station Miramar in San Diego has a similarly scaled system, costing $20 million and integrated with diesel generators yet capable of sustaining operations if they are out of service. All in all, these examples showcase advanced battery technology integration by ensuring rapid response to various load demands thanks to efficient discharge cycles.

Other developments allow for the use of small-scale tactical micro grids in austere contingency bases, requiring portable components and fully self-sustaining systems. In this case, PV+battery+fuel cell integration is most useful. Such technology allows for small-scale rapid response forces in combat zones to be fully self-reliable in their operational energy needs. In fact, the Army is already exploring this model using the newly developed Advanced Medium Mobile Power Source (AMPPS) micro grid.

Overall, the United States enjoys a strong and thriving technology sector which can spearhead development. However, government to private sector partnerships should seek to connect laboratory innovation to commercial application and required defense user needs and design constraints. Furthermore, multi-round competitive contracts and long-horizon oriented investments must be used in increasingly streamlined acquisitions processes with regular technology readiness level updates to the customer (DoD) as well as R&D “check-ins” from investors.

Policy Proposal

1. Promote public-private sector investment arrangements to connect laboratory innovation to commercial application (DoD customer).

2. Increase DoD budget towards ODASD(OE) from $1.6 billion for larger investment opportunities and subsidizing of industry and academia partners to cover the full spectrum of operational energy needs in a plausible near-future environment (25% of total OE needs).

3. Increase significant cooperation between DoD, DoE, research universities, and private businesses through multi-round competitive and long-horizon investments with technology readiness level updates and R&D milestone checks.

4. Implement incremental infrastructure and logistical restructuring to allow for
implementation of both permanent and tactical micro grids in tandem with novel batteries across an array of platforms and systems.

5. Scale back use of archaic logistical supply networks based on fossil fuel resources for OE needs.

End State: A more energy resilient, efficient, independent, self-sufficient, adaptable, and capable (tactically, operationally, and strategically) force structure across all branches of the Department of Defense, primed to sustain critical missions in a 21st-century combat environment.

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Capability Gaps in Allied Space Deterrence

Mary Black

U.S. predominance in space power is undermined by two capability gaps: the transatlantic gap for interoperability and the authoritarian gap for defense against asymmetric threats.

The space domain is becoming saturated. With countries like the United Arab Emirates to India, more actors are becoming involved in the domain in direct and tangible ways. Still, when looking at the Atlantic states, the United States is the predominant space power. This is a source of allied vulnerability. In terms of defense and power projection in space, the United States (US) faces two distinct capability gaps. As a leading power of the North Atlantic Treaty Organization (NATO), the US has historically taken on greater political and kinetic responsibility in allied defense initiatives, developing into what scholars call the transatlantic capability gap. This continues to be apparent in contemporary NATO space strategy.

Alongside this phenomenon, another gap has appeared. The United States once had space unipolarity through technological dominance. However, technological optimism has historically blinded American strategists from the reality that states could innovate and create asymmetric threats, now known as sharp power. This has given way to another hypothesized disparity of power projection in space, identified in this paper as the “authoritarian capability gap.” Because sharp power is relatively novel, this latter gap remains a theory.

Facing one, let alone two capability gaps, the US cannot expect to lead in space security. Thus, NATO Allies cannot reliably depend on American strategic, technological, or information superiority.
**HOW WE GOT HERE: THE TRANSATLANTIC CAPABILITY GAP**

James Appathurai, then policy planning officer of NATO’s Political Affairs Division, identified the transatlantic capability gap as disparities in burden sharing, due in great part to the US’s “lead in military technology” since NATO was established. He describes the origins of this gap as a combination of historical, structural, and financial factors. To engage in the Second World War, geographical factors caused the United States to achieve mobility through technology. Structurally, the European Union’s many armies, departments, headquarters, training facilities, and other infrastructures reflect a “duplication of effort and industry, lack of coordination in policies, and higher costs” that have hindered European technological advancement. Finally, the sheer, staggering financial disparity between the US and European defense makes the US military the most capable for virtually all missions. For example, according to the Center for Strategic and International Studies, the US’s 2019 defense expenditure was nearly 2.5 times more than other NATO allies, equaling 3.42 percent of its gross domestic product (GDP). The consequences this has for European defense are innumerable, including decreased capabilities in transport, refueling, precision strike, reconnaissance and intelligence, command and control, and communication. For these reasons, these NATO allies are incentivized not to expand their defense capabilities, relying on the United States to lead in the strategy and execution of NATO’s aims.

Now, as access to space, its resources, and terrestrial dependencies thereof have become increasingly vulnerable, the security environment appears to have formed two capability gaps: the transatlantic capability gap, which has developed among NATO allies for decades, paired with the asymmetric threats that China and Russia present, labeled hereafter as the “authoritarian capability gap.” This paper proposes, through the application of the historical case method, that the transatlantic capability gap persists and shapes NATO space deterrence strategy. Therefore, the future of sovereignty and security in space depends on the actions of more NATO members, not only the US. Additionally, this paper will provide suggestions for future analysis of the authoritarian capability gap through this method.

**METHODOLOGIES: TECHNOLOGICAL OPTIMISM AND SHARP POWER**

Technological advancement has been the purpose and ideal of defense acquisitions for as long as militaries have existed. Within this paradigm, it is easy for military and political leaders to uphold technology as the decisive and necessary element of military success and maintaining defense. This can be understood as technological optimism, a presumption that “the new technology is categorically different, delivers a devastating effect, and will be decisive in warfare, especially if its introduction on the battlefield is a surprise.”
Many scholars and strategists have been influenced by decades of technological optimism, making it difficult to assess the rising threats of authoritarian regimes fairly. In their 1996 article “America’s Information Edge,” Joseph Nye and William Owens made predictions about American technological advantages, perhaps having been influenced by technological optimism through decades prior. They asserted that the “American Century” was not coming to an end as other scholars believed; rather, they found that the “United States is better positioned than any other country to multiply the potency of its hard and soft power resources through information.” They recognized conceptual problems with information power, specifically that strategists had been preoccupied with traditional measures of power (e.g., gross national product) and that the nature of information power made predicting its implications difficult. Nevertheless, they presented a very optimistic outlook on American information advantages, suggesting the few “prerequisites” of their maintenance were funding defense technologies, loosening information sharing restrictions, broadcasting information internationally, and promoting a healthy democracy domestically.

Granted, Owens and Nye expressed some uncertainty toward lasting American information supremacy, having predicted that information technology would change deterrence theory as it was once understood. They contended that, unless the United States enabled a network of allies through information and technology sharing, other countries would replicate or exploit the US’s advantages in information. Still, their suggested preventative measures only work under the assumption that countries would have to match US technology to become a threat in the first place. This was likely due to the contemporary, limited understanding of asymmetric information threats, now known as “sharp power,” a term popularized in 2017 by the National Endowment for Democracy.

