Space Junk Norms:

US Advantages in Creating a Debris-Reducing Outer Space Norm

BY

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APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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ABSTRACT

This study explores the influence of norms governing state behavior in outer space. While the US currently enjoys a preponderance of presence in outer space, and is thus the most influential state within the space medium, this lead has been eroding as more states actively participate in space. At a time of soaring national debt and shrinking military budgets, this thesis looks at ways the US can maintain its lead and protect its investment in space. While kinetic weaponization of space offers one option for protecting US space assets, state fears of space debris associated with such weapons precludes extensive testing as well as application above low Earth orbit. This paper concludes that the US should use its influence in space to foster a debris *reduction* (vice mitigation) norm in space by developing and deploying a satellite recycling system.

This thesis traces norm development and evolution both within the Law of the Sea, as well as within the Space Race, to demonstrate how state interaction influences the creation and evolution of norms, and to highlight how competition within cooperatively forged norms is necessary and beneficial to states overall. This thesis also explores both the notional design and the weaponization potential of a satellite recycling system and argues for the system's political acceptability within a space debris-reduction norm. Ultimately, this thesis argues that creating such a norm would provide an avenue for stable non-kinetic weaponization that can spurn innovation,—which favors the US—garner the US increased prestige, and would thus further solidify the US lead in space while creating a safer and more stable environment for its substantial space investment.

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Introduction

As the 2010 National Space Policy states, "The United States considers the sustainability, stability, and free access to, and use of, space vital to its national interests."[1] As the largest investor and user of space capability today, the US struggles with how to protect its interests in space from a continually growing list of space capable competitors as well as increased threats to its space assets. US attitudes on the best way to utilize space, to exploit space, and the proper standards of behavior have been diverging from those of most other states since man first achieved orbit in 1957. Comparing these perspectives as analogous views on the vastness of space best encapsulates these differing attitudes.

Adam Smith describes the contrast between the view by the myriad of astronauts who have looked upon the earth from low-orbit and the 24 humans—all Americans—who have spied earth from deep space. "The orbital astronaut experiences the planet as huge and majestic, while from afar it is tiny, beautiful and shockingly alone."[2] For the US, the low-earth view reveals the vastness as an expanse around the earth that extols virtually limitless potentials to exploit; while for most other states, the deep-space view implies a vulnerable, small sphere engulfed within this vastness. The low-earth vastness depicts a sense of possibility and power to be seized, while in the deep-space view, the vastness represents the power, an aloof power threatening to engulf the solitary earth if humanity does not protect it. Both of these allegorical views have influenced humankind's brief history into space.

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[1] National Space Policy of the United States of America, 28 June 2010.

[2] Quoted in Michael Sheehan, *The International Politics of Space* (London: Routledge, 2007), 7.

At the same time, this vastness descriptor of space has invoked analogies to another medium of human endeavor, that of the sea, and the norms and laws governing it. Indeed, many aspects of man's endeavor into the oceans, as both a resource and a medium for communication, relate well to the exploration of space from a normative perspective. The frequency of the sea analogy's use among so many space analysts, with perspectives on space ranging from controlling to protecting it, indicates further exploration in its relation to outer space is warranted. The Law of the Sea also represents an opportunity to explore the creation of norms, both as a summary of long-term state behavior, codified after the fact in treaties and agreements, as well as attempts to legislate or codify norms in the short-term and modify state behavior afterward.

While aspects of the Law of the Sea norms encompass hundreds of years of state seafaring tradition, human space exploration has continued for only slightly more than a half century, and normative behavior formation is still in its infancy. However, there still exists both the emergence of state behavior in space establishing normative behavior, such as growing emphasis on debris reduction, as well as the attempts to first legislate standards, then to modify state behavior later, as represented by the debate over space weaponization.

Stephen Krasner defines norms as "standards of behavior defined in terms of rights and obligations."[3] In international politics, norms are not something states simply declare to exist; rather norms represent the way states normally behave. Of course, the standards comprising a norm are also influenced by state behavior: either because a state has the will and power to enforce a standard, which over time becomes a norm, or because states gravitate toward a type of behavior viewed as generally in their interest. For example, though the US is constrained in

[3]Quoted in Everett C. Dolman, *Pure Strategy: Power and Principle in the Space and Information Age*. (London: Frank Cass, 2005), 80.

its ability to use space weapons to enforce standards—either because the weapons have not been developed, they have been banned by treaty as with WMD, or the application is politically infeasible as with kinetic weapons—the US preponderance of presence in space still provides a great deal of influence upon these standards, and thus the norm. As John Klein states in his concept of space control, "Those with the highest levels of participation will easily achieve more influence over those with minimal involvement in space."[4]

As the US searches for the best means of protecting its considerable space investment, its actions are simultaneously influencing, as well as influenced by, the emerging space norms. While US policymakers and DOD leaders might first look at a capability-based solution for protecting space assets, either through the deployment or withholding of space weapons, those actions have costs and implications beyond just the protection of space, or the space domain. While US choices exert a tremendous amount of influence upon the governing norm of space operations, these choices can also have political ramifications terrestrially. "Space and politics are, and always have been, inseparably interlinked."[5]

For the US, a more fundamental question than whether to weaponize space is how can it influence the norms of space behavior in order to enable or bolster protection of its assets while still facilitating open access to all states? While searching for viable means of protecting its space capability, the US also wishes to keep space open for business with few restrictions upon its peaceful use. Is weaponization required to ensure the desired level of protection and openness in space the US seeks? Perceptions and definitions play a large part in how all states approach space and the weaponization issue. The US has shifted over

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[4]John J. Klein, *Space Warfare: Strategy, Principles, and Policy* (London: Routledge, 2006), 61.

[5] Sheehan, *International Politics of Space*, 2.

time from viewing the vastness of space as a new frontier for political dominance during the Space Race, to a realm of market opportunity and military capability today. Where fear and ideology drove innovation during the Space Race, innovation today has shifted more toward the private sector and somewhat away from its original and sole benefactor of the government.

As mentioned above, definitions and perceptions matter, and they affect both what a state desires and the way it behaves. The definition of space for *peaceful purposes* represents one area of contention. Steven Lambakis points out the difference: "One interpretation views 'peaceful' as 'nonmilitary.' The other interpretation, one more accurate and useful, is closer to meaning 'non-aggressive.'" [6] As Michael Sheehan highlights, the debate over the militarization term is misleading, because "space has always been militarized."[7] In terms of behavioral norms, imagery, navigation, and communication represented accepted means of using space for military support. Weaponization of space, however, begins to stress the limits of normative acceptability.

Militarization is not the real focus of today's debate on space—militarization is arguably an established norm. The essence of today's debate on normative space behavior really hinges on turning space from a support realm to a battlefield. Within the United Nations venue, a global push has emerged, most notably in the last decade, to maintain space as a sanctuary free of weapons. Led by China and Russia, this sanctuary movement argues for a complete ban on weapons in space. This state view of non-weaponization as the definition of peaceful purposes in space naturally clashes with the non-aggressive view of the definition held by the US.

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[6]Steven James Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY.: University Press Of Kentucky, 2001), 64.
[7] Sheehan, *International Politics of Space*, 2.

Though space norms are still in their infancy, norms have formed and are still emerging between states as they operate in space. Indeed, some of the current and emerging norms of today derive from initial state behavior—originally just the Cold War superpowers—in space, as well as from the agreements and codifications of these short-lived norms. The freedom of space, the common heritage principle, and the forgoing of the stationing, testing or use of nuclear weapons in space (all weapons of mass destruction, to be completely accurate) represent norms created by state behavior or codified in international agreements. At the same time, many of these concepts emerged in similar form as norms within the Law of the Sea.

Today the US sits at an ideological crossroads, and at a time when budgets in general, let alone for space, are tight. The US possesses a great deal of influence in space, but this is neither absolute, nor necessarily permanent as the number of space actors and the amount of non-US space activity grows. This paper will explore the influences upon the emergence of normative state behavior and ultimately argue for the US to influence the solidification of a debris-reduction norm, mainly through its actions, as the best means to remain a leader in space development, while still keeping the domain open to healthy business and stable military competition.

Ultimately, this paper will recommend the development and fielding of a satellite recycling system to channel US influence toward a debris-reduction norm that will allow for politically acceptable pre-weaponization research and testing.[8] This will have the result of creating a norm facilitating increased protection of US systems while still leaving

[8] For the purposes of this paper, weaponization refers to any system designed to degrade or destroy another system in space. Satellite recycling system refers to the mean to safely repair or de-orbit satellites from any height, LEO to GEO. De-orbiting can entail either employing a mechanism to return the satellite to the Earth safely, or allowing it to degrade into the atmosphere. Of course, such a system clearly possesses applications as a weapon; this will be addressed later in the paper.

the environment open to a stable form of innovative competition. However, such a proposition warrants a word of caution: norms are not a panacea, as they can be broken. This happens in war quite often. Nevertheless, established norms push state behavior back toward what is acceptable over-time, even after defying a norm. Understanding the overall context of what drives state behavior in a domain enables better preparations for the future. "Knowing completely what *cannot* be done allows for an investigation of what *can* be done."[9]

Chapter one will set the foundation for norm formation by exploring aspects of the Law of the Sea development, from its original codifications in the 16th century, to the current debates within the United Nations in the last 50 years over navigation, territorial and resource rights, and deep sea drilling. Since becoming the foremost naval power post WWII, the US maintains a great deal of influence upon the norms that govern the Law of the Sea— it currently enjoys a similar level of influence in space. [10] The US approach to the Law of the Sea has been to maximize open and free use for non-aggressive purposes while respecting the rights of sovereign states. As with space, US views do not necessarily resonate globally.

Chapter two will take the lessons and issues from the previous chapter and compare them to the formation of normative behavior that emerged within the Space Race and continued through the Cold War up to the present day. Interestingly, later-day norm formation issues within the Law of the Sea occur simultaneously with those of space; some issues, such as the common heritage principle, even cross between the environments. The threat of nuclear holocaust influenced a great deal of state behavior during the Space Race and beyond, but ultimately non-nuclear competition formed a sort of state cooperation within the establishing norms, which both shaped and drove innovation.

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[9] Dolman, *Pure Strategy*, 76.

[10] Colin Spencer Gray, *Explorations in Strategy* (Westport (Conn.): Praeger, 1998), 93.

Chapter three will explore the emerging norms of today by surveying the current established rules and norms, as well as norm-influencing institutions, and investigate the effects of the proposed rules on weaponization. It will compare the influences of today with those of space history, as well as the Law of the Sea, in order to show how the US can influence a debris reduction norm with a satellite recycling system and explore the benefits of such a norm. It will also highlight potential pitfalls to the norm's emergences related to a satellite recycling system's weaponization potential and recommend initial deployment of a simpler system to protect the emergent norm by keeping state interaction in space more stable. It will also briefly explore notional design concepts for a satellite recycling system and discuss how this system fits into norm formation. Ultimately, it will argue for the solidification of the debris-reduction norm as an effective way of protecting US space capability overall while fostering continued space innovation in a stable manner.

This paper will utilize unclassified, open-source material written in English for its sources. It considers the geopolitical context up through 1 April 2011 and assumes no major technological innovations will occur prior to that date. At the same time, the paper tends to take a homogenous view of global opinion for the sake of analysis of the overall norms governing space operations. A myriad of factors influence an individual state's particular view on the proper norm, which are not identical to another state's factors, even for two states who ultimately share a similar view on an overall space issue. For the sake of analysis, this paper will only explore major influencing factors, typically from major states or blocks of states, influencing norm formation. At the same time, this paper assumes the motivations behind stated national policies to be reasonably ascertainable. This becomes challenging for counties like China, which tend to maintain close-hold on future actions and intensions.

Chapter 1

Norms within the Law of the Sea

The genesis of the established norms guiding state behavior upon the sea represent an evolutionary process influenced by the development of technology, as well as technologically-enabled resource opportunities that emerged within the deep sea, beyond the sovereignty of any state. The development of the Law of the Sea (LOS) demonstrates how norms, like state behavior, evolve over time. The normative process exemplified by LOS provides a sufficient baseline for the study of norms in space, as well as demonstrates how the US can influence space norms to its benefit in similar fashion to the way it did so within the modern LOS.