Christian Walker, the Vice President for Studies and Analysis at the National Endowment for Democracy, defines sharp power as “efforts at censorship, or the use of manipulation to sap the integrity of independent institutions [with] the effect of limiting free expression and distorting the political environment.” The term “sharp” depicts how this form of power attempts to “pierce, penetrate, or perforate” various political and societal targets. Sharp power is a capability that is uniquely attributed to authoritarian actors, particularly those seeking to erode the liberal world order such as the Chinese Communist Party (CCP) and the Russian Federation. This is primarily because democratic institutions, in accordance with their values of openness and integrity, are vulnerable to such revisionary threats and incapable of responding in kind.
CASE STUDIES

Transatlantic Capability Gap: The Gulf War

Having defined the transatlantic capability gap and proposed the authoritarian capability gap, this paper will apply the historical method to assess the US’s capability to lead in space deterrence. The Gulf War is an appropriate case example of the transatlantic capability gap because it was a decisive coalition victory, typically attributed to the US’s strategic and technological superiority. Furthermore, in terms of technology and strategic planning, the US surpassed both its adversary and coalition allies, the United Nations (UN) in this case. This decisive victory entailed the swift implementation of a six-week allied air campaign, in which 88,500 tons of bombs were dropped during 116,000 sorties, leading to a 100-hour ground invasion that liberated Kuwait from Iraqi forces.\textsuperscript{13} In terms of manpower, the US provided a cumulative “540,000 troops, [and] some 28 other (mostly European) countries deployed air, sea, or ground forces totaling 245,000 personnel.”\textsuperscript{14} The US spent an estimated $61 billion on the Gulf War, and although other nations compensated for roughly 88 percent of this cost, the only European country to contribute significantly was Germany ($10 billion).\textsuperscript{15} While the US was by no means alone in this conflict, the fact that 28 of its allies made up roughly half of the material contributions is a staggering example of transatlantic dependency on the US to ensure global security.

Brent Talbot, a professor at the US Air Force Academy, asserts the European coalition members evidently desired the US to take leadership in this conflict: “Encouraged from the very beginning by the British Prime Minister to lead, Bush put together the coalition by building personal relationships with major contributors to the effort. His relationships with Thatcher/Major (Britain), Mitterrand (France) and Kohl (Germany) are particularly notable.”\textsuperscript{16} Furthermore, the US demonstrated leadership during the UN’s decision-making in response to the invasion through actions such as implementing a period of 48 days between the Security Council’s resolution and the launch of forces.\textsuperscript{17} Therefore, it is clear the US was a leader in terms of both assets committed and its diplomacy throughout the conflict.

The US’s leadership and kinetic superiority in the Gulf War contributed to an undue sense of technological optimism and unchallenged unipolarity. Strategists became overconfident that technology, namely long-range precision missiles, would enable US invincibility by subduing the largest of forces “in a matter of 100 hours.”\textsuperscript{18} This optimism, in turn, caused American leadership to become ignorant of the developments of asymmetric threats, what is now known as sharp power.
Authoritarian Capability Gap: Considerations For Future Study

At this time, it is not possible to examine the authoritarian capability gap according to the historical method. This is primarily because the authoritarian capability gap is inextricable from the demonstration of sharp power, a concept in political science that is still nascent. Furthermore, the study of sharp power actions themselves is relatively new as those actions are made capable by advanced information and cyber technologies. As such, this paper outlines possible conditions to analyze this gap in the future:

A historical study of the authoritarian capability gap requires the identification of two actors: one being an instigating actor that leans towards authoritarianism, and a comparatively more open and democratic target. In this context, the limitations of the historical method must be considered. To begin with, it is difficult to prove that sharp power is in action, not to mention the difficulty of attributing it to a specific state actor. Nevertheless, the intangibility of the authoritarian capability gap must be examined further to illuminate trends that can be attributed to space security. Below are some ongoing, contemporary, and thus hypothesized examples of authoritarian capability gaps:

- Confucius Institutes (China acting upon various democracies): These institutes, which claim to promote Chinese language and culture to students and universities, are suspected branches of propaganda for the CCP as instructors have pressured school administrations to avoid statements or events that the Chinese government also seeks to downplay;

- The Ukrainian Orthodox Church–Moscow Patriarchate (Russia acting upon Ukraine): President Vladimir Putin has invoked the Orthodox Church to assert the unity of Russia and Ukraine. This Kremlin-allied branch of the church has started promoting “the idea that Russia should be viewed as a guardian of Christian civilization and traditional family values in opposition to the relatively secular orientation of many European Union nations;”

- Russian media channels abroad (Russia versus various democracies): Channels such as the Russia Times and Sputnik, funded by the Russian government, broadcast to large audiences in several languages worldwide. They are thought to inject misinformation into societies through divisive narratives, which portray right-wing grievances and nationalism.

APPLICATION TO SPACE DETERRENCE TODAY

Transatlantic Capability Gap

The Gulf War case has direct applications to allied space deterrence today as it is often considered both the first space and information war. For the first time, satellites played a
critical role in US operations:

Space-based assets carried over 80 [percent] of all messages to and from the US Central Command’s (USCENTCOM’s) area of responsibility (AOR). Satellite intelligence data was essential for planning the air campaign, critical for early warning of SCUD ballistic missile attacks, and aided in determining enemy positions and activities... Global Positioning System (GPS) satellites provided precise position information essential for navigation over an almost featureless desert terrain.23

With minimal doctrine in space operations at the time, US operations in the Gulf War were challenged by integrating these technologies into relatively “uninformed and unprepared” forces.24 Such planning, integration, and capacity-building challenges are now exacerbated as more countries have access to these technologies, which were once advantages primarily held by the United States. While other NATO members have begun developing these capacities to various extents, this capability gap persists in allied space deterrence.

It is clear that the transatlantic capability gap applies to NATO members with regards to space deterrence. Other than the US, the remaining 29 NATO members each have varying degrees of space policy, institutions, and multilateral involvement. Figure 1 below categorizes NATO members into four tiers based on space policy engagement: Tier 4 (No official space policy, strategy, or security forum), Tier 3 (Has a space policy forum but no independent space capabilities), Tier 2 (Part of a national or international space agency), and Tier 1 (Has a national space agency and militarized space component). Tier 1 is subdivided based on space strategy: Tier 1a (Engagement in international or multilateral space programs) and Tier 1b (Isolationist space strategy).

Additionally, Appathurais’ structural cause of the transatlantic capability gap also exists in NATO’s collective space defense. Regarding structures of allied space deterrence, there appears to be redundancy among NATO allies in establishing norms. While the existence of the NATO Space Policy and similar doctrine unites the nations’ efforts for the sake of interoperability, the fact remains that space defense efforts are duplicated throughout Europe. This concept is exemplified by the existence of the European Space Agency (ESA), of which 17 of its 22 members are also NATO members.

Like NATO, the ESA has published a vision and strategic goals for norms and behavior in space. Furthermore, it has issued a joint statement alongside the European Union, reaffirming the value of freedom in space, pledging to cooperate to integrate space technology into European society, protect space assets, and foster competitive innovation in the space industries.26 It could be argued that redundancy in messaging might prove to be valuable for NATO space deterrence; more interconnectedness indicates a greater commitment to the goals that NATO, the ESA, and the European Union share in space.
Nevertheless, the fact stands that the United States is the leader among NATO members when crafting NATO space policy and narratives. The plurality of narratives, though they share a vision, is decentralizing and distracting other members from contributing strategic input to NATO and, more importantly, suggests any training exercises or ‘wargaming’ capabilities they have are spread thin across several coalitions. As such, the United States faces more pressure to lead in NATO space deterrence, its primary transatlantic defense forum and lifeline to the European powers.

Simply put, the threats that NATO and the US face in space today are far greater and more complex than they faced in the Gulf War. Knowing, then, that China and Russia pose asymmetric threats, NATO members will not be able to rely on the United States to be the greatest contributor to a space coalition response as it has been because of such a wide capability margin.