This section compares norm formation within development of the original LOS, based on consent and backed-up by power, with the modern LOS, where international agreement takes the place of state power as the main regulating influence upon state behavior. I show how the US possessed considerable influence upon formation of norms within the international agreement regime governing the creation of the modern LOS. For ease of analysis, this study divides LOS development into two halves: the original LOS, stemming from the sixteenth century to 1945, and the development of the modern-day LOS post 1945 to date. While the US became the dominant global sea power post-1945, understanding how LOS norms originally developed prior to the rise of the US provides a great foundation for understanding the subsequent normative development within the modern LOS.

Development of the original LOS, dating back to the sixteenth century, occurred in a very realist manner. Sea power was the main driver for establishing acceptable state behavior, and force, or the potential for it, formed the basis for norms within this period. The basic process of establishing a norm revolved around the deference of a state's relative level of power. When a state made a claim, if other states either

viewed the claim in their own interest, or perceived the claimant as possessing the commensurate power to back it up, the claim normally went unchallenged and eventually became a norm. Because power was the main ingredient of norm formation during this period, the process often involved conflict, with the norm resulting from the eventual outcome.[1] Norms also shift over time, just as relative state power does.

Through sea power, coastal states attempted to maximize the extent of their sovereignty over what they considered territorial waters and freedom of movement on the high seas. The interaction of states balanced out those two concepts over time. Within the terminology of the day, this equalizing struggle represented a conflict between the competing concepts of *mare clausum*, national sovereignty over the ocean, and *mare liberum*, freedom of the sea for all.[2] Attempts to extend sovereignty or freedom to the detriment of other states typically saw at least tacit alliances to push the excessive defectors back toward the acceptable norm. The case of Spanish and Portuguese global overreach in the sixteenth century provides an example of the phenomenon.

In essence, the original LOS norm dictated that states could not reasonably reach beyond what their power allowed. One example of state overreach occurred jointly between Spain and Portugal in the early sixteenth century. Backed up by Papal decree, these two states attempted to divide the oceans outside Europe between them, to the exclusion of other European states—not to mention other states and peoples around the globe—in what David Anderson describes as an attempt to exert power not as a coastal state, but as a global hegemon.[3]

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[1] James B. Morrell. *The Law of the Sea: A Historical Analysis of the 1982 Treaty and Its Rejection by the United States* (Jefferson, N.C.: McFarland, 1992), 185-186.

[2] David Anderson. *Modern Law of the Sea: Selected Essays*. (Leiden: Martinus Nijhoff Publishers, 2008), 4.

[3] Several treaties comprised the process of dividing the globe between Spain and Portugal, with the initial and more notable, the Treaty of Tordesillas, concluded in 1494. For a description of the treaties between Spain and Portugal, see Frances G. Davenport and Charles Oscar Paullin. *European Treaties Bearing on the History of the*

"The two Kingdoms claimed trading monopolies with large parts of the East and West Indies, including claims to control navigation over large expanses of the oceans."[4]

Originally, the claims went unchallenged both because of the relative naval power of Spain and Portugal, but also because this was the new world and resource benefits were unknown. As the benefits became clearer, and the relative naval power of Spain and Portugal dwindled, the other emerging sea powers began to challenge these claims by Spain and Portugal and eventually ignored them. A statement by Queen Elizabeth I of England, made nearly a century after the Spanish and Portuguese claims—and after English sea power had since eclipsed that of the two claimants—largely reflected European sentiment toward the exaggerated claim. In responses to a Spanish protest regarding the exploits of Sir Francis Drake, the Queen opined, "the use of the sea and air is common to all; neither can any title to the ocean belong to any people or private man, forasmuch as neither nature nor regard of the public use permitteth any possession thereof."[5] This sentiment becomes the basis of the freedom of the sea concept put forth by a Dutch theorist, and subsequently adopted by other states.

The Dutch government's interests in the East Indies also conflicted with the claims of Spain and Portugal. Hugo Grotius's book, *Mare Liberum* (1609), "was written in order to vindicate the claims of the Dutch East India Company, by whom he was employed, to trade in the Far

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United States and its Dependencies (Washington, D.C.: Carnegie Institution of Washington, 1917), 84-85. In addition, many Papal Bulls were also of significance to this process at the time. Arguably the two most important were the Bull of 1493 by Pope Alexander VI and the Bull of 1506 by Pope Julius II. The first granted control to Spain of all land West and South of the Azores (which Portugal did not approve), and the second moved the line West to allow Portugal to control what is now roughly Brazil. For a brief summary of the Bulls influences on the agreements between Spain and Portugal, see Davenport, *European Treaties Bearing on the History of the United States*, 101-108. For a summary of the Bulls influence on norms of the sea, see David Anderson, *Modern Law of the Sea*, 5.

[4] David Anderson, *Modern Law of the Sea*, 5.

[5] David Anderson, *Modern Law of the Sea*, 5.

East, despite the monopoly on trade in the area claimed by Portugal."[6] Within this document, Grotius captured the sentiments of most other states regarding the freedom of the ocean. He declared, "The seas and oceans a global or 'common' space available for all to use on a basis of equality."[7] All states were free to partake in the navigational opportunities and resource potential—namely fishing at the time—of the ocean. Of course, Grotius' declaration alone did not nullify the claims of Spain and Portugal, the acceptance of his proposal by the other European sea faring states, and the collective sea power these states represented, did.

Of course, while freedom of the sea facilitated trade and the extraction of resources, in the extreme it was also contrary to state security because it provided no buffer. The *mare clausum* concept formed in response to Grotius's *mare liberum*, freedom of the sea, theory. Within *mare clausum,* "A state is entitled to claim and exercise authority over a defined area of the sea, including powers over any foreign ships, notably fishing vessels, that might seek to enter that area. These claims occasionally extend to complete closure (hence the use of clausum), but in most instances they have been less extensive."[8] While all states recognized the need for a reasonable extension of sovereignty beyond their shores, backed up by sea power, the challenge was finding the applicable equilibrium between these contradictory concepts. The eventual balance in the application of the *mare clausum* and *mare liberum* concepts were the development of cannon shot rule and the right of innocent passage, respectively, and defined in the following two paragraphs. As demonstrated in the case of Spain and Portugal, *mare clausum* applied in the extreme meant global hegemonic claims. While

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[6] R. R. Churchill and A.V. Lowe. *The Law of the Sea*. New, Rev. ed. (Manchester: Univ. Pr., 1988), 3.
[7] David Anderson, *Modern Law of the Sea*, 5.
[8] David Anderson, *Modern Law of the Sea*, 4.

most states agreed in principle to a more limited extension of sovereignty from the shore, the consent on the actual distance had yet to emerge.

Initially, states enacted individual methods to define the limit to their extended sovereignty, such as the amount of sea area that one could view while aboard a ship still in view of the shore.[9] The practical solution that emerged, which was in tune with the power basis of sea norms at the time, was the distance a states could affect the ocean from shore, the range of shore-based cannon.[10] While debate emerged initially about the need for an actual cannon to be present for the rule to apply, eventually states accepted the general guideline of three miles, or one league—the maximum range of cannon at the time—as the accepted norm that applied to all coastal state sovereignty, commonly referred to as territorial waters.

Complementing the extension of territorial sovereignty was a norm of free transit, termed innocent passage, which derived from Grotius' *mare liberum* concept. As Everett Dolman describes, "Innocent passage held that any vessel, even military craft, had right of access to unmolested transit on the oceans (so long as no state of war existed between the nations involved, or intention to commit an act of war was pending)."[11] As long as a ship was transiting for the purpose of navigation, and posed no threat to the economic or security interests of a coastal state, the concept of innocent passage eventually applied to territorial waters as well.[12] The subsequent debate regarding innocent passage (explored later in the paper), was the potential for modernizing warships to partake in innocent passage through territorial waters.

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[9] This represents a transferring of the "land-keening" concept used by King James I of England applied to the ocean. See David Anderson, *Modern Law of the Sea*, 4.
[10] Churchill and Lowe, *The Law of the Sea*, 65.
[11] Everett C. Dolman. *Pure Strategy: Power and Principle in the Space and Information Age*. (London: Frank Cass, 2005), 98.
[12] Churchill and Lowe, *The Law of the Sea*, 70.

Though the interstate behavior norm emerged within the original LOS, its acceptance did not imply its permanence.

The norms of the original LOS, though set between states, were out of date virtually upon their emergence. The old power based normative system of state interaction worked well until technological advancements, as well as resource potentials derived from these advancements, began to strain the system. While resources in terms of navigational routes were still inexhaustible, new ship technology threatened fishing. "By the sixteenth century, extremely efficient mariners had the capacity to locally deplete existing resources to the detriment of latecomers."[13] In addition, ship speeds became too great for the three-mile cannon shot rule to provide a reasonable security buffer.[14] Since the sixteenth century, states have continually proposed, and attempted to enforce, new limits on the original LOS norms to protect both their security and economical interests primarily though bilateral treaty or declarations backed up by power; this changes with the rise of norm influencing entities and the eventual codification of the modern LOS.

The creation of supra-national agencies, embodied today in the United Nations, brought about a reduction in state power as the main currency of norm solvency with regard to the world's oceans after 1945. Instead, the necessary state consent required to solidify a proposed norm came through agreements spawned via these supra-national agencies. This does not mean to imply that power played no role in the modern LOS, just that consent of a norm meant acknowledgment of international agreement vice a recognition of another state's power to enforce its will. Power still provided influence as norms mainly apply to times of peace, and conflict always was, and remains, an option for states. However,

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[13] Everett C. Dolman. *Astropolitik: Classical Geopolitics in the Space Age*. (London: Frank Cass, 2002), 98.

[14] David Anderson, *Modern Law of the Sea*, 19.

within the new regime, power shifted from direct enforcement of a state's will through conflict to influence upon agreements shaping the norm.

The modern LOS of today derives from multiple treaties and conventions spanning from post 1945 to date. The United Nations Convention of the Law of the Sea (UNCLOS) encompasses three different agreements spanning from 1958 to 1982. The first convention, UNCLOS I, derives from four separate UN treaties signed in 1958, which represented the culmination of the first attempt to modernize the LOS.[15] While UNCLOS II did not yield any new agreements, UNCLOS III did yield a treaty still in existence today. It is noteworthy that the US refrained from signing UNCLOS III at the time of this writing for reasons discussed below. While a complete recounting of the details of these codifications is beyond the scope of this thesis, a general overview of the process will lay the foundation for understanding the US role and motivation in shaping of the modern LOS.

Similar to the original LOS, codification of the modern LOS represented an international effort to solidify state desires to maximize security and freedom within the supra-national United Nations regime. States were motivated to update the law in light of modern ocean technology and resource opportunities—nuclear powered and armed vessels, along with fishery and ocean floor mineral rights, to name a few. However, differing from the original system, the supra-national nature of this regime caused a relative leveling of influence upon norm formation amongst virtually all states. "Less developed countries [found] the UN to be an excellent sounding board for their grievances, a forum that [gave] them disproportionate weight in the international affairs relative to their

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[15] These conventions dealt generally with rights and responsibilities regarding territorial sea, the high seas, fishing rights and conservation, and continental shelf resources (non-living resources typically on or beneath the ocean floor). See the UN's Oceans and Law of the Sea: Division for Ocean Affairs and the Law of the Sea, "The United Nations Convention on the Law of the Sea (A historical perspective)," http://www.un.org/Depts/los/convention_agreements/convention_historical_perspective.htm.

economic and military strengths."[16] While proponents of such a regime would term it fairer, mainly from the perspective of developing countries, opponents would term it redistributionist for the perceived favoritism the regime appears to provide to less powerful developing states at the expense of developed states.[17]

Within this dynamic, all coastal states, regardless of size, worked to maximize their economic and security interests. However, the process also spawned unintended consequences, requiring additional modifications. For example, many states pushed for an extension of the three-mile territorial limit to 12 miles in order to protect coastal fishing resources. However, this limit affected state navigation rights in certain areas by effectively eliminating international waters in straits 24 miles wide or less. The process also frequently took the track of relatively weaker states attempting to increase regulations to limit the power of stronger states, as evidenced by the dispute between China and Russia over flag-state sovereignty rights of a ship in another state's territorial waters.[18] It is within this dynamic that the US began influencing normative behavior as the dominant global sea power.

The US rose as the main global sea faring state post 1945. Despite having tremendous sea power both militarily and economically at the time, such power no longer enabled the US to dictate the rules upon which the normative sea behavior would derive. Like all states, the US also sought to maximize its interests, which in the case of the LOS meant

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[16] Dolman, *Astropolitik*, 100.

[17] David A. Ridenour, "Ratification of the Law of the Sea Treaty: A Not-So-Innocent Passage," *National Policy Analysis: Publication of the National Center for Public Policy*, August 2006, http://www.nationalcenter.org/NPA542LawoftheSeaTreaty.html.

[18] Jeanette Greenfield documents a fishery jurisdiction dispute in the early 1970 between the Soviets and the Chinese regarding flag-state sovereignty of a ship in the territorial water of another state. The Soviets, with relatively greater fishing capability that ranged beyond its territorial waters, wanted to limit jurisdiction of the territorial state; while the Chinese, with distinctly less capability focused solely within its territorial waters, sought to maximize the coastal states rights within the regime to protect its territorial resources. See Greenfield, *China's Practice in the Law of the Sea*, (Oxford: Clarendon Press, 1992), 116.

maximizing economic and navigational freedoms for its global seafaring capability. Despite the limitation on direct application of its power, the US still managed to influence the creation of the modern LOS in its favor. This occurred through cooperation with states (even competitors) who viewed the US proposal advantageously, as well as through the translation of its sea power into influence upon norm creation. In a sense, the US was both the quintessential freedom-maximizer and security protector of its time, able to secure, for the most part, the economic and navigational rights that it viewed as beneficial.

US influence upon development of the modern LOS begins in 1945 with the Truman Proclamations. These proclamations dealt with US ocean resource concern in mineral and fishing. The first proclamation stated, "the Government of the United States regards the natural resources of the subsoil and seabed of the continental shelf beneath the high seas but contiguous to the costs of the United States as appertaining to the United States, subject to its jurisdiction and control."[19] According to David Anderson, this proclamation marked a turning point in that it advanced a new doctrine—that of coastal states' rights, specifically jurisdiction and control over the resources of the adjacent continental shelf.[20] Unlike Spain and Portugal, who attempted a global extension that other states resisted, this first US proclamation was uncontested by other coastal states because they also saw economic benefit in the new regime.

The second Truman Proclamation sought to conserve fishing resources beyond territorial waters. While not making specific jurisdictional claims, the proclamation did call for "the establishment of conservation zones in parts of the high seas contiguous to the US territorial sea by means of agreement with fishing States."[21] As

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[19] Quoted in Churchill and Lowe, *The Law of the Sea*, 122.
[20] David Anderson, *Modern Law of the Sea*, 8.
[21] David Anderson, *Modern Law of the Sea, 8.*

previously mentioned, overfishing concerns related to state interests began as early as the sixteenth century. The second Truman proclamation highlighted how territorial waters no longer protected coastal states economic interests because fish stocks, beholden to no oceanic demarcation, were vulnerable to overfishing just beyond a coastal states territorial sea.

Again, coastal states did not reject the US proclamation, but instead moved to clarify it with practical demarcation. Subsequent declarations by many Latin American countries in particular, who were concerned primarily with fishing rights, claimed sovereignty extended 200 miles from their shores.[22] In a way, this represents an unintended consequence to the US proposal, which was concerned primarily with conservation, but extended beyond the original intent. An eventual compromise emerged in the establishment of a 200-mile Exclusive Economic Zone (EEZ) concept within UNCLOS regime. Not an extension of sovereignty (as some developed states proposed), the EEZ grants rights to the coastal state to protect resources, while protecting freedom of navigation (a primary interest of developed states). In the end, the EEZ concept eventually emerged within the modern LOS within the approximate intent of the original US proclamations. The EEZ concept enabled the US to extend protection of its economic interests without affecting its global maneuver capability.

The extension of territorial waters beyond the three-mile limit, mentioned above, represented another area threatening the US interest in global navigational freedom. Post-1945, the US sought to maximize maneuver flexibility for it global naval capability. David Ridenour cites this as a continuing interest today because "the U.S. is the only nation capable of extended, extensive long-range maritime operations."[23] Within

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[22] Churchill and Lowe, *The Law of the Sea*, 124.

[23] David A. Ridenour, "Ratification of the Law of the Sea Treaty: A Not-So-Innocent Passage," http://www.nationalcenter.org/NPA542LawoftheSeaTreaty.html.

the emergent modern LOS however, several other states also possessed global naval capabilities and shared this same interest in codification of navigational freedom within UNCLOS. The Soviet Union was one such power, which actively cooperated with the US to propose language within UNCLOS that maintained global freedom of navigation within the extending norm of territorial ocean sovereignty.[24]

While the concept of innocent passage clearly allowed commercial shipping to pass through territorial waters, the passage of warships constituted a normative grey area. Free warship passage through territorial waters, a constituted security buffer, created a security dilemma as the speed and firepower of modern warships had vastly improved since the innocent passage norm had first emerged. As mentioned, many less powerful coastal states pushed for an extension of territorial waters to 12 miles for security and economic reasons. However, this extension threatened navigation through certain critical straights of less than 24 mile width—such as Dover, Gibraltar, Hormuz, Bab el Mandeb, and Malacca.[25] Thus, smaller coastal states sought to maximize their territorial sovereignty within the 12-mile regime, while the global sea powers opposed it.

Within the competitive tensions of the Cold War, the US found common ground to cooperate with the Soviet Union in the 1970s over maintaining its global navigational freedom within the UNCLOS conventions. Through its efforts, the transit passage concept emerged as a compromise between the two sides. Specifically, transit passage retained "the international status of the straits and [gave] the naval powers the right to unimpeded navigation … that they had insisted on. Ships and vessels in transit passage, however, [had to] observe

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[24] The developed states that worked together to maximize global navigation within the UNCLOS III conference, termed the Group of Five, were the United States, the Soviet Union, France, Japan, and the United Kingdom. See Anderson, *Modern Law of the Sea*, 28.

[25] Churchill and Lowe, *The Law of the Sea*, 90.

international regulations on navigation safety … and prohibitions of vessel-source pollution and [proceed immediately, and non-threateningly, through the strait]."[26] Thus, though cooperation with a competitive adversary, the US maintained its interest in global freedom of navigation.

The final area of contention within the UNCLOS norms tested the extent of US influence itself. While previously the US was interested in maintaining global navigation capability while protecting resource interests relatively close to its shores, interest in deep-sea mineral resource potentials—an area within the no man's land of the high seas—eventually caused a change in US priorities. The UNCLOS III Treaty (1982) contained a provision, Part XI, which declared the resources of the deep seabed the "common heritage of mankind."[27] The rational of the common heritage purported that because the seabed resources belonged to all states (no state could declare sovereignty upon the high seas), then all states should share the profit. The treaty also included provisions on technology transfer from the developed states to the developing states so all could directly partake in the wealth. To facilitate profit allocation and technology transfer, UNCLOS III proposed establishing a supra-national Seabed Authority to oversee seabed resource allocation.

During negotiations for UNCLOS III, the US opposed the common heritage concepts, viewing them as contradictory to free market ideals. The crux of US opposition to this portion of the regime dealt with potential effects upon business incentives to undertake investment in deep sea drilling with a reduction in potential profits, and forfeiture of proprietary technology to potential competitors, deriving from the common heritage principle. In 1976, Henry Kissinger proposed a

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[26] "The United Nations Convention on the Law of the Sea (A historical perspective)," http://www.un.org/Depts/los/convention_agreements/convention_historical_perspective.htm.

[27] United Nations Convention on the Law of the Sea, http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf, (accessed 1 March 2011), 66.

compromise, suggesting a parallel system, which proposed to halve all new resource discovery areas on the seabed—one side mined freely by the claimant state and the other placed under the Seabed Authority.[28]

While the US valued global navigation as paramount within the initial negotiations, this changed under the Reagan administration, which began viewing mineral-resource access on par with its navigational priorities.[29] While the US was both satisfied, and currently complies, with all other aspects of the UNCLOSS III proposal, it did not sign the 1982 convention because of its opposition to Part XI of the treaty. Opponents of the US decision, such as Leigh Ratiner, cited above, feared a loss in US influence should the Part XI aspect of the regime solidify without US participation. In addition, there was concern in the US that UNCLOS III would create an unbeneficial norm because it would pass into customary law if the majority of states accepted and began adhering to Part XI without the US. As it turned out, quite the opposite occurred.

Joseph Nye points out the power a single influential actor has to influence regime formation, "While it might seem paradoxical at first, unilateral action can play an important role in regime construction. Indeed, traditionally the unilateral actions of great powers were major sources of regime formulation."[30] By actively opposing Part XI of UNCLOS III, the US effectively blocked its application as international law upon itself. For customary law to apply, a state must satisfy two concepts: it must acknowledge the law's existence, and comply with the law out of a sense of *opinio juris*, or obligation.[31] As a major sea player at

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[28] Joseph Nye, "Political Lessons of the New Law of the Sea," in *Law of the Sea: US Policy Dilemma,* David D Caron, Charles L. Buderi, and Bernard H. Oxman, eds. (San Francisco, Calif: ICS Press, 1983), 117.

[29] Leigh S. Ratiner, "The Costs of American Rigidity," in *Law of the Sea: US Policy Dilemma,* David D Caron, Charles L. Buderi, and Bernard H. Oxman, eds. (San Francisco, Calif: ICS Press, 1983), 117.

[30]Joseph Nye, "Political Lessons of the New Law of the Sea," in *Law of the Sea: US Policy Dilemma,* 123.

[31] Churchill and Lowe, *The Law of the Sea*, 6.

the time, US open opposition to Part XI blocked that part of the convention from passing into customary law, and therefore denied its norm-creating effect.[32] Eventually, an agreement reached in 1994, just prior to the treaty taking force, exempted the US from the aspects of Part XI it found unsatisfactory.[33]

Though the requirement for norm emergence within the LOS shifted from power in its original form, to international agreement in the modern era, state interaction played a large role in each. As the major naval power after 1945, the US was still able to translate its power into considerable influence within the supra-national framework of the UN by proposing rules that other states viewed as beneficial or withholding its support for proposed rules contrary to its interest. Ultimately, it demonstrated the ability to drive norm formation within certain limits. As is shown in the next chapter, the US demonstrated similar influence within the fledgling emergence of norms in space.

[32] All other aspects of UNCLOS III, which the US both found satisfactory and adheres to, have arguably passed into customary international law.

[33] David Anderson, *Modern Law of the Sea, 8.*

Chapter 2

Norms within the Space Race

Everett Dolman describes the paradox of space norm formation throughout the Cold-War-Fueled Space Race, "The outer-space regime, widely recognized as the acme of global cooperation, is in fact the product of Cold War competition and national rivalry."[1] Indeed, many space theorists including Michael Sheehan point out that terrestrial politics went into space along with human technology.[2] State politics in space reflected terrestrial Cold War political concerns, which motivated aspects of both competition and cooperation between states. In the midst of the Space Race, the US strove to appear cooperative and peaceful while simultaneously competing for technological superiority. More importantly, however, the US helped shape a normatively cooperative environment that sought stability in the midst of this competition. In other words, the norms the US helped create served its overarching security interests, and later its economic interests, but also bounded the Space Race competition in a stable and productive fashion.