**Hypothetical: Authoritarian Capability Gap**

The authoritarian capability gap could seriously reduce interoperability between NATO members. The revisionary, divisive, and distracting nature of sharp power may already be employed to erode information and cohesion of space strategies. The proposed examples of the authoritarian capability gap above are thought to reduce trust among democratic societies, particularly the trust in their institutions and government. Therefore, these authoritarian regimes may be attempting to degrade trust between state actors, including states that seek to cooperate in space, by injecting false narratives and disinformation.

As a result of the authoritarian capability gap, countries like the US, which respect international norms, sovereignty, and freedom, could be at a severe disadvantage in the prevention and response to sharp power attacks on space defense. Compounded with the transatlantic capability gap, which forces the US to assume greater responsibility in space operations planning and execution among NATO allies, the authoritarian capabilities gap may reflect the challenges in NATO’s ability to achieve space security. In this case, cohesion among allies, including information exchange and capacity building, is under contest when it is needed more than ever before.

**CONCLUSION**

As a result of the transatlantic and hypothetical authoritarian capability gaps, the US is less equipped to assure security in space, while NATO allies continue to depend on the US for leadership in space security. Therefore, NATO must no longer expect the US alone to uphold security against threats to space operations. To address these gaps, more NATO members must develop their national space capabilities and policy involvements, as the tier ranking in Figure 1 indicates. This begins with a widespread acknowledgment of the US and NATO’s blind spots: technology, kinetic size, and finances will not determine the winner of
a space conflict; NATO has and cannot continue to rely on the US for leadership and material prowess; and interoperability and information exchange are the strongest methods, known thus far, to deter sharp power actions towards democratic actors. Going forward, the most efficient way to deter threats to NATO space infrastructure is to demonstrate interoperability at the strategic and tactical levels, starting with eliminating institutional redundancy.

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<table>
<thead>
<tr>
<th>Tier</th>
<th>Countries</th>
<th>Vulnerabilities in the Event of Conflict</th>
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<tbody>
<tr>
<td>1</td>
<td>a Canada, France, Germany, the United Kingdom, the United States</td>
<td>- Heavy reliance on space-critical infrastructure</td>
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<td></td>
<td></td>
<td>- Vulnerable to rapid space conflict escalation</td>
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<td></td>
<td>b China, Russia, Iran</td>
<td>- Lack of communication in the space domain; risk of miscommunication</td>
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<td>resulting in violence</td>
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<td>- Non-fluent flow of space situational awareness (SSA) data</td>
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<tr>
<td>2</td>
<td>Bulgaria, Iceland, Italy, Netherlands, Norway, Poland, Slovenia, Spain,</td>
<td>- Lack of redundancy across existing and emerging space platforms</td>
</tr>
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<td></td>
<td>Turkey, Romania, Luxembourg</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Albania, Belgium, Croatia, Czech Republic, Denmark, Estonia*, Greece,</td>
<td>- Other industries/domains are vulnerable to attack (e.g. cyber-enabled</td>
</tr>
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<td></td>
<td>Hungary, Latvia*, Lithuania*, Portugal, Slovakia</td>
<td>goods)</td>
</tr>
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<td></td>
<td>*Former Soviet bloc</td>
<td>- Still in a period of transition to modern space infrastructure</td>
</tr>
<tr>
<td>4</td>
<td>Montenegro, North Macedonia</td>
<td>- Same as Tier 3; no independent capabilities; dependent on NATO political</td>
</tr>
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<td>networks and technology</td>
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Figure 1. Tiered Ranking System of NATO Countries Regarding Space Policy Engagement
Figure 2. NATO Members Space Policy Engagement Diagram
Notes:

1. National Aeronautics and Space Administration, “Emirates Mars Mission.”
2. Bhattacharjee, “After the moon.”
3. Appathurai, “Closing the capabilities gap.”
4. Ibid.
12. Ibid, 12.
15. Horan, “How much did the Gulf War cost the US.”
17. Ibid, 67.
18. Bae, “From the First Gulf War to Islamic State: How America Was Seduced by the ‘Easy War.’”
24. Ibid.
25. N.b., chart includes China, Russia, and Iran to contextualize the capabilities of adversary space powers.
26. “Joint statement on shared vision and goals for the future of Europe in space by the EU and ESA,” European Space Agency.
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“Joint statement on shared vision and goals for the future of Europe in space by the EU and ESA.” 2016. European Space Agency. https://www.esa.int/About_Us/Corporate_news/Joint_statement_on_shared_vision_and_goals_for_the_future_of_Europe_in_space_by_the_EU_and_ESA.


Revitalizing America’s Low-Yield Deterrent

Alex Kleitz

An array of low-yield weapons will play a vital role in integrated deterrence. *The following essay, submitted in June 2022, earned the Junior Division USSTRATCOM General Larry D. Welch Deterrence Writing Award.

The ongoing war in Eastern Europe has focused considerable public attention on a topic largely forgotten in the peaceful bliss of the post-Cold War era: low-yield nuclear weapons. Many fear Russian use of such weapons to salvage their clearly troubled conventional campaign, while even more are concerned about the risk of spillover leading to NATO involvement which escalates into a nuclear exchange. Though the theoretical usage of low-yield weapons in an otherwise conventional war has gained more popular attention in recent months, American military thinkers and policy makers have grappled with the issue of determining what role these weapons play in the modern era ever since the fall of the USSR. Over the last three decades, America’s low-yield arsenal has steadily dwindled in size and has not been significantly modernized. Today it is based almost entirely around gravity bombs delivered by F-16s, Tornadoes, and F-35s. As our adversaries pursue larger arsenals, greater capabilities, and more aggressive foreign policies, we must reverse course. Expanding and modernizing the American low-yield nuclear arsenal will promote peace by lowering the chances of both conventional and limited nuclear war involving the United States.

To begin, it is important to establish several basic definitions. Expansion in this context refers to an increased number of low-yield weapons ready for combat use in short order at an increased number of locations around the world. Modernization is meant to imply new capabilities which enhance combat effectiveness, not simply life-extending existing low-yield weapons. In this case, low-yield refers to a variety of nuclear weapons which have the primary purpose of destroying enemy conventional military capabilities on the battlefield during a major war. Often called “tactical nukes,” they contrast with strategic nuclear weapons in that the latter generally produce yields in excess of 100 kilotons and are intended to destroy the enemy’s nuclear arsenal, leadership, industry, and/or population using deep strikes against the enemy’s homeland. As low-yield weapons play a significant role in strategy, the term “tactical” will be used sparingly in reference to them.

Low-yield weapons are not a new phenomenon. Of course, the weapons dropped on Japan may fit the modern definition of low-yield in terms of destructive power, though they were used for a countervalue attack on the Japanese homeland. Still, even at the time American leaders contemplated using Fat Man-type bombs to soften up Japanese beach
defenses, and the theoretical use cases of low-yield weapons only grew from that point on (Giangreco). Low-yield nuclear weapons were planned to be employed in anti-air, anti-submarine, anti-ship, field artillery, and various other roles by both sides throughout the Cold War.

Most notably, the US and her NATO allies planned to make extensive use of low-yield weapons against Warsaw Pact forces in the event of war in Europe. This was for good reason. The communists possessed a significant advantage in conventional arms along the Iron Curtain, and it was believed that only nuclear weapons could hope to stem the tide of Soviet tanks pouring into West Germany (Snook). NATO’s intent was made clear to the Soviets and the US kept sufficient nuclear weapons in theatre so as to make a disarming strike impossible. Any thoughts of the Red Army withstanding the nuclear blow were unreasonable. Importantly, European allies were brought into the nuclear sharing program, diminishing Soviet confidence that the US would not risk nuclear escalation over issues an ocean away (Snook). As a result, despite a clear conventional advantage and a stated national goal of achieving global communism through the defeat of “imperialist” Western forces, the Soviets never attempted an invasion of Western Europe.