Like norm formation within Law of the Sea, the norms of space law experienced an evolution, albeit on a relatively compressed timeline. The initial space norm, freedom of satellite overflight, or Open Skies, spawned because of the need for accurate intelligence on enemy nuclear missile delivery capabilities. However, as the Open Skies norm was solidifying, US emphasis shifted toward a regulated form of cooperative competition that sought nuclear stability in the midst of a race for engineering prestige. As with its approach to the LOS, the US initially held its freedom of action paramount to enable its security, but eventually

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[1] Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002), 88.

[2] Michael Sheehan, *The International Politics of Space* (London: Routledge, 2007), 183.

widened its scope to include its budding economic interests in space. The US sought to create as open, but stable, a space regime as possible; this regime ultimately advanced space technology beyond where it could have evolved otherwise. The basis for normative formation within the Space Race existed within the terrestrial Cold War, which requires definition before an understanding of more heavenly pursuits can take place.

As mentioned previously, the emerging Cold War struggle for terrestrial dominance represented the basis for the later struggle in space. Beyond its status post-1945 as the preeminent sea power, the US was in fact the predominant global power due in large part to its monopoly on the possession of atomic then nuclear weapons. The Soviet's, however, were determined to match, and ultimately surpass the US in global influence. As Walter McDougall points out, the Soviet's saw the world as a venue for ultimate Soviet conquest and were determined to challenge US preeminence through technological dominance.[3]

The first milestone along the Soviet path for dominance was the acquisition of atomic weapons in 1949.[4] This event set off a defense spending spiral in both the US and Soviet Union, in the form of a race for both bigger and better nuclear weapons and the means to deliver them via the ICBM. As Pat Norris points out, an element of fear-mongering fueled the budding competition, "Underpinning the arms race was a propaganda war in which each side painted the other as wanting to dominate the world."[5] The US initially approached the Soviet threat from an attitude of technological superiority, which the Soviets were determined to undermine, if only by cultivating a global *perception* of

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[3] Walter A. McDougall, *...The Heavens and the Earth: A Political History of the Space Age* (Baltimore : Johns Hopkins University Press, 1997), 47.
[4] Pat Norris, *Spies in the Sky: Surveillance Satellites in War and Peace* (Chichester, UK: Springer, 2008) 43.
[5] Norris, *Spies in the Sky*, 45.

military and technical superiority. Sputnik provided the Soviets just such a means of fostering this perception.

At once, the successful launch of Sputnik in 1957 was both a blow to US technological prestige and a palpable demonstration of an operationalized Soviet nuclear weapon delivery capability. "Sputnik challenged the assumptions of American military and fiscal policy, and thus seemed to have scary implications for American security and prosperity."[6] While some Americans, to include members of the Eisenhower administration, attempted to quell the mounting hysteria in response to the Soviet achievement, many—especially Eisenhower's political opponents—felt the USSR had achieved "a tremendous propaganda coup, and that America had been humbled."[7] For the then-Senator Lyndon Johnson, Sputnik represented a "'technological Pearl Harbor' and a terrible blow to U.S. prestige because 'in the eyes of the world, first in space means first, period; second in space is second in everything.'"[8]

Prior to the Sputnik launch, nuclear weapons represented a potentially economical means for each side to counter the other's threat. The fiscally conservative President Eisenhower sought in his *New Look* program a demobilization of the military and a 30 percent decrease in military spending because the power of nuclear weapons provided, "more bang for the buck."[9] Eisenhower also feared a runaway military-industrial complex, which might induce pressures to overspend on defense, and thus go "hog wild."[10] Like Eisenhower's *New Look*, Khrushchev's comparable program also sought to enable a reduction in

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[6] McDougall, *Heavens and the Earth,* 142.

[7] Sheehan, *International Politics of Space*, 26.

[8] Walter A. McDougall, "Shooting the Moon," *AmericanHeritage.com*, Winter 2010, Volume 59, Issue 4, www.americanheritage.com/articles/magazine/ah/2010/4/2010_4_88_print.shtml. (accessed March 9, 2011).

[9] McDougall, *Heavens and the Earth*, 114.

[10] McDougall, *Heavens and the Earth*, 133.

the Soviet's massive land force, which nuclear weapons had rendered less potent. However, with the launch of Sputnik, the Soviets demonstrated a rapid and virtually unstoppable means of nuclear weapon delivery. While in reality Soviet capability for delivery was overblown, the theoretical possibility was real enough. The Soviets leveraged this fear, and fueled by the shock of Sputnik, presented a veneer of superiority that its US adversary could not counter without intelligence.[11]

Against this backdrop, Eisenhower sought creation of the first space norm, solidification of an Open Skies regime, to provide an avenue for satellite intelligence in order to discover the full extent of Soviet nuclear weapons capability. The challenge was not just overcoming Soviet secrecy, but also its assertion of vertical sovereignty extending into space. As it did for its approach toward norm formation in the Law of the Sea, the US initially viewed its ability to maneuver in space as paramount. "To realize its long term plans, the United States desperately wanted to have the prevailing notion of innocent passage as reflected in the law of the sea applied to outer space, and not to allow an upward extension of existing air law, in which territorial ownership extends upward, *usque ad coloeum* (as far as the sky)."[12]

At the same time, Eisenhower had to respect the threat posed, however vague or exaggerated, by Soviet nuclear weapons. Having failed to achieve a diplomatic agreement with the Soviets on an Open Skies regime, he had to search for other methods.[13] With an eye toward nuclear stabilization, Eisenhower believed a civilian satellite possessed the best chance of blazing the trail by not rousing insurmountable Soviet protests to the overflight of satellites. As Sheehan highlights, "the

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[11] McDougall, *Heavens and the Earth*, 266-268.

[12] Dolman, *Astropolitik*, 108.

[13] Mike Moore, *Twilight War: The Folly of U.S. Space Dominance* (Oakland, CA: The Independent Institute, 2008), 174.

decision to use a civilian program to launch an American satellite during the IGY … reflected Eisenhower's desire to establish the legal legitimacy of satellite over flight of foreign territory, in order to allow a subsequent reconnaissance program."[14]

Thus, the more civilianized Vanguard program was favored over the Army's more developmentally advanced Redstone, which derived its technology from the Nazi German V2 weapon and former Reich scientists responsible for the V2's design.[15] In addition, Eisenhower split responsibility between the newly created NASA, the civilian face of US space operations, and the DOD, which oversaw the subsequent secret reconnaissance program.[16] Eisenhower's grand plan, though jarred somewhat by the launch of Sputnik and the subsequent rise of missile gap fears, was to gain the necessary intelligence on Soviet nuclear capability to facilitate creation of a sufficient deterrent, formed in a stabilized fashion. At the time, Eisenhower sought to make the US "*a* leader in space, not *the* leader in space."[17] Though the shock of Sputnik was a blow to US prestige, it became the key to Eisenhower's plan.

While the launch of Sputnik garnered the Soviets the appearance of technological superiority over the US—and created a political hurricane for Eisenhower in the ensuing nuclear hysteria—from a norm-creating standpoint, the Soviet achievement ceded the initiative to its adversary. While the Soviets had previously condemned US espionage attempts via balloon or aircraft, Sputnik opened the door for spy satellites. Sputnik effectively wrote overflight into international law because the US and other states under the satellite's path did not protest.[18] As Assistant Secretary of Defense Quarles framed it, "the Russians have in fact done us a good turn, unintentionally, in

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[14] Sheehan, *International Politics of Space*, 39.
[15] Sheehan, *International Politics of Space*, 39-40.
[16] McDougall, *Heavens and the Earth*, 172.
[17] McDougall, *Heavens and the Earth*, 172.
[18] Sheehan, *International Politics of Space*, 44.

establishing the concept of freedom of international space."[19] "The USSR had no choice but to uphold 'freedom of space' and renounce its [previously held] belief in 'unlimited vertical sovereignty.'"[20] Thus, the Soviets achieved the US aim of maximum maneuverability by making space akin to the high seas and therefore beyond effective government control.[21]

With the Open Skies space norm perhaps unintentionally constructed by the Soviets, the US next sought to nurture this budding regime in a manner that enhanced its security by enabling its nuclear deterrent. However, the solitary orbit of the beeping Sputnik could hardly match the hundreds of years invested in the evolutionary process of the norms guiding state behavior on the sea. Therefore, to prevent a potentially destabilizing and expensive arms race in space, but still protect the US freedom of maneuver, Eisenhower now had to turn to treaties in order to establish the rules that would guide formation of normative state behavior. As McDougall aptly describes it, "U.S. space strategy aimed at the establishment of a legal regime in space that complemented the American propaganda line of openness and cooperation in space and held out hope of agreements to 'put a lid on the arms race,' and at the same time preserved American freedom to pursue such military missions in space as were needed to protect and perfect the nuclear deterrent."[22] Here begins the cooperative competition: A façade of scientific openness and cooperation coupled with a cutthroat race for engineering superiority, but ultimately guided by a real form of cooperation to keep the race stable and non-nuclear. It was, as McDougall phrased it, a benign hypocrisy; but this hypocrisy ultimately

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[19] Quoted in McDougall, *Heavens and the Earth*, 134.
[20] McDougall, *Heavens and the Earth*, 258.
[21] McDougall, *Heavens and the Earth*, 258.
[22] McDougall, *Heavens and the Earth*, 178.

helped shape the norms in space by advancing space technology beyond what it might have achieved along a different path.[23]

Subsequent US influence upon the space regime began domestically. The 1958 Space Act declared US support for the budding international notion of space for the *benefit of mankind*, as well as declaring its desire for cooperation in space. While the Space Act bolstered the US cooperation façade, it also acted as a cover for its development of passive military reconnaissance satellites.[24] The act split space responsibility between NASA and the DOD, as previously mentioned, and it internationally announced the US attitude toward space. Its emphasis on peaceful cooperation was intentionally vague to provide the US maximum political flexibility in the pursuit of its passive military space capability.[25]

On the international scene, the process of extending supra-national treaties into space began the year following Sputnik's launch with the creation of the initially ad hoc—but permanent by 1959—United Nations Committee on the Peaceful Use of Outer Space (COPUOS). From COPUOS originates many procedures and concepts still used internationally today, such as the registration of space launches, while further championing the concept of "space exploration for the benefit of mankind."[26] While an exploration of every space norm-influencing resolution and treaty generated by the UN is beyond the scope of this thesis, certain key treaties comprise the bulk of the normative framework of the international space regime.

The nuclear scare of the Cuban Missile Crisis provided the political impetus for the first two treaties that helped shape the norms of the

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[23] McDougall, *Heavens and the Earth*, 345.

[24] Sheehan, *International Politics of Space*, 43.

[25] Steven James Lambakis, *On the Edge of Earth: the Future of American Space Power* (Lexington, KY. : University Press Of Kentucky, 2001), 216.

[26] United Nations Office for Outer Space Affairs, "United Nations Committee on the Peaceful Uses of Outer Space: History and Overview of Activities," http://www.oosa.unvienna.org/oosa/en/COPUOS/cop_overview.html.

Space Race. The first of these, the Limited Test Ban Treaty of 1963, "prohibits nuclear weapons tests 'or any other nuclear explosion' in the atmosphere, in outer space, and under water."[27] Due to the newly discovered environmental dangers of nuclear explosions, as well as the threat to satellites on-orbit, the major space powers agreed to limit testing. The ban met the duel US goals of appearing cooperative in space while normalizing freedom of the skies for passive military uses. It also contributed to the tacit acceptance of reconnaissance satellites by limiting the ability to develop nuclear weapons in an anti-satellite role.[28]

The second agreement of 1963, the Declaration of Legal Principles Governing Activities of States in the Exploration and Use of Outer Space, solidified the peaceful notions motivating the original creation of COPUOS post-Sputnik. Concepts advocated in 1959 were now codified, such as the *benefit of mankind*, satellite jurisdiction remaining with the launching state—and thus the responsibility and liability for damages as well—and the prohibition on jurisdictional claims upon celestial bodies.[29] The *benefit of mankind* concept, which echoes the US 1958 Space Act, represents a common heritage principle the US initially supported, as it did initially within the Law of the Sea, because it held freedom of maneuver in both the sea and space realms supreme. Of note, the US would later resist common heritage principles in subsequent space treaties as the economic potential for space emerged, just as they did within the sea.

However, in the early stages of the Space Race, the US was primarily concerned with protecting its potential to gain intelligence on Soviet capability. From the US perspective at the time, these treaties

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[27]United States Department of State, "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water," http://www.state.gov/www/global/arms/treaties/ltbt1.html.

[28] McDougall, *Heavens and the Earth*, 274.

[29] United Nations Office for Outer Space Affairs, "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space," http://www.oosa.unvienna.org/oosa/SpaceLaw/lpos.html.

protected the passive military uses of space. In addition, these treaties reinforced the avenue for competitive cooperation in space. "In sum, the principles accepted by both sides in the first flush of détente represented no self-abnegation, but rather recognition by the USSR that it had the same interest as the United States in developing a panoply of military satellite support systems without interference from third parties."[30]

The next major norm-forming treaty, the 1967 Outer Space Treaty, stands out as somewhat redundant because it reaffirmed the treaties put forth though COPUOS in 1963. In fact, the OST further solidified US aims of a non-nuclear, but otherwise wide-open space regime that allowed for the passive military use of space. The OST represented an amalgamative evolution of the two treaties, as it reaffirmed the assertions of the *Declaration of Legal Principles* treaty, but went beyond the *Limited Test Ban* treaty by specifically banning the placement of nuclear or other weapons of mass destruction in outer space.[31]

The OST is the only treaty in force today that deals with the subject of weaponization.[32] By design, the US stayed specifically close to the treaty language of the 1963 agreements in order to maintain limitations to only nuclear and other specified mass destruction weapons. At the time, the US looked to maintain its freedom of maneuver and wanted to protect its passive military uses of space, which any anti-weaponization language could jeopardize.[33] Therefore conventional weapons were only banned from celestial bodies—an

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[30] McDougall, *Heavens and the Earth*, 275.

[31] The prohibition on weapons of mass destruction in space included (and was limited to) biological, chemical and radiological. See United Nations Office for Outer Space Affairs, "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," http://www.oosa.unvienna.org/oosa/SpaceLaw/outerspt.html.

[32] While the US-Soviet bilateral 1972 ABM treaty limited anti-satellite weapon capabilities, the subsequent US withdrawal limited, but arguably did not eliminate, its influence. See Sheehan, *International Politics of Space,* 95.

[33] McDougall, *Heavens and the Earth*, 416.

impractical location for affecting the earth anyway—and not in transit or orbit.

Creation and subsequent ratification of the OST also represents the emergent split in attitudes regarding the meaning behind the *space for the benefit of mankind* concept within international treaties. Developing states pushed for the concept's inclusion in the treaty, to invoke a notion similar to the common heritage principle emerging within the Law of the Sea: a literal sharing of the tangible profits and technological transfer. However, the US achieved language that was more limited, which avoided specific references to property and economic rights, and chose to interpret the concept akin to the freedom of the sea, meaning it was open to all states willing and able to partake within their means.[34]

While the 1967 OST did not facilitate direct technology transfer, the codification of open access did spawn space technological advancement by opening up the game to all comers willing and able. As McDougal writes, "Indeed, the real gainer in space treaty was space technology itself. It grew and spread around the world, to Europe, Japan, China, India, and elsewhere by the 1980s, … in targeted competition, pushing into the heavens in new ways for new purposes with new organizations."[35]

The next space norm influencing agreement, the bilateral Strategic Arms Limitation Talks, led to the implementation of the Anti-Ballistic Missile Treaty of 1972. This treaty further solidified the sanctity of national verification means within the tensions of the Cold War by limiting the deployment, but not the R&D and operational testing, of anti-satellite weapons, which at the time were kinetic kill, direct ascent weapons. James Moltz argues the agreement created a powerful consensus to treat on-orbit space assets as off-limits to hostile space

[34] See McDougall, *Heavens and the Earth*, 416-418.
[35] McDougall, *Heavens and the Earth*, 420.

activity.[36] The fact both countries observed an informal ban on the testing of such weapons from the mid-1980s lends credence to Moltz's argument. While the US withdrawal from the agreement in 2001 has rendered it somewhat moot, the sentiments embodied within the agreement could be customarily binding as no state has yet moved beyond the testing of such weapons to date. This will be explored further within the next chapter.

Another important normative influencing agreement worthy of mention is the 1972 Convention of International Liability for Damage Caused by Space Objects. The treaty expands on the liability portion of the 1967 OST, dictating a "launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The Convention also provides procedures for the settlement of claims for damages."[37] In essence, the treaty establishes state responsibility for the intentional or incidental actions of the objects it launches in space.

The final treaty considered with this chapter that influenced Cold War and post-Cold War normative behavior in space, the unratified 1979 *Agreement Governing the Activities of States on the Moon or other Celestial Bodies*, or Moon Treaty, marks the clear divergence between the priorities of the developed space faring states and the developing world. As a contemporary to UNCLOS III, this treaty also attempted to shift the approach to space from one of equal *access* to one espoused by the developing nations and the Soviet Union at the time of equal *benefit*.[38] Sheehan describes the treaty as an attempt by developing states to

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[36] James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, Calif.: Stanford Security Studies, 2008), 170.
[37] United Nations Office for Outer Space Affairs, "Convention on International Liability for Damage Caused by Space Objects," http://www.oosa.unvienna.org/oosa/SpaceLaw/liability.html.
[38] Dolman, *Astropolitik*, 133.

create a "'new world economic order,' in which they could benefit from a more equitable distribution of the world's resources and preferential trade practices."[39]

Therefore, by the late 1970s and into the 1980s, the US stood as the face of the developed world's guardian of open access to space, but not in the spirit of the common heritage principles espoused by the developing world. While the Soviets continued to share concerns with the US over space access, they were not officially partaking of space for military means—the Soviet listed all launches in the UN launch registry under the scientific designation *cosmos*.[40] As such, the Soviets could stand "aside and let the Americans play the role of 'heavy,'" letting the US bare the propaganda assault.[41]

Nonetheless, the US position ultimately prevailed in the rejection of the Moon Treaty as the US now prioritized the economic potentials of space on par with protection of its access. Like the UNCLOS III proposal, the Moon Treaty espoused "the Moon and its natural resources [to be] the common heritage of mankind and that an international regime should be established to govern the exploitation of such resources when such exploitation is about to become feasible."[42]

Consequently, the US rejected the Moon treaty on the basis that "unless states or companies had a right to the benefits derived from … exploitation [of the moon], they would have no incentive to carry out the exploitation in the first place and therefore the lunar resources would always remain untouched and would not benefit humanity in any way."[43] The fact few space faring nations ever signed the treaty, and no major

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[39] Sheehan, *International Politics of Space*, 125.

[40] Sheehan, International Politics of Space, 32.

[41] McDougall, *Heavens and the Earth*, 434.

[42]United Nations Office for Outer Space Affairs, "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies," http://www.unoosa.org/oosa/SpaceLaw/moon.html.

[43] Sheehan, *International Politics of Space*, 135.

space faring nations have ratified it, not only demonstrates consensus on the economic interests but also further exemplifies the cooperation on normative formation that bound state space behavior in a stable and practical manner.

Ultimately, space technology benefited from the cooperative competition of the Space Race and beyond. Competition provided the impetus for broad-spectrum political support enabling advancement of space technology. As evidenced by Soviet admissions regarding manned-space programs, "If [the US and Soviet Union] really cooperated on man-in-space, neither country would have a program because the necessary large support in money and manpower was only because of the competitive element and for political reasons."[44] While competition for prestige and national security generated political support for technological advancement, nuclear-limiting cooperation also provided broad based political motivations for competition. "Liberals could support it as an alternative form of competition with the Soviet Union in an era when the dangers of nuclear war were very real, while conservatives saw the program as developing military hardware and providing capabilities that would in the long run enhance the effectiveness of US armed forces."[45]

While prestige and national security—with economic interests emerging later—drove the major players to advance their space technology, the non-nuclear norms codified in the international agreements channeled this energy along a stable path. As it did within formation of the modern Law of the Sea, the US exerted a great deal of influence upon formation of these norms in space. The US retains this type of influence today, and working within the current international sentiments regarding space, can continue to shape the norms in a beneficial, but stable fashion.

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[44] McDougall, *Heavens and the Earth*, 350.

[45] Sheehan, *International Politics of Space*, 44.

Chapter 3

Satellite Recycling and the Space Norms of Today

The regime governing conduct in outer space established within the context of the Cold War Space Race remains largely in force today. However, the current international debate concerning the evolution of space norms has shifted emphasis from solidifying common heritage principles—though the language has carried on in proposed treaties—to limitations on weaponization and debris mitigation. The cacophony of global condemnation for the debris created by China's successful 2007 anti-satellite test demonstrates international sensitivity toward both space weapons and debris.[1] While weaponization opponents sometimes exaggerate the imminent danger of space debris, the unified global response to China's test reveals a shared international concern for the debris issue—a concern shaping an international space norm.

Within this international environment, the US seeks to protect and cultivate its space capability and technological lead. As the 2010 National Space Policy states, "The United States considers the sustainability, stability, and free access to, and use of, space vital to its national interests."[2] At the same time, the 2010 NPS affirms the US desire to bolster its technological leadership in space.[3] The challenge currently facing the US government is the best means of protecting this

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[1] A myriad of news outlets, from newspapers to websites, reported the international condemnation directed at China in response to the 2007 ASAT test. The website *The Age* reported, "International condemnation descended on China last night after it fired a missile into space to destroy one of its weather satellites." See Brendon Nicholson, "World Fury at Satellite Destruction," *The Age*, 20 January 2007, http://www.webcitation.org/5whIOfFlv, (accessed 10 April 2011). Other sources echoing this sentiment include: BBC, "Concern Over China's Missile Test," *BBC News*, 19 January 2007, http://news.bbc.co.uk/2/hi/asia-pacific/6276543.stm, (accessed 10 April 2011). Or Carin Zissis, "China's Anti-Satellite Test," *Council on Foreign Relations*, 22 February 2007, http://www.cfr.org/china/chinas-anti-satellite-test/p12684, (accessed 10 April 2011).

[2] National Space Policy of the United States of America, 28 June 2010, 3.

[3] National Space Policy of the United States of America, 28 June 2010, 13.

national interest in the midst of declining budgets, and therefore limited political will. While the NPS justifies US assured access based upon its right of self-defense, which includes both the deterrence and the direct defense of its systems, the policy leaves open the means of achieving this goal.[4] Options for attaining assured access and technological leadership range from the weaponization of space to the establishment of international rules banning the development and use of any weapon in space.

As demonstrated in the development within both the modern Law of the Sea and the current space regime, the US possesses considerable influence upon norm formation. This influence has its limits, however, and norms still require a degree of international consent for their creation and sustainability. Accordingly, the argument that follows is that the US should leverage the current concerns regarding space debris in order to foster the creation of a debris-reducing norm as a method for facilitating both the protection of its space capability and its continued leadership in space technology. Because of the current political and economic constraints against full-scale kinetic weaponization, the US should also leverage the existing international debris-reduction principle as a motivating catalyst to develop and deploy a satellite recycling system.[5] US deployment of such a system would strengthen the influence formation of a debris-reduction norm, which, in turn, could cooperatively channel space innovation in a more politically acceptable competition to develop non-kinetic forms of weaponization. Such a norm plays to the United States' innovative strength while further protecting its

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[4] National Space Policy of the United States of America, 28 June 2010, 3.

[5] Again, for the purposes of this paper, weaponization refers to any system designed to degrade or destroy another system *in* space. Satellite recycling system refers to the mean to safely de-orbit satellites from any height, LEO to GEO, and either return the satellite to the Earth, repair it and return it on-station, or allow it to degrade into the atmosphere. Of course, such a system clearly possesses applications as a weapon; this is addressed later in the paper.

current on-orbit systems by raising the threshold for destructive kinetic attack on US satellite systems.