The deterrent effects of Cold War low-yield weapons were not confined to the European theatre. The US based such weapons in East Asian countries such as Taiwan and South Korea (Smith). Despite the overwhelming numerical superiority the Communist Chinese could have brought to bear against American forces in the region, the presence of low-yield nuclear weapons made clear that attempts at conquest were futile, even given the PRC’s assured strategic second strike capabilities. Though these weapons were gradually withdrawn, their role was filled in the relatively low-threat post-Cold War environment by other resources in region such as TLAM-Ns aboard naval vessels. The value of these weapons was demonstrated by the Japanese and South Korean outrage at their eventual withdrawal, and the actions the US took to continue a regional presence via forward basing of bombers (Regehr). Since the recent outbreak of war in Europe and increasingly aggressive actions by the PRC, there have been calls in Japan for renewed basing of low-yield weapons within that country (Johnson). In short, though not as clear-cut as the European situation, low-yield weapons have demonstrated deterrent effects in East Asia and there is general agreement among our allies as to their importance.

Given the historically demonstrated value of low-yield weapons for shaping adversary decision making about conventional war, it is no surprise that Russia continues to appreciate their value in this role. While US policy has deemphasized the use of low-yield weapons since the fall of the USSR, Russian policy makers have taken the opposite course. Much has been made over the Russian concept of “escalate to deescalate” in which the Russian Armed Forces would strike NATO formations with nuclear weapons in order to coerce a settlement in the event that Russia faces conventional defeat (Schneider). Even in the current war there has been some discussion about the possibility of Russia making use of nuclear weapons to achieve results on the battlefield as their initial campaign has faltered.
and, at least in the north, collapsed (Wainer).

While many Western commentators’ kneejerk reaction is to decry the “escalate to deescalate” policy as insane and dangerous, the theory is logically sound. Such action would create immense pressure on NATO leaders to accept a ceasefire as, given Russia’s significant “tactical” nuclear capabilities and arsenal size, it is doubtful that NATO conventional forces could hope to fight through a nuclear onslaught to victory. This is the same fact which we ourselves relied upon during the 20th century in our plans to defeat the conventionally superior Warsaw Pact. Responding with strategic nuclear strikes inside Russia would invite an equivalent response as Russia would certainly retain an assured strategic second-strike capability. The option of accepting the status quo ante, as unthinkable as that may be in the face of enemy nuclear first use, may be the most reasonable course of action.

That is unless the US has the ability to respond in-kind, destroying the conventional power of the enemy. Conventional strength deters conventional attack and strategic nuclear strength deters strategic nuclear attack. In the same vein, low-yield nuclear strength can deter Russia, or any other adversary, from believing that first use of low-yield weaponry would be to their advantage, or that they could succeed in a conventional invasion of an American ally. Any invasion could be made unacceptably costly by use of low-yield weapons, and any nuclear usage from a single low-yield detonation on the battlefield to an attempted disarming first-strike could be met with an effective response.

Of course, the US does still have low-yield weapons deployed, albeit far fewer than Russia, and one may ask why the current posture is not sufficient to counter Russian policy and deter war. The US low-yield options are effectively limited at this time to fighter-bombers equipped with around 100 forward deployed B-61s operating from a small number of bases in Europe (Snook). Strikes by these aircraft could be supplemented with B-52s launching ALCMs or B-2s delivering B-61s on long-range missions. The low-yield SLBM option exists as well, though this program may be rolled back by the current administration given political controversy over its wisdom (Woolf). Given the paltry state of this force, it is clear that expansion and modernization consistent with earlier definitions will significantly enhance deterrence.

Perhaps most obviously, it is necessary to expand the number of weapons readily deployable. More weapons assigned to a target increase the probability that one will make it through, an important factor when our primary means of delivery are aircraft which are vulnerable to the extensive Russian and Chinese integrated air defense systems (IADS) (Pułaskiego and Smura). Having more weapons will also increase the number of targets which can be held at risk, ensuring the destruction of the enemy’s forces to an acceptable degree. Additionally, this lowers the burden on strategic bombers to lend support to the in-theatre fighter-bombers and the low-yield mission at a time when it would certainly be desirable to hold as much of our nuclear-capable strategic bomber force in reserve for strategic missions in case the need arose. Finally, the message of willpower sent by a numerical increase in our low-yield deployments should not be underestimated. After years
of watching us neglect the low-yield mission and hearing our politicians decry low-yield weapons as destabilizing, a reconstitution of this force would unmistakably demonstrate to our foes our willingness to employ these weapons if necessary. After all, our adversaries’ impression of our will underpins our deterrence.

Numerical expansion must be accompanied by basing expansion. In our current configuration, with B-61s deployed at fewer than a dozen bases in Europe, it is rather easy to envision a Russian first-strike which completely eliminates our in-theatre low-yield arsenal. Expanding to more bases would complicate adversary targeting and reduce their confidence in their ability to neutralize our low-yield capability via first-strike, therefore reducing the temptation to attempt to do so during a crisis and thus reducing the risk of war. Further, new bases for low-yield weapons must be added outside of the European theatre. As we face the specter of war with China, the need to be as prepared to deter and fight in the Pacific as we are in Europe is self-evident. The new calls from our Asian allies for a return to nuclear basing in the region should awaken us to this capability gap. Finally, as with numerical expansion, the basing of low-yield weapons throughout the Pacific, which could be done using existing bases in the region, would send a clear message to Beijing as to the futility of any aggressive war against an American ally.

Though expansion would go a long way towards correcting current deficiencies, modernization must not be overlooked. As noted earlier, reliance upon air-delivered gravity weapons creates many problems in the face of an enemy with sophisticated air defenses. Though the low-yield SLBM is an attractive option for its mobility, promptness, and penetration ability, there are significant issues with exposing the location of an SSBN in order to carry out a low-yield strike during a major crisis where we would likely desire to retain with the highest confidence our strategic second strike capability. More options are necessary. New standoff weapons, sea-launched cruise missiles, short to intermediate range ballistic missiles, and other delivery systems should be developed and deployed to give the US a wide array of capabilities when facing the need to fight a limited nuclear war. A variety of options will also allow the US to project power without the diplomatic difficulties of basing in foreign nations. Hypersonics, in particular, present a unique opportunity owing to their range, promptness, and surety of air defense penetration (Cummings).

Despite the clear advantages of this revitalization program, there are legitimate concerns surrounding the concept of increasing the role of low-yield weapons in our defense strategy. Many have expressed a fear that as low-yield weapons are more “usable” than strategic nuclear weapons, having them in large quantities would increase the chances of a nuclear war (Reif). This argument lacks historical backing. The deployment of thousands of such weapons by both sides during the Cold War prevented the outbreak of any conventional war which would lead to their use, as usage would defeat any offensive conventional action. Additionally, it is questionable whether a fear of “usability” makes sense if our objective is American national security. We may one day face a situation where our leadership determines that usage of low-yield weapons is a preferable outcome to the alternatives of...
conventional defeat or strategic nuclear escalation. To tie the hands of our future selves now would be unwise and only encourage our adversaries to utilize low-yield weapons knowing we would have no appropriate response. It should go without saying that we need usable weapons and should not base our security off of unusable weapons.