This chapter first includes an outline of the current debate regarding space regulation and then an exploration of how such international sentiments can act as a catalyst for technological advancement. A brief discussion of what a notional satellite recycling system might entail follows. Then, leveraging the normative examples outlined in the previous two chapters, I offer examples of how such a system could influence international norms as well as explore some potential normative and security pitfalls related to the weaponization potential of such a system. In addition, I show how such a system might benefit the US by creating a potential avenue for stable technological competition that favors the US and benefits space technology overall. However, the current debate regarding normative behavior in space revolves around limitations, not on possibilities.

As stated previously, the regime governing state behavior in space, largely formed within the UN's COPUOS, remains largely intact. Concepts such as the freedom of space access, state liabilities and responsibilities for damage, as well as the prohibitions on declarations of sovereignty or the stationing or testing of weapons of mass destruction, are all established norms of the current space legal regime.[6] Since these constitutive elements became codified, however, the forum for debate on the space regime relating to weaponization and debris has largely shifted from COPUOS to the UN Council on Disarmament.

The UN established the Council on Disarmament in 1979 to act "as the single multilateral disarmament-negotiating forum of the

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[6] Henry Hertzfield, "The 'Law Of Outer Space' is at a Crossroads: Current and Future Issues in International Space Law," *ILSA Journal of International and Comparative Law*, (Spring 2009), http://www.lexisnexis.com/hottopics/lnacademic/?verb=sr&csi=156989.

international community."[7] In terms of the outer space regime, this newly established body explores issues relating to the *prevention of an arms race in outer space* (PAROS).[8] While many proposals generated within the Council in the last two decades, such as the *Comprehensive Test Ban Treaty* (1996) or the *Recommendations on the Practice of States … in Registering Space Objects* (2007), have essentially sought further codification of previously established norms, the Council has also explored an evolutionary change in two other areas of the space regime.

Two themes continually resonate within the Council when it comes to the current PAROS debate, debris and weaponization. While not directly related to an arms race in space, the space debris issue has become a subject for the Council under the auspice of international security. Statements from both Brazil and Japan in February of 2011 reflect international sentiment on the debris issue. From Brazil, "In this new overpopulated space environment, with more than 3,000 satellites in operation, the number of inactive devices and the innumerable pieces of space debris pose increasing dangers."[9] From Japan, "The most urgent concern [created from increased global space dependence] was the creation of space debris, which posed an immense danger to satellite operations and a threat to the space environment and international security. Space debris had many causes, both civilian and military. But while the civilian aspect of debris was being tackled, the military aspect

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[7] The United Nations Office at Geneva, "Disarmament: An Introduction to the Conference," http://www.unog.ch/80256EE600585943/(httpPages)/BF18ABFEFE5D344DC1256F3100311CE9?OpenDocument.

[8] The United Nations Office at Geneva, "Disarmament: An Introduction to the Conference," http://www.unog.ch/80256EE600585943/(httpPages)/BF18ABFEFE5D344DC1256F3100311CE9?OpenDocument.

[9] The United Nations Office at Geneva, "News and Media: Conference on Disarmament Discusses the Prevention of an Arms Race in Outer Space," 8 February 2011, http://www.unog.ch/80256EDD006B9C2E/(httpNewsByYear_en)/4C787D7B568CB32AC1257831004C597C?OpenDocument.

remained unaddressed."[10] While the actual threat posed by debris might be debatable in a technical sense, from a normative perspective, the technicalities are essentially irrelevant. As the statements above demonstrate, the *perception* of the threat exists among states, and therefore influences what states will accept normatively. Of course, it is probably a sound hypothesis that most rational actors in space, state or otherwise, would agree that space debris is at least a concern and that less debris is generally a good thing.[11]

The other overarching concern of the Council related to PAROS is naturally the weaponization of space. As the general comments from the February 2011 meeting state, "Of grave concern to all delegations was the potential weaponization of space and an arms race in outer space, which would threaten all nations, both space-faring and those without space technology or capacity."[12] Member states opposed to the weaponization of space essentially seek an evolution from the current norm precluding weapons of mass destruction to a norm banning all forms of weapons.

Russia and China have led the charge on the evolutionary change front with treaty submissions to the Council in 2002 and 2008 proposing

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[10] The United Nations Office at Geneva, "News and Media: Conference on Disarmament Discusses the Prevention of an Arms Race in Outer Space," 8 February 2011, http://www.unog.ch/80256EDD006B9C2E/(httpNewsByYear_en)/4C787D7B568CB32AC1257831004C597C?OpenDocument.

[11] The array of opinions on the threat posed by space debris range from dire to over-exaggerated. For an opinion on space debris as an environmental threat to space operations, see James Dunstan and Brerin Szoka, "Beware of Space Junk," *Forbes*, 17 December 2011, http://www.forbes.com/2009/12/17/space-junk-environment-global-opinions-contributors-berin-szoka-james-dunstan.html, (accessed 9 February 2011). For a comparison of the range of opinions, see "Does the accumulation of 'space debris' in Earth's orbit pose a significant threat to humans, in space and on the ground?" *Science Clarified*, http://www.scienceclarified.com/dispute/Vol-1/Does-the-accumulation-of-space-debris-in-Earth-s-orbit-pose-a-significant-threat-to-humans-in-space-and-on-the-ground.html (accessed 10 April 2011).

[12] The United Nations Office at Geneva, "News and Media: Conference on Disarmament Discusses the Prevention of an Arms Race in Outer Space," 8 February 2011, http://www.unog.ch/80256EDD006B9C2E/(httpNewsByYear_en)/4C787D7B568CB32AC1257831004C597C?OpenDocument.

a complete ban on weapons stationed in space. Article two of the 2008 proposed *Draft Space Weapons Treaty* states:

> The States Parties undertake not to place in orbit around the Earth any objects carrying any kinds of weapons, not to install such weapons on celestial bodies and not to place such weapons in outer space in any other manner; not to resort to the threat or use of force against outer space objects; and not to assist or induce other States, groups of States or international organizations to participate in activities prohibited by this Treaty.[13]

The US opposed implementation of the proposed treaty for a variety of reasons: the draft treaty only deals with space-based, not terrestrial based weapons, it limits only deployment and not the R&D or storage of such weapons, the contradiction within the draft treaty over the banning of weapons and the inherent right of self-defense, and ultimately that the goals of the draft treaty were essentially unverifiable.[14]

The US response to the proposed *Draft Space Weapons Treaty* also cites its own 2010 NPS and 2011 NSSS as evidence of US consideration for the interests "of all space faring and space using nations."[15] At the same time, the NSSS describes the threat to space in terms of trends. "The current and future strategic environment is driven by three trends—space is becoming increasingly congested, contested and competitive."[16] It is congested in terms of the total number of objects (debris or otherwise), contested in terms of the increased threats to US space

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[13] United Nations Conference on Disarmament, "Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects," CD/1839, 12 February 2008.

[14] United Nations Conference on Disarmament, "Analysis of a 'Draft Treaty on Prevention of the Placement of Weapons in Outer Space, or the Threat or Use of Force against Outer Space Objects.'" CD/1847, 26 August 2008.

[15] The United Nations Office at Geneva, "News and Media: Conference on Disarmament Discusses the Prevention of an Arms Race in Outer Space," 8 February 2011, http://www.unog.ch/80256EDD006B9C2E/(httpNewsByYear_en)/4C787D7B568CB32AC1257831004C597C?OpenDocument.

[16] United States of America National Security Space Strategy Unclassified Summary, January 2011, 1.

systems, and competitive in terms of the increased number of space actors eroding the US comparative edge in space.[17]

In order to demonstrate tangibly its commitment to open access, as well as a beginning to alleviate the congestion issues, one option the US should consider is the design and deployment of a satellite recycling system. Such a system would include the capability to rendezvous with a satellite within any orbit, from LEO to GEO, and either facilitate repair and replenishment of the satellite, or facilitate the satellite's removal from orbit. Were the system so designed, repair could occur within the satellite's current orbit, or the system could de-orbited the satellite, repair it in LEO by a manned or more sophisticated repair system, and return to its previous station. Removal of a defunct satellite entails either de-orbiting it to facilitate atmospheric burn-in or safely returning the satellite to the Earth. The actual design of a satellite recycling system could take many forms.

Deployment of such a system would help shape the international norms in the spirit of the previously stated debris concerns because it would begin to *solve* vice just mitigate the debris problem. Such a system would also shape the threats contesting the US technical edge and vector potential competition in a more stable—and thus more politically acceptable—manner while favoring US innovative strengths. Solidifying the debris reduction norm via a satellite recycling system also allows the US the initiative in pre-weaponization testing of a non-kinetic system. In short, a satellite recycling system plays the debris concern off the fears of weaponization—it begins solving the first problem, while allowing open testing of capability for the second. Before exploring how such a system would influence the norms, a theoretical exploration of the notional makings of such a system must occur.

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[17] United States of America National Security Space Strategy Unclassified Summary, January 2011, 1-3.

A satellite recycling system, as briefly described above, would consist of a vehicle, or more likely a series of vehicles, designed to retrieve or rendezvous with satellites orbiting at any height, LEO to GEO. After rendezvous, the system would either facilitate the satellite's repair or refurbishment, and return the satellite to service, or facilitate the satellite's de-orbit for atmospheric reentry or safe return to earth. Of course, should such a system prove economical, the system could retrieve any type of space debris. This would require a cost calculation in dollars compared to the benefits gained in prestige and solidification of a debris reduction norm—a calculation for the policy maker. Therefore, such a system should probably focus initially on satellites—which can include currently operational satellites or defunct satellites parked in junk orbits.

One potential candidate for the basis of such a system is a follow-on to the X-37B, which successfully launched and returned to Earth in 2011.[18] This type of retrievable, remotely-piloted platform could conceptually form the basis for such a system. The Under Secretary of the Air Force for Space Programs, Mr. Gary Payton, described the X-37 as a reusable vehicle meant to take a payload or satellite up, and return it to Earth.[19] Described further as a test vehicle, the X-37 has limited direct applications for satellite recycling in its current form, but conceptually it has potential if certain limitations in design overcome. Because of its likely limited range in terms of achievable orbital height (which remains officially classified), the X-37 would need to deploy a

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[18] For an open source account of the X-37B's most recent mission, see Mike Wall, "Secretive X-37B Space Plane Launches on New Mystery Mission," *Space.com*, 5 March 2011, http://www.space.com/11031-secret-x37b-space-plane-launch.html (accessed 10 April 10, 2011), and Tarik Malik, "First Landing Photos: Secret X-37B Robot Space Plane Lands in Calif." [sic], *Space*.com, 3 December 2010, http://www.space.com/9640-landing-photos-secret-37b-robot-space-plane-lands-calif.html (accessed 10 April 2010).

[19] Mr. Gary Payton (Under Secretary of the Air Force for Space Programs), "Media Teleconference on the X-37B Launch," 20 April 2010, http://www.defense.gov/Blog_files/Blog_assets/PaytonX-37.pdf.

secondary vehicle designed to conduct the actual rendezvous beyond LEO. In that case, unless the X-37 actually accomplishes any repairs on a satellite, it would be filling the role of useless intermediary—the secondary retriever vehicle could launch directly on a repair mission without the X-37.[20] At the same time, any retriever vehicle will also have fuel concerns getting to the heights of GEO and back. As rapid transit is not necessarily a requirement, the retriever vehicle could potentially utilize some type of fuel-efficient ion propulsion in conjunction with traditional thrust methods.[21]

Of course, as mentioned previously, cost, as well as capacity and feasibility, will factor into such a system. As the X-37 achieves orbit via traditional booster technology, it is itself more of a payload than a traditional vehicle. At roughly $200 million for the booster alone, policymakers might naturally be hesitant to utilize the capability as a recycling system when a replacement vehicle would cost the same.[22] In addition, with a capacity of only a few hundred kilograms, the X-37 could not return large satellites to Earth were it sent for such a purpose.[23] Finally, there is the issue of current satellite design not accounting for the possibility of repair were that option explored (either safely by an X-37 type vehicle or for atmospheric burn-in). But at least one private company, MacDonald Dettwiler and Associates—the designer of the

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[20] Stephen Clark, "Air Force Spaceplane is an Odd Bird with a Twisted Path," *Space.com*, 2 April 2010, http://www.space.com/8140-air-force-space-plane-launch-long-twisted.html.

[21] National Aeronautics and Space Administration, "Ion Propulsion: 50 Years in the Making," http://science.nasa.gov/science-news/science-at-nasa/1999/prop06apr99_2/ (accessed 25 March 2011).

[22] Mr. Gary Payton (Under Secretary of the Air Force for Space Programs), Media Teleconference on the X-37B Launch, 20 April 2010, http://www.defense.gov/Blog_files/Blog_assets/PaytonX-37.pdf.

[23] Mr. Gary Payton (Under Secretary of the Air Force for Space Programs), Media Teleconference on the X-37B Launch, 20 April 2010, http://www.defense.gov/Blog_files/Blog_assets/PaytonX-37.pdf.

shuttle's robotic arm—is exploring the concept despite the challenges posed by current satellite design.[24]

While challenges to such a system clearly exist, theoretically the US is already on the path to developing the necessary technology. A larger capacity version of the X-37 that could get to orbit more economically, most likely via partial flight prior to boost or in a sling-launch fashion similar to the Scaled Composites' X-Prize winning SpaceShipOne, would lower operating cost.[25] However, a complete exploration of the feasibility, implementation methods, and costs of such a system is beyond the scope of this thesis. The previous description was meant to provide a notional depiction of a satellite recycling system in order to facilitate demonstration of how deployment of such a system, however best or reasonably implemented, would influence the norms of today's space environment—the fear of debris providing the necessary catalyst for system development.

The political motivations to participate in the cooperative-competition of the Space Race derived from the fear of the dangers posed by an unconstrained extension of the Cold War rivalry into outer space. Thus, fear of Cold War annihilation was the necessary catalyst for the Space Race. Today, however, the perception of an impending national threat to the US, or to its space dominance, does not exist as it did during the Cold War.[26] Lacking such a catalyst, little political will exists to pursue comprehensive space weaponization.

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[24] Tiffany Kaiser, "Space Recycling: Startup Aims to Recharge, Refuel Satellites," *DailyTech*, 23 July 2010, http://www.dailytech.com/Space+Recycling+Startup+Aims+to+Recharge+Refuel+Satellites/article19128.htm.

[25] Scaled Composites, "SpaceShipOne and White Knight," http://www.scaled.com/projects/tierone/ (accessed 25 March 2011).

[26] Mike Moore argues that the nearest global competitor to the US, China, has little interest in direct military competition with the US. See Mike Moore, *Twilight War: The Folly of U.S. Space Dominance* (Oakland, CA: The Independent Institute, 2008), 263-268.

The majority of the response to China's 2007 test was over the debris the test created, not the test itself. China's ABM tests in 2010 garnered relatively little international or domestic response. While China's actions certainly represent a threat to the US space systems, the threat primarily resonates within military and policy circles of the US Government. The overall national response to China's actions does not rival the Sputnik hysteria. The current international response indicates states can posses these weapons, but their testing is limited to low orbits due to the debris issue. Therefore, the current motivating catalyst is not fear of an impending enemy, but fear of space debris.

This political catalyst justifies a certain level of expense in development and deployment of a debris-reducing satellite recycling system. It does not justify a large increase in direct, and especially kinetic, space weaponization technology beyond current levels. While the US responsibly demonstrated its anti-satellite capability in 2008, at least in regards to space debris mitigation, research funding to develop and test a new system, one possibly more accurate and capable of striking higher orbits, is not currently justified within the current political climate.[27] With the national debt approaching 14 trillion dollars, policymakers must choose carefully the systems to both fund and field.[28] The debris concern provides the US government political leverage to justify application of economic resources to this global need; pursuit of which influences the debris-reducing norm.

As mentioned in the introduction, US preponderance of presence in space grants a large degree of influence upon the formation of norms.

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[27] For an explanation of the US 2008 ASAT test, see Jamie McIntyre, Suzanne Malveaux and Miles O'Brien, "Navy Missile Hits Dying Spy Satellite, Says Pentagon," *CNN.com*, 21 February 2008, http://www.cnn.com/2008/TECH/space/02/20/satellite.shootdown/index.html, (accessed 10 April 2011).

[28] United States Department of the Treasury, Bureau of the Public Debt, "Debt position and activity report," http://treasurydirect.gov/govt/reports/pd/pd_debtposactrpt_1011.pdf (Accessed 12 February 2011).

US actions in space can have a greater precedent setting influence than other states; its actions, in essence, directly influence the standard in space. As Joseph Nye pointed out, unilateral action by great powers is a major source of influence upon regime formation. [29] At the same time, for the regime to last requires the actions taken to be consistent with current international sentiment. "Unilateral actions should retain some inducement for others to follow, and that the actions should be consistent with [the] long-term goals of the regime."[30]

If the US government pursues development and deployment of a relatively low-cost means of repairing or returning satellites to the Earth, this would be in line with international sentiment regarding space debris and would likely influence other states to follow suit in designing and operating satellites under a debris-recycling regime. For example, satellites above low earth orbit would not be disposed of into higher orbits at the end of their lifespans, but de-orbited, as much as feasible within a satellite's capability, to facilitate recovery. Recovery capability also opens the possibility of reconstitution or repair of satellites. Satellite refueling could occur with such a system, as well as component replacement or upgrade, in turn influencing new satellite design to work with the new capability. Thus, were the US to take the lead in satellite recycling, the norm induced would likely affect more than just orbits; it would affect future satellite design and operation as well. However, in-depth exploration of the affects of a debris-reducing norm on satellite operations is beyond the scope of this thesis.

Beyond the orbital safety argument for designing and implementing a satellite recycling system, states would also find motivation to explore this technology because of its clear weaponization

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[29]Caron, David D., Charles L. Buderi, and Bernard H. Oxman. *Law of the Sea: US Policy Dilemma.* (San Francisco, Calif: ICS Press, 1983), 123.

[30] Caron, David D., Charles L. Buderi, and Bernard H. Oxman. *Law of the Sea: US Policy Dilemma.* (San Francisco, Calif: ICS Press, 1983), 123.

potential. Unlike kinetic space weapon systems, a satellite recycling system converted for used as a weapon system would have mainly non-debris causing applications. Similar to the Space Race-induced agreement to avoid nuclear weapons in space, any motivation today toward debris-reduction weaponization would represent a similar form of cooperation within a competition. Robert Keohane argues, "Intergovernmental cooperation takes place when the policies actually followed by one government are regarded by its partners as facilitating realization of their own objectives, as the result of a process of policy coordination."[31]

During the Space Race, the US and Soviet governments competed in space for the means of demonstrating technological superiority to validate ideological superiority. Terrestrially, the threat of nuclear weapons underwrote the ideological struggle.[32] However, regarding space, both states saw the mutually damaging and destabilizing potential of atmospheric nuclear testing (and therefore atmospheric use), as well as on-orbit stationing of nuclear weapons. By banning the testing and orbital stationing of nuclear weapons via the Test Ban Treaty, and the Outer Space Treaty, respectively, both states chose to forgo policy options seen as mutually not in their interests. In sum, the states chose to cooperate in the banning of weapons of mass destruction out of their own interests, which then pushed competition into space engineering. Thus, the Space Race became a non-weapons of mass destruction-based, technological competition. Arguably, a reduction of space debris can fill a similar role, as it is in the interest of all space faring states.

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[31] Robert Owen Keohane, *After Hegemony* . (Princeton, N.J.: Princeton University Press, 2005), 51-52.

[32] McDougal, as cited in chapter 2 of this paper, argued a major source of the Sputnik hysteria in the US was the newly demonstrated nuclear weapon delivery method the Sputnik launch represented. See, Walter A. McDougall, *...The Heavens and the Earth: A Political History of the Space Age* (Baltimore : Johns Hopkins University Press, 1997), 141-145.

Today, the US has the opportunity to shape the norm and thus channel any potential competition in outer space away from kinetic forms of weaponization. As mentioned previously, the principle of space debris reduction exists in the international attitude exhibited in response to China's 2007 anti-satellite test. The standards for a debris reduction regime, how to operate within it, would begin with the US government's actions as the most influential actor within space. An international agreement could further codify this method of operation and speed up solidification of this norm; however, the international debris reduction principle indicates states will gravitate toward this norm led by the US regardless if actually codified up front. Deploying such a system may even render current efforts to ban all weapons problematic, or even mute, as a satellite recycling system has clear purpose for both the common good and space weaponization.

A space recycling system presents both a normative and security conundrum because the necessary technology perfected in its use has such clear weaponization potential. The challenge comes in deploying the system to shape normative behavior, and allow non-kinetic technological competition to occur without it causing competition to spill over into a kinetic arms race. Because of the tremendous cost of current lift technology, the first step in making a satellite recycling system feasible requires an evolution in lift capability. However, the necessary changes in the realm of space lift could have ulterior weaponization applications. For a new lift system to prove economical, it would likely require a shift away from current booster technology—not an easy proposition considering the current, and deeply rooted, economic and industrial structure of booster technology.[33] While boosters have

[33] Neal Stephenson lays out many of the factors contributing to the continued dependence upon booster technology and the lack of serious alternatives to the current method of boosting from the ground. See Neal Stephenson, "Space Stasis: What the strange persistence of rockets can teach us about innovation. [sic]" *Slate*, 2 February 2011, http://www.slate.com/id/2283469/ (accessed on 10 April 2011).

provided an effective but not economically efficient means of space lift, a revolutionary non-booster lift system could actually live up to the term Operationally Responsive Space, by measuring the response time in terms of day, possibly hours, instead of years, possibly months.[34] Such a lift system subsequently opens up a myriad of space application possibilities because the reduced launch costs would also drive a relaxation of the current risk mitigation limitations on satellite deployment.[35] Reduced worries concerning risk allows for launches to occur more rapidly and frequently, thus enabling the introduction of capability at a speed that could be difficult for other states to counter. While this represents a tremendous capability, it can have destabilizing effects in a normative sense.

The satellite recycling system itself has clear weaponization potential, which necessitates care in its design and deployment to facilitate advantageous norms in space. Virtually all possible recycling system designs have weaponization potential. Any system designed to move satellites provides a potentially reversible means of affecting the operations of an adversary's satellite by blocking it, or changing its orbit or orientation. A more technologically advanced on-orbit satellite repair capability would simply increase the interdiction possibilities upon adversarial satellites when considered from a weaponization perspective. Regardless of design, such a system could provide attractive options to

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[34] According to the "Plan for Operationally Responsive Space," submitted by the DOD to Congress in 2007, "Operationally Responsive Space (ORS) has been defined broadly in the DoD as assured space power focused on timely satisfaction of Joint Force Commanders' needs." Current responsiveness is limited in application however, because of the expense and risk of booster technology, which, in turn, drives up the cost of booster payloads. National Security Space Office, "Plan for Operationally Responsive Space," US Department of Defense, 17 April 2007.

[35] Neal Stevenson also argues, "If satellites and launches were cheap, a more easygoing attitude toward their design and construction might prevail." Neal Stephenson, "Space Stasis: What the strange persistence of rockets can teach us about innovation. [sic]" *Slate*, 2 February 2011, http://www.slate.com/id/2283469/, (accessed on 10 April 2011).

policymakers and commanders; but this increased capability can also be problematic in a normative sense.

To influence normative behavior in space advantageously requires a certain amount of care and thought in deployment. From a normative perspective, the tangibility, clarity and simplicity of a system (relatively when compared between different system designs) influences the amount of stability in space between states, and thus the developing norms. For instance, the tangibility of the system lies within its construct—i.e. a physical construct of the system can keep the threat posed mainly *within* space. Less tangibility could result from the use of energy systems, such as lasers, to eliminate debris, because such a means could conjure fears from other states that the system might later expand capability to effect not just other satellites, but terrestrial targets as well.—this despite any current technical limitations to such a system.[36] Such a system could be difficult to verify, further increasing its intangibility.