There is also a reasonable concern that a reconstitution of our low-yield force would lead to an arms race. This concern should not stop us. With regard to Russia, it is unclear what we have to lose from engaging in an arms race considering how severely the Russians currently outmatch us in the low-yield realm (Weitz). To not build up would not avert a race, it would simply constitute our acceptance of our defeat in the race. That said, China may present a different situation, given their small arsenal relative to our own. A large build up in the Pacific would almost certainly provoke a Chinese response. However, this does not doom us to a never-ending game of one-upmanship. We need not concern ourselves with matching adversary numbers one-to-one. We need only maintain a capability which is survivable under attack and presents a credible means of defeating any conventional aggression and responding to any low-yield nuclear escalation decisively. Accepting these objectives rather than becoming concerned with some relative balance on paper will prevent a costly arms race.

Low-yield weapons play a vital role in integrated deterrence. This fact was obvious during the Cold War and is still understood today by our adversaries. We must not forget it ourselves. As war wages in Europe and nuclear rhetoric escalates, the need for the US to revitalize her low-yield arsenal only grows. Expansion and modernization are necessary to prevent war by making clear to any enemy that they cannot achieve strategic objectives through aggression, for they will be met with an overwhelming response. Failing to reconstitute our low-yield forces to meet the challenges of the modern era will only encourage hostile powers to strike first and leave us with no options other than surrender or mutual destruction. Revitalization of our low-yield arsenal will preserve both deterrence and decision space, keeping America and her allies secure.

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Documentation: No outside help received.
Waging Peace on the Final Frontier
64th Academy Assembly Proceedings

*In October 2022, the 64th annual Academy Assembly at the U.S. Air Force Academy took up the theme of “Waging Peace on the Final Frontier.” The following are proceedings of roundtables held by select undergraduates from around the country on questions of space policy & strategy.

Workshop I: Space Crisis Simulation—Norms

Executive Summary: In the modern age, the outer space domain is of critical importance to the national security and commercial/economic development of States. State action in space is governed by a number of long-standing treaties (the Outer Space Treaty (1967), Rescue and Return Agreement (1968), Liability Convention (1971), and Registration Convention (1973)). However, there are few meaningful limitations on State action in space, especially as new State and commercial actors enter the space domain. The development of “norms”—largely non-binding principles that States mutually agree to follow, frequently for safety-related or practical purposes—is one method by which States could further develop the principles, concepts, and enforcement mechanisms of existing treaty responsibilities. This simulation provided a model of how norm development, and responses to norm violation, can work in a limited scenario involving only four (4) countries and limited norm subject-matters.

Takeaways and Recommendations:
Limitations on available information (particularly in a “crisis” scenario) and lack of transparency from state actors makes decision-making difficult—and can lead to significant escalation of a situation!

- It was easier to gauge states’ motivations when meeting personally and discussing particular issues (i.e., the difference between the summit *developing* the mock-norms vs. the crisis scenario in which states were largely constrained to their own “teams” and relied largely on passed messages and public pronouncements to understand other states’ perspectives).

- By the beginning of the second crisis scenario, states seemed to be more willing to make *public* statements in an apparent effort to *increase* the amount of information communicated to other actors.

- However, during the second crisis scenario, we also saw how state activity—even initially covert activity—could lead to escalating situations that were ultimately harmful for all space actors. Worst assumptions by state actors and attempts to protect national interests through harmful/dangerous countermeasures can lead to catastrophe.
Further, assumptions about what other states know or don’t know, and assumptions about what your own state can/can’t do or has/hasn’t done can complicate crisis resolution.

Prior to crisis, there is a need for building trust and establishing common ground.

Workshop II: Commercial Space War

Executive Summary: In the age of growing technology, the use of commercialized industries has become ever more present, especially within the military. For years, the military has contracted out to commercial industries. With the war in Ukraine, commercial space industries are ever present and take a surprising level of active roles in the conflict. This roundtable sought to determine the appropriate capabilities and how involved commercial space companies should be with regards to the military. Additionally, the roundtable sought to find the extent to which the government should support these commercial space industries. In this current age of technological expansion, space related activities of the government have been expanded upon by the relationship with commercial industries and the relationship is necessary to further achieve the goals sought in space.

Main Discussion Points: This discussion began by determining the capabilities of commercial space and how the DoD could leverage these capabilities to their advantage. The capabilities were determined to include infrastructure, innovation culture, and communications. The delegates concluded that the appropriate use of these capabilities was not exclusive, and in the demands of a commercial space war, all the capabilities should be used. Next, the roundtable discussed what restrictions, if any, the government should impose on commercial space industries. The delegates concluded that the government should continue to follow regulatory frameworks and tailor regulations in response to particular innovations. Lastly, the roundtable discussed how the government should support commercial space industries during time periods of war and peacetime. The delegates concluded that the government should protect American commercial space industries, provide relief from liability, and information/intel. Overall, the government must continue to bolster their own space capabilities by also focusing on the protection and interests of the commercial space allies while still remaining within a regulatory framework in order to continue the development and growth of both the government and commercial space.

Takeaways and Recommendations: Despite the growth of commercial space industries, the government must continue to use existing commercial space capabilities while simultaneously expanding investments on emerging/experimental capabilities. In order for the DoD to leverage these capabilities in the private sector, they need to draw upon models such as the CRAF and DAP. With the growth and expansion of new space technology, it is important for the private industries to also operate in good faith. Yet, if the government finds the commercial space companies are not operating in good faith nor within regulatory frameworks, there should be penalties such as revoking licenses. For continued support of commercial space industries, the government should continue funding, contracts, and public support to maintain relief from liability. Additionally, the government should also include Space Domain Awareness Data in their relationship with commercial space as a method of intelligence and information. Lastly,
the government should actively protect assets such as launch stations or ground relays of commercial space industries during times of war and peace.

Workshop III: International Space Traffic Coordination

Executive Summary: Over the past decade the cost of entering Low Earth Orbit (LEO) has dropped dramatically, leading to the rise of commercial satellite operators and increasing the number of spacefaring countries. However, International Space Traffic Coordination (STC) has not kept pace with LEO’s exponentially growing population. Without an updated and better structured STC framework the international community risks an unsustainable buildup in LEO’s population and inert space debris. Should an orbit’s satellite population growth exceed its carrying capacity, then a collision between two objects could trigger a chain reaction, destroying all satellites in orbit and rendering space inoperable. This is called the Kessler Syndrome; this is what we seek to avoid.

This working group identified the lack of incentives among international adversaries to compromise on this core problem within the existing international order. Major actors (U.S., China, Russia) currently operate under the realist philosophy, seeking power and security and using bargaining and coercion to achieve desired outcomes (with respect to other major powers). Desiring a more stable and organized space environment over realist anarchy, we sought to shift the international order from one of realism to one of liberalism where no single actor holds outsized power. To achieve this, we need to dilute the power of major actors to the point where coalitions and cooperation become crucial to success. If major powers can gain more from cooperation than the current status quo allows, we believe there will be greater action towards developing international STC rules and norms.

Main Discussion Points: We’ve identified three potential solutions that could help encourage a shift towards liberalism: diluting the power of the Permanent Five (P5) members on the U.N. Security Council (UNSC), establishing a space economy modeled after the International Telecommunications Union (ITU), and expanding the EU’s Space Surveillance and Tracking support framework (EUSST), internationally. Each seeks to change the international institutions which govern and control STC activities and norms of behavior.