The other two aspects, clarity and simplicity, relate to how much states know about a system's purpose and capability based upon what has been stated, and demonstrated. Overly secretive deployment regarding capability, as demonstrated by the recent X-37B mission, leads to a host of speculation about capabilities by other states, which in turn can increase instability via state reaction in planning for worst-case scenarios outside the bounds of the norm the US wishes to instill. As discussed above, the greater the complexity of the satellite recycling system, the more potentially destabilizing it can be upon emerging norms. If the system facilitates satellite repairs on-orbit, how could other states not assume that such a system could affect modifications upon

[36] Taylor Dinerman argues for the US to take the lead in removing space debris and explores multiple methods of doing so, to include the use of energy weapons. Such system currently would only have applicability for debris in LEO, but regardless of actually capability, state perception of potential effects would ultimately guide how states behaved in space. Taylor Dinerman, "Unilateral Orbital Cleanup," *The Space Review*, 4 May 2009, http://www.thespacereview.com/article/1365/1, (accessed 10 April 2011).

their own satellite systems? As such, the simpler the system design at the outset, the more stable its normative influence. Notionally, the design providing the most stability within space norms would only retrieve satellite for burn-in or Earth return, not repair, because of the system's relative simplicity and potential verifiability. Therefore, such a system could solidify the new norm initially, and could increase in complexity later after the norm became more established. From a normative perspective then, a conscious balance must occur in deployment of such a system, at least initially, to account for the natural reactions of other states. In this way, the emergent norm can benefit the US by fostering innovation.

Solidifying the debris-reduction regime via a system perceived as working strictly within space could also provide an avenue for continued technological space innovation though competition to create non-kinetic-weaponized capability.[37] As discussed in the previous chapter, during the Space Race, "competition was the engine of spaceflight."[38] So a certain degree of competition, if channeled correctly, benefits space technology overall.[39] The Space Race drew its impetus from fear of conquest coupled with an ideological competition, as well as from fears of an economically untenable space arms race (which also relates to the fear of conquest); existential and ideological motivations that do not exist

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[37] In this case, the term non-kinetic-weaponized refers to competition to develop satellite-recycling systems. Such systems are not direct or kinetic forms of weaponization, but have non-kinetic weaponization applicability. Any state wishing to compete and possibly apply non-debris creating force would need to develop this type of technology.

[38] Walter A. McDougall, *...The heavens and the earth.* (Baltimore : Johns Hopkins University Press, 1997), 189.

[39] Steven Lambakis writes, "The 'dirty little secret' is that U.S. military purposes and the visionary work done by the armed forces and the military laboratories are largely responsible for the country's current position in space." Without some impetus to compete and innovate, the sources of not only the US technological lead in space, but also a large degree of space innovation in general (because of the US preponderance in space) can stagnate or dry up. See, Steven James Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY : University Press Of Kentucky, 2001), 24.

to the same level today. Economics have always factored into space, of course, and all systems much account for their economic value in the satisfaction of state interests. Nevertheless, development of a satellite recycling system designed to work strictly within the space domain does not directly incite fears of destruction without warning as feared during the Cold War; therefore, such a system avoids the hyper-spending pressures to ensure survival.[40] But it does justify some spending to maintain the innovative edge.

The US desire to protect its investment and lead in space, coupled with a competitor attempting to perfect similar technology, could spur the US to innovate—a historical source of US strength—in order to stay ahead in space. Where the political hot button issue of kinetic weaponization precludes the actual testing of such systems beyond LEO to perfect their use, a debris-reduction norm provides a politically acceptable venue to test and deploy satellite recycling systems into all orbits, and has the potential for weapon applications later, should the need arise.

Competition then, were it to emerge, could further spurn innovation as it did in the Space Race along a debris reduction path. Were competition not to emerge, the push for innovation will surely be less, slowing technological advancement. However, developing a satellite recycling system would still benefit the US by further solidification of its lead in space because of the technological challenges of implementing such a system. No other state has the preponderance of presence in space, contributing to the prerequisite space situational awareness capability necessary to implement such a system as effectively as the US. Such a system would provide the US a politically tenable means of further protecting its lead in space, and would garner the US prestige for

[40] At the same time, stability considerations always apply as well. As highlighted previously, in the Space Race, the US and Soviet Union chose to treat early warning systems as somewhat sacred in the name of stability. Such considerations still apply with any form of weaponization in space, kinetic or non-kinetic.

being the first nation to begin dealing with the inevitable problem of cleaning up the skies.

Finally, emergence of a debris-reduction norm would further raise the threshold for states to employ kinetic weaponization capabilities *against* US systems. This relates to Forrest Morgan's concept of first-strike stability, which involves raising the cost and reducing the benefit of an attack on space assets in order to increase stability in space operations.[41] Because of its dependence on space capability, the US would pay a relatively higher price for a destructive exchange in space.[42] Solidifying the debris-reduction norm reduces the threat to our overall satellite systems because it raises the threshold calculation of when a state may attempt to employ kinetic weapons. The cost of an action is higher for a state when that action is contrary to defined international behavior. Indeed, the debris-reduction norm, if accepted and codified by other states, could raise the political cost of testing kinetic weapons—especially at higher orbits where debris would remain. States can still make the choice to use such weapons, regardless of the cost, but the higher cost of doing so decreases the likelihood a state would make such a choice.

The concept of satellite recycling is not new. The space shuttle demonstrated this capacity to a degree—albeit an extremely cost prohibitive, and orbit-limited, means of accomplishing such a mission. A more reasonably priced unmanned satellite recycling system, developed to return to Earth, or repair satellites, from within any orbit, would enable the US to solidify an international debris-reduction norm, were it deployed with an eye toward stable norms. Like the fear and ideology that drove the Space Race, the perceived global threat of space debris provides the political justification to pursue a reasonably cost-effective

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[41] See Forrest E. Morgan, *Deterrence and First-Strike Stability in Space: A Preliminary Assessment*, (Santa Monica, CA: RAND, 2010), 1-2.
[42] Morgan, *Deterrence and First-Strike Stability in Space*, 3-4.

means of reducing the debris threat by recycling satellites. With clear non-kinetic weaponization potential, such systems may motivate technological competitors; but also as demonstrated by the Space Race, competition serves to bolster innovation. A debris-reduction norm shifts the competition into a new and technologically challenging realm, which plays to US strength. In addition, such a norm increases the threshold of destructive weapons use against US space assets. Of course, states can always violate established norms; therefore, the US should continue to improve satellite defenses to reduce the damage from another state crossing the destructive threshold. Ultimately, by taking the lead in shaping this debris-reduction norm, the US places itself in a position to set the rules for how to compete in space, and can maintain its technological lead in a more politically acceptable manner.

Conclusion

To return to the vastness metaphor from the introduction, a state's perspective on space can represent a range of views, from a domain to conquer to an area requiring preservation. For the US, in order to partake of the former view, it must acknowledge the latter. While the concern regarding the threat debris poses may arguably be low, the ever-increasing use of space, coupled with the dictates of orbital mechanics, means the debris issue can only increase in severity over time if left to its own devices. In other words, space debris will inevitably become a problem at some point in the future—however distant that future might appear. Rather than wait for it to become an un-debatable crisis, the US can instead seize the issue as an opportunity to shape the future of space operations in a beneficial manner.

As demonstrated both within the Law of the Sea and in space, states cannot shape norms effectively for the long-term by decree and enforcement through power. While not all states are created equal when it comes to influencing international norms, all states have at least some say within the process. The final result—something that is technically never really *final*, but rather always in flux, however slowly, over time—represents the current outcome of this interaction between states and their interests. Ultimately, US efforts to influence the regimes within both mediums represents an attempt to shift behavior toward a particular pattern.

Deployment of a satellite recycling system can shape future norms in space because it addresses a principle interest of most other states, be those states space users or simply space benefactors. Because of this demonstrated principle, states will likely follow willingly the regime trail the US could blaze with such a system. As Everett Dolman states, "Ordered behavior is the result of properly constituted regimes, and

whether they inform free market or collective security behavior, they must be based in established principles and norms."[1]

Within the Law of the Sea, the norms emerged over a long period. At first, states sized each other up and decided how much they could control directly, and how much they needed to acquiesce to the interests of other states in order to satisfy their own. Power was the root currency for the first few centuries, but it eventually took a back seat—but not too far back—to international agreements via supra-national organizations or between states directly. Of course, the agreements, and the institutions that facilitate an agreement's creation, are not the norm, but a representation of the norm; a representation of what states have essentially decided constitutes normal behavior.[2]

As the foremost naval power, the US could drive the norm toward the desired maximization of navigation and free market ideals upon the sea. The norms trended in directions favorable to the US because other states, at least enough representing a preponderance of global interest and influence, agreed with US aims and intensions. Because these norms formed with a basis of cooperation (even in the midst of competition), they will likely continue for the foreseeable future—regardless of the US maintaining the moniker as the global naval power.

In space, the US sought similar goals to its desire for both navigational, and later economic, freedom within the Space Race. Because the race took place during the Cold War, power in the form of nuclear weapons underwrote the struggle, and influenced the norms that

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[1] Everett C. Dolman, *Pure Strategy: Power and Principle in the Space and Information Age*. (London: Frank Cass, 2005), 84.

[2] Everett Dolman notes, "Regimes are thus intended to be more than a substitute or expediency for short-term self-interest. They imply a continuing area of agreement and cooperation. Too commonly we mistake regimes for the functioning bodes and bureaucracies associated with them, and lose sight of the regime as a process for cooperation." By his logic then, the UN, which facilitated agreements for both the modern Law of the Sea and space, is not the regime, but a part of the regime's overall structure. The UN helps give form to the regime where the guiding rules, norms and principles reside. See Dolman, *Pure Strategy*, 82.

emerged between the two space players at the time. The superpowers saw nuclear weapons as a threat to stability, so they chose to exclude them from taking part directly within the engineering competition of the space race. As such, space technology advanced beyond where it might have gone had the norms within space traveled along another path. Fear of nuclear annihilation may have been the initial catalyst for the race within space, but such fear did not continue as the direct driver. Such fears maintain a relegated status at present.

Today the economic benefits of space have become dominant, but realization of those benefits requires access. States have come to view space debris as a threat to access—far more than the excluded nuclear weapons—and thus a threat to those economic benefits. A large part of the motivations for attempting to exclude all types of weapons from space derives from the fear of debris eventually precluding access. Ironically, the only way to solve the problem without forgoing access requires development of technology that has weaponization applications of some form. By taking the lead in developing this technology, the US can garner both the prestige from beginning to solve vice just minimize the problem as well as shape the future norms within space.

Of course, care must be taken in the manner such technology is introduced upon the international scene. From a normative perspective, the more simple and straightforward the initial design, the more stable and influential this technology can be upon the solidification of a debris reduction norm. The more complex the technology initially, and the more secretive the US is about the technology's purpose while deploying it, the more destabilizing such technology can be upon such fledgling norms. Technological complexity can always advance in the future, after states become accustomed to this technology's existence and can appreciate, however begrudgingly, the benefits it provides. At that point, states would have no choice but to accept the further solidification of US space dominance within this somewhat benign space hegemony (to use

McDougal's parlance), or challenge the US by developing technology with similar application.

The debris reduction norm the global community desires today appears to preclude technological development along any other normative path. Competition, should it form, would do so in a stable fashion because it would have a foundation within cooperation to solve a global need and would avoid destabilizing avenues touching on state existential issues (it would confine its effects to the space domain). Ultimately the US, and space technology overall, would benefit from either acceptance or competition (or both) within a debris reduction norm; though the benefits would likely be greater under competition. No other state currently sits in a similar position today to influence norms to the same level. Because the basis of this norm rests upon the interests of so many states, the norm would likely last beyond the decline of US power, were such a future ever to emerge.

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