The Permanent Five: Spacecraft live in a constant state of dual use: what is a communications satellite today can be a kinetic projectile tomorrow. Such security concerns all but ensure that an eventual disagreement will find its way to the UNSC. With their absolute veto power, there is little incentive among the P5 to cooperate. As the U.S. relies on space technology for civilian and military operations more than China and Russia, there is little incentive for these actors to compromise and change the status quo. Doing so could remove their ability to strike U.S. satellites, putting their military objectives in jeopardy. We need to change their calculus and dilute their power. This could be achieved through any of these three changes:

- Amending the consensus rule from unanimous to 4/5 approval [lowers the barrier for motions to succeed]
- Changing the Chairmanship to a council of 2-3 P5 members [increases the number of major powers in charge of the agenda]
• Shifting to a coalition-based membership (i.e., EU instead of France) [requires coalition agreement or majority will to exert veto power]

In each scenario the major powers would be more inclined to compromise, as their individual power has decreased. Alternatively, if STC issues could avoid the UNSC, either through another adjudication process or a new institution dedicated to STC, then the absolute veto power of the UNSC would become irrelevant. While an unlawful destruction of a satellite would still trigger action at the USNC, a better institution could facilitate a space environment where satellite attacks become a less attractive military option.

The Space Economy: Liberalism centers around the common pursuit of wealth by all nations. This requires a more developed, secure, and reliable space economy than exists today. Establishing a space economy modeled after the ITU would create the necessary conditions for liberalism to succeed. This would begin with the formation of an International Space Management Organization (ISMO) as a central authority. The ISMO would allocate orbits much like how the ITU allocates frequencies. Guided by a Board of Governors comprised of state shareholders, the ISMO would lease or sell shares of orbitals to states and corporations. In receiving this allocation, operators would gain property rights over their orbital with the agreement that they will abide by certain standards and practices regarding STC. Furthermore, the ISMO would reserve or subsidize orbitals for developing actors, fulfilling the requirements of Article I of the Outer Space Treaty. Since they are the entity allocating orbital property rights, the ISMO would have grounds to adjudicate disputes and claims between shareholders. This is perhaps the most important aspect of the ISMO: creating a multi-stakeholder adjudication process. This could be modeled after the International Court of Arbitration, the International Civil Aviation Organization, or a new structure best pertaining to the nature of STC.

Expanding the EUSST: The ISMO plays into our final proposal, expanding the EUSST internationally. This organization would track satellites from all actors, providing a standard data set for the ISMO and other actors to use when navigating LEO. Within this organization there would be two assemblies, one focused on norm and policy creation and another on advising government enforcement. This organization’s strength would come from its collection of valuable orbital data and standardization of operating norms. A country would only get access to this data if they contributed their own satellite data and abided by the organization’s operational norms.

This organization could potentially be a part of the ISMO or an independent but cooperating agency. Their data collection and categorization combined with standard operating practices could allow greater distinction between military and civilian space activities. Standardized and trusted data may provide clearer declaration of intent between adversarial nations. It is understood that the sharing of tracking data could appear detrimental to military missions. However, as the large community of amateur satellite trackers could tell you, there is no hiding the trajectory of one’s orbit if an adversary seeks to find you. Having trusted, filtered, and regulated data would allow countries to avoid other satellites while securing the privacy of their operations enough to act with discretion.

Key Takeaways and Recommendations: Considering these solutions points to a clear issue: the major powers need a reason to change the status quo. What countries lack must be used to
bring them to the negotiating table, and we concluded that a more secure and standardized space economy and international orbital data are the best carrots available. When combined, the ISMO and EUSST-equivalent leverage crucial data and information to implement economic organization, creating a more stable international structure to draft, standardize, and enforce STC. If this can be done, we may be able to avoid amending the P5. Changing the structure of the UN Security Council is the most difficult proposal to accomplish, as its existing structure favors the incumbent major powers. If the international community adopts the ISMO and EUSST-equivalent, then better coordination of movements and dissemination of space traffic data may prevent an issue arising that would require the attention of the UN Security Council, avoiding the issue altogether.

Workshop IV: Space Warfighting

Executive Summary: In this workshop, we dissected the main issues that are currently prevalent in space as a warfighting domain: those being the defense of our interests, what weapons and capabilities we must provide, and the rules of engagement between our country, other countries, and private entities. The overarching concept that drove this discussion was that, in order to maintain peace in this domain, we must prepare with a warfighting mentality that will enable our country and allies to combat the conflict when it presents itself.

Main Discussion Points: Civilian cyber capabilities are the backbone to defending U.S satellites and interests in space. In defending against Russian attacks, Starlink especially has presented itself as a viable and reliable ally while contributing to the growth of civilian interest in space. The U.S also condones civilian ventures and exploration of space, which can only strengthen and expand this investment and partnership. With cyber, though, there exist certain limitations that interfere with these capabilities, namely the high accessibility to interference and the need for reliable spectrum to communicate with satellites.

Satellites on station have also been bypassed by the recent and continually progressing cyber defense technology. Another issue discussed was the use and distribution of weapons in space. Our current strength lies in our ground-to-ground capabilities. With missiles, lasers, and jamming, we are able to present highly active and capable weapons to deter our adversaries, but if we have possession of this technology, then so do our enemies. To combat our adversaries’ advancing capabilities, we must improve our maneuverability and detectability assets, management of distance between us and other objects in space, and the lack of visibility we are able to obtain for our own weapons relative to the weapons of our adversaries.

Finally, we discussed certain rules of engagement that must exist in order for space to continue as a peaceful domain. Fortunately, we are able to draw from other domains to model and construct our laws and policies. The Freedom of Navigation Exercise was used as an example of how we can assign certain orbits or areas of space for countries and entities while designating other areas as international “territory”. Because this is a new and growing domain, it is malleable to the point where we can instill these rules before decisive conflict begins. Although this is an advantage, the lack of set territory naturally alludes to the question of who has the authority to assign rules. Currently, we foresee China as our biggest adversary and defiant to any rules we may put in place, and our lack of communication with
their government and military only stresses this relationship further.

**Key Takeaways and Recommendations:** Considering both the strengths and weaknesses discussed, we then formulated solutions to these issues before they escalate and evolve into bigger complications. For defense, we must improve our satellite technology to ensure that it is able to compete with the ever-changing abilities of the cyber domain. Physically, these satellites can be armed with their own lasers and sensor shields in order to deter and evade while improving thruster speed in order to escape the advancements of enemy spacecraft. Identified as the biggest strength in defense, we also need to continue to outsource to the civilian side of the issue in order to reinforce the alliance and partnership it provides. For the shortcomings we face with weapons, innovation and expansion is key. Plasma plumes, decoys, and coloring can all be used in order to deceive and allude the detection of the enemy. Entering into exotic orbits can also foil targeting in ways similar to unpredictable maneuver in the air domain.

Light and e-optical technology, as well as infrared and synthetic aperture radar can either work toward or against our weapon advantage, depending on how we choose to expand and innovate. With rules of engagement, collaboration is the only feasible option we see as providing solutions. The involvement of other countries and entities will ensure cooperation and adherence to policies emplaced while providing a solid face of retaliation for any actors that choose to defy them in space. As far as collaboration with China, incentives can be used in order to open up communication and guarantee their compliance. Ultimately, in order to actively combat and resolve the issues we identified in the warfighting of space, we must continually improve and progress alongside our allies and enemies, especially in establishing rules of engagement, weapons, and defense, ensuring our position in this new and expanding domain.

**Workshop V: Strategic Foresight for the Space Enterprise**

**Executive Summary:** The only certainty we have for the future is that it will be different from today. In order to limit the impact and shock of this uncertainty, leaders must engage in strategic foresight practices. Foresight involves scanning the horizon, casting a wide net, and looking for potential connections across disparate and related fields to uncover the realm of the possible. Foresight differs from forecasting in that forecasting seeks to predict a future or define probable events. Foresight on the other hand does not yield predictions, rather it is an exercise in conceptual analysis that can assist leaders in exposing emerging trends and areas of concern. Armed with this information, decision makers can allocate resources or attention and avoid or mitigate the pitfalls of surprise. This workshop paired cadets and traditional students with thought leaders from industry and academia to engage in strategic foresight for the space domain.

**Main Discussion Points:** To begin the workshop, participants discussed the nature of the evolving global and space environment, namely that it is volatile, uncertain, complex, and ambiguous (VUCA). With this foundation in mind, participants performed fringe signal scanning to uncover emerging trends, that when combined, could become significant drivers of change both in space and terrestrially. In order to provide a more comprehensive picture of emerging global signals, participants were unconstrained by space topics and were asked not
to seek out trends they believed might be important, but rather scan the horizon broadly, free from confirmation bias. The result of this work was a wide variety of signals, ranging from genetic modification to AI algorithms receiving patents, to workforce burnout, weather control, nuclear fusion, and a variety of topics in between. With these signals, participants then began drawing connections and creating futures webs with second and third-order effects mapped out, and possible time horizons identified. Following this work, key topics were identified and mapped on a cross-impact matrix to determine stakeholders and relevant parties. Finally, participants identified critical uncertainties and possible “black swans” related to these issues in order to inform decision makers on possible actions to be taken.

**Key Takeaways and Recommendations:** Workshop participants identified four possible catalysts for future change, two from the space domain and two others. The primary area of focus was a potential boom in the U.S. space industrial base, which included emerging growth areas like space mining, off-world habitation, space-based solar power, and broader access to space capabilities globally. Along these lines, another key topic was an advancement in space policy and awareness, with the implication that future space policy will ultimately shape not just actions taken in space but could affect the sustainability and survivability of life on Earth. Will precious space resources be open for harvesting? Will states be able to claim territory on celestial bodies? Can policies that promote restraint and deterrence be enacted or is conflict inevitable? These are some of the primary questions considered with space policy foresight. Other areas of focus included a push toward green/renewable energy and the emerging use of weather control, both for peaceful and nefarious purposes.

While all of these areas could have a significant positive impact on humanity and the global economy, there are a number of other challenges that must also be considered. These challenges were identified as critical uncertainties and could have a fundamental impact on how the trends identified play out in the future. The critical uncertainties identified by participants were: space governance (autocratic vs. democratic values in space); viability of the space domain (Will Kessler syndrome reduce/negate utility?); technological advancements (nuclear fusion, space-based solar power, weather control, maturity timelines and unintended consequences); a changing international order (bipolarity, multipolarity, other); distribution of technology globally (Who will have access, and when); and finally, how the public and governments will react to all of these trends. It is these critical uncertainties that participants advocate for continued research and investigation. Strategic foresight can identify these gaps in understanding, but proactive effort is also necessary to address these uncertainties to enable leaders to favorably shape the future environment and minimize the possible negative impacts of strategic surprise.

**Workshop VI: Future of Conflict via Science Fiction**

**Executive Summary:**
Session 1: Within Workshop I, there was a great emphasis on character and setting development, and how a story can start with either a main character that you build around, or it can begin with a setting that you develop and then place a character into. Having a structural approach to writing and planning your story is extremely important, and it helps to know the end of the story before you begin writing it. Assembly delegates began with the story ‘seeds’
that they developed prior to the workshop, and then set out to ask ‘Who?’ ‘Where?’ and ‘Why?’. This is known as the ‘origins game’, for the understanding of which we listened to a brief podcast. At the end of the first workshop, we created a sentence to describe the loose plot of our story, outlining the struggle of the main character and why it should matter to the reader.

Session 2: During the second workshop, there was an initial jump back into the original workshop format, where we were discussing how to create both an internal and external struggle for a character to make the audience care about their journey, and we discussed the reasons why that should matter. After this, we had a 20-minute window of time where we brainstormed and worked on our individual products. After our work time, we came together to share ideas, discuss the impact that internal and external struggles had on our work, and exchange feedback to foster creative thinking. Next, we shifted gears to draw attention to why science fiction matters in the realm of space and warfighting.

Session 3: We discussed how science fiction is a great way to illustrate concepts that can be difficult to describe, using imagery to make things such as AI seem more feasible. Science fiction, we discussed, is what we ultimately reach for and has been a way for us to see the future of technology. Examples of this can be seen with video calling, which was once seen only in science fiction until it was made possible, and with AI decision aids. Science fiction also acts as a way to reach a broader audience and influence the public, which can be both helpful and harmful. The ‘Top Gun’ effect of boosting positive views can be counteracted by satirical science fiction titles, similar to the ‘Space Force’ show. Different perspectives from the media can control public perception and willingness to support. Making space more digestible is an issue that can be aided by the military, potentially to set more realistic expectations.

Main Discussion Points:

- Is there a system for building great science fiction?
- What makes a character worth caring about?
- Internal and external struggles, what is the relation between morality and warfighting?
- Why is science fiction relevant to the future fight?
- Why is science fiction relevant to the way technology develops?
- How does the perception of space change in relation to science fiction?
- How can we make space more digestible?
- Perception of Space Force and their capabilities and responsibilities in the general public can be formed by science fiction that is easily consumable.
- Unrealistic public expectations also need management.
- Wargaming: Practice mission planning can be done via science fiction writing, and can act as a platform to problem solve, safely discover, and assess potential consequences of military strategy and future technology.
- Technology: Science fiction often inspires new technology and gives direction to those who develop new technologies and their capabilities.
- Great science fiction fosters creative, critical, and analytical thinking.
- Science fiction allows cadets to problem solve and incorporate the aspect of morality to war and space concepts.
- Discussion and good communication skills lead into persuasive writing and higher order execution of strategic concepts.

Key Takeaways and Recommendations:

- Great discussion promoted a healthy environment for sharing ideas and growing individually with the help of others around us.
- Teamwork was there, but maybe one-on-one exercises could be beneficial as well.
- This workshop should be expanded in future years to come, maybe with more participants from other schools.

Workshop VII: Allied Space Deterrence: Waging Peace in Space

Executive Summary: The Ukraine Crisis has demonstrated two important themes of the current international stage: the lacking power of NATO and the increasing reliance on space to wage war. In addition to the Ukraine Crisis, anti-satellite (ASAT) testing by Russia and China has sparked discussion over NATO’s response, should escalation occur. NATO must create a new space strategy with updated deterrence strategy in hard and soft law. When developing deterrence strategies, there are key assumptions and considerations to factor into the framework: for example, Thucydides’ trinity of fear, honor, and interest; causes of conflict and escalation; and the impacts of miscommunication and misinterpretation. One must also consider each state’s actions and reactions, especially main actors in space such as NATO, China, and Russia. Strategies already employed include economic sanctions, a form of deterrence by punishment; redundancy in capabilities like GPS, a form of deterrence by denial; and the current norms of space behavior. Nevertheless, NATO should evaluate different deterrence strategies as new threats emerge, including irreversible effects (i.e., Kessler Syndrome), loss of human life, first strike, and breakdown of communication. This paper proposes to diversify NATO’s deterrence framework through reduction of NATO’s space reliance, a deterrence by interdependence strategy, and prioritization of a diverse and resilient constellation system. Finally, NATO must ensure cooperation and mutual understanding in space behavior, establishing clear norms and thresholds for all actors.

Main Discussion Points:
Framing Questions
- What are the top priority threats that NATO is currently trying to deter or respond to?
- What would a space attack look like in relation to these threats?
- What are some of NATO’s possible policy options to deter these scenarios?
Proceedings

Understanding the current deterrence framework allows leaders to refine actions and define norms through means tailored to certain threats. Currently, the space domain supports other domains and respective missions. There remains ambiguity in the current space deterrence model in part because of reliance on cross-domain response and retaliation.

**Identified Threats to Space Deterrence**

**Irreversible Effects:** ASAT operations are instruments that render a satellite permanently disabled, leading to the satellite becoming uncontrollable debris and contributing to a Kessler Syndrome scenario. The Kessler Syndrome is an exponential increase in density of space debris in Lower Earth Orbit (LEO), making collisions unavoidable and making space inaccessible and resources unusable.

**Loss of Human Life:** Most countries consider any action that threatens human lives to any degree as an attack, which is likely to lead to escalation. In space, this can manifest in hazardous debris which may, even unintentionally, harm humans on space stations (e.g., the International Space Station).

**First Strike:** If an actor is the first to develop certain technology, it is inherently incentivized to employ such technology before other actors acquire it. Because NATO members are increasingly dependent on space, China and Russia may be incentivized to enact preemptive strikes in space, crippling the most reliant actors.

**Breakdown of Communication:** This can be defined as a misunderstanding between actors, leading to asymmetric responses that contradict the respondent’s norms or values given the reality of the situation. Asymmetric responses can provoke escalation, exacerbated when one or both countries have not thoroughly identified norms and ‘redlines’ of behavior. To understand space deterrence, the following case studies serve as models: the Vietnam War, the Cuban Missile Crisis, and the 2017-2018 U.S.-North Korea Crisis.

**Key Takeaways and Recommendations:** Conventional actions against NATO in space and subsequent responses are not entirely symmetrical. Actions done for prevention or retaliation in space have to be nation-oriented such that the effect is focused on a threatening punishment or denial toward aggression. For example, China and Russia rely less on space systems than the U.S., so destroying China or Russia’s satellites could render a different response compared to the destruction of an American satellite. Similarly, because North Korea limits its internet capability by blocking global networks, limiting GPS access would have different implications than GPS outages among NATO members.

**Deterrence Policy Suggestions**

**Diversify NATO Dependency in Space:** The United States, and by proxy NATO, is currently more dependent on space than other adversaries. If the current fleet of U.S. space assets are compromised, it would immediately weaken its military posture. Through diversification of capabilities across domains and redundancy of NATO space assets, the alliance can deter space aggression through denial of benefit.

**Deterrence by Interdependence:** By increasing interdependence on space, NATO can promote responsible space behavior. As nations around the world become space-dependent, they will become more invested in responsible space behavior. Building up national space-reliant infrastructures, including space-based communication systems, global positioning satellites,
and earth imaging technology, will ensure a stronger incentive to protect space. NATO can encourage this through collaboration and supporting the global commercial space industry. By helping other countries utilize space technology, NATO will secure broader motivation for a sustainable space environment. Actions that were once appealing to less space-dependent nations (e.g., kinetic ASAT attacks) will be de-incentivized.

**Diverse / Resilient / Redundant Constellations:** Weaponizing space has the potential to escalate terrestrial tensions and should be avoided. As space technology develops, weapons should not be at the forefront of a space race. Globally, NATO could enter a security dilemma where actors aim to increase security through weapons, furthering danger worldwide. To safeguard our largely vulnerable dual-use space capabilities, such as imagery satellites providing intelligence, surveillance and reconnaissance (ISR), we need to procure constellations that are resilient to aggression through redundancy and diversity.

**Foster Cooperation and Mutual Understanding:** Communication at the state level, especially when actors have different native languages, will always have its challenges. In his analysis of international law during the Gulf War Crisis, Dr. Christopher Kuner identifies the “rule of linguistic equality”¹ as a critical norm in diplomatic communication. In short, state actors and diplomats are entitled to communicate in their native language. The implications thereof suggest that NATO maintains a cohort of the most astute translators such that social nuance and speech connotations are preserved.

**Establish Clear Norms and Thresholds:** Clearly defined norms of behavior are essential for stability within any domain. However, space faces a unique challenge due to its underdeveloped understanding of acceptable behaviors. Underdeveloped norms can lead to misunderstandings between two non-aggressive states. It also complicates deterrence by challenging the idea of responsible imposal of cost. Little precedent exists of what non-escalatory proportional punishment looks like. This makes response to aggressive action in the space domain risky. Lastly, NATO must make its redlines explicitly known with clear examples, so that adversaries have a clear understanding of NATO’s expectations for behavior, preventing unintentional conflict.

**Future Implications**

Space is not a new domain, but one that has become renovated and refined for decades by warfighters and policymakers alike. The means of protecting space assets, deterring hostile action, and ensuring the success of international operations have evolved as new threats arise. The ambiguity of space deterrence, and subsequent responses, is a challenge that requires us to predict the unknown. Space is shaped by daily actions that reinforce thresholds and norms for expansion into the final frontier. 

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¹ Kuner, “Linguistic Equality in International Law: Miscommunication in the Gulf Crisis.”
Notes for Contributors to *Space & Defense*

*Space & Defense* seeks submissions that will contribute to the intellectual foundation for the integration of space into overall security studies. Indeed, the emergence of space as a unique and critical element in national security, economic security, homeland security, cyber security, nuclear security, environmental security, and even human security has persuaded us that this line of inquiry is vital to innovation for national defense.

Contributions are welcome from academic scholars and policy analysts at think tanks and research institutes; senior management and policy officials from international and governmental agencies and departments relevant to space and security issues; senior management and policy officials from organizations responsible for critical national and international infrastructures that rely upon space; major aerospace corporations; scientists and engineers interested or involved in space and security policy issues; and military officers and operators in relevant units, commands staff colleges, and service academies.

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Details of the author's institutional affiliation, full address, and other contact information should be included in a separate file or cover sheet.

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All maps, diagrams, charts, and graphs should be referred to as figures and consecutively numbered and given appropriate captions. Captions for each figure should be submitted on the same page as the figure to avoid confusion. Tables should be kept to a minimum and contain only essential data. Each figure and table must be given an Arabic numeral, followed by a heading, and be referred to in the text. Figures and tables are not to be embedded in the text. Each table and figure should be clearly labeled. In the text, make sure and clearly explain all aspects of any figures or tables used.

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Authors are responsible for ensuring that their manuscripts conform to the style of *Space & Defense*. Please follow the Chicago Manual of Style. Listed below are some additional style and writing guides:

• Dates in the form: 1 January 2009.

• Headings (bold, ALL CAPS, title case and centered).

• Subheadings (bold, italic, title case and centered).

• Acronyms/abbreviations should always be spelled out in full on first use in the text.

• The 24-hour clock is used for time, e.g., 0800, 1300, 1800.

• Use percent rather than % except in figures and tables.
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• For numbers, spell out numbers less than 10.

• Make use of 21ststyle where appropriate.

• Keep capitalization to a minimum.

• Concise paragraphs and sentences are desirable.

• Avoid a paper that is just descriptive; rather engage the literature and provide analytical rigor and assessment.

• Avoid policy recommendations in the analysis part of paper; leave this, if applicable, for a separate section at the end of the paper. Define all new terms used in paper.

• Avoid hyphenated words when possible (e.g., low Earth orbit).

• Avoid the use of passive voice when possible.

• Footnotes, numbered consecutively with a raised numeral in the text, use the Insert-Preference-Footnote function of MS Word. S&D