Whence the Power? A Reevaluation of Air and Sea Strategic Theories for Spacepower Theory

A Monograph

by

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Abstract

Whence the Power? A Reevaluation of Air and Sea Strategic Theories for Spacepower Theory, by Lt Col Ryan A. Sanford, USAF, 47 pages.

This monograph evaluates air and sea strategic analogs for applicability to space. In its evaluation, the study determines that previous spacepower theorists overlooked airpower theory to the detriment of spacepower theory. Moreover, this study offers new ideas for spacepower theory using seapower analogies. Understanding that human experience in space lacks enough data to build a theory from ground-up, this monograph instead offers nine propositions—adapted from airpower and seapower theories—for the student of strategy to contemplate spacepower at the military and grand strategic levels.

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Abbreviations

ACSC	Air Command and Staff College
LEO	Low-Earth Orbit
OST	Outer Space Treaty
SAASS	School of Advanced Air and Space Studies
USAF	United States Air Force

Introduction

The space domain cannot escape the gravitational pull of strategy. Indeed, "man made war in his own image."[1] Where humankind goes, so too will follow the logic and grammar of strategy and war. Accordingly, scholars sought to explain strategic behavior in space. By evaluating and applying analogs from better-understood domains—namely, the air and the sea—they hoped to model strategy for the cosmos.

Spacepower theory carries an aroma of salty, sea air because of its heavy reliance on seapower theory. Seapower theory has proven useful to spacepower theorists—professor at the George Washington University Space Policy Institute, Dr. John J. Klein's *Space Warfare* is one example wherein a scholar adapted seapower theory for the space environment. Some seapower concepts, however, as currently applied, do not sufficiently address the strategic environment in space. Additionally, few scholars tested the applicability of airpower theory to spacepower theory. When scholars evaluated airpower theory, their treatment was superficial, based on an incomplete understanding of airpower thought. Such oversight hampers thinking about space.

The topic of grand strategy has also suffered due to the literature's heavy focus on space weaponization that overlooked other issues of strategic importance. Humankind's space activity to date has included and will invariably continue to include all aspects of a spacefaring nation's power. With few exceptions, scholars overlooked the full panoply of instruments of power in space.[2] If strategy is—as Dr. Beatrice Heuser, professor of international relations at the University of Glasgow, asserted—"a comprehensive way to try to pursue political ends, including the threat or actual use of force, in a dialectic of wills," then conceptions of space strategy should

[1] H. P. Willmott, *When Men Lost Faith in Reason: Reflections on War and Society in the 20th Century* (Westport, CT: Praeger, 2002), 14.

[2] See Brent Ziarnick, *Developing National Power in Space: A Theoretical Model* (Jefferson City, NC: McFarland, 2015); John J. Klein, *Understanding Space Strategy: The Art of War in Space* (London: Routledge, 2019).

address more than the military instrument—most, however, do not.[3]

This monograph looks beyond the debate on space weaponization to address such a shortfall and hypothesizes that existing spacepower theory inadequately addresses the strategic environment in space, in part, because of its conceptual lineage in seapower theory. While airpower concepts have no isomorphic equivalents in space, airpower theory can inform spacepower theory, especially as the space domain matures as a warfighting domain. Still, this work does not advocate throwing seapower theory's conceptual offspring out with the bathwater. Beyond incorporating airpower concepts, this monograph reexamines seapower strategic thought to adapt new concepts for inclusion into the spacepower theory corpus. In effect, amalgamating seapower and airpower strategic theory into existing spacepower theory intensifies the light that theory casts upon the path of the strategist who must bridge the chasm between ends and means.

This study focuses on the evolution and contextualization of strategic ideas and concepts to explore how such things apply to space strategy and uses two tests to evaluate the hypothesis above. One such test includes examining current literature, discussing contextual influences, and then assessing whether new ideas are needed. Bernard Brodie, in *Strategy in the Missile Age*, employed this approach to argue how nuclear weapons necessarily and irrevocably changed the way states conceived their strategies.

For the second test, the study employs Dr. Harold R. Winton's, professor emeritus from the School of Advanced Air and Space Studies (SAASS), evaluation criteria articulated in his 2011 article, "An Imperfect Jewel: Military Theory and the Military Profession." In this article, Winton offered five criteria to evaluate a theory. Rather than labeling theory as good or bad, Winton suggested that if theory is to be the Clausewitzian "inner light" that lights the way, the theory should be able to: define, categorize, explain, connect, and anticipate.[4]

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[3] Beatrice Heuser, *The Evolution of Strategy: Thinking War From Antiquity to the Present* (Cambridge: Cambridge University Press, 2010), 27-28.

[4] Harold R. Winton, "An Imperfect Jewel: Military Theory and the Military Profession," *Journal of Strategic Studies* 34, no. 6 (2011): 854-858.

In 1996, Dr. Colin S. Gray, professor emeritus at the University of Reading, asked, "Where is the theory of space power? Where is the Mahan for the final frontier?"[5] Since then, many have answered and advanced the conversation on spacepower. This study aims to spur new incisive and vigorous thinking about spacepower.[6] It does not "pretend to give the power of conduct in [orbit]; it claims no more than to increase the effective power" of strategic thinking in space.[7] While acknowledging that space is the most technology-dependent domain, the reader "must remember that the basic element of strength in any nation is not in its machines but in its [people]."[8] To that end, this work turns to a review of existing space literature. It then offers nine propositions—six based on airpower theory followed by three adapted from seapower thought—that as prisms and lenses, cast spacepower theory in various hues before focusing the light and illuminate the way for the strategist.

Literature Review

Even before humanity's first adventure in space with Sputnik in 1957, many scholars had written on space technology, policy, and strategy. While much changed in the strategic environment of space since Sputnik's entry into microgravity, one constant remains: scholars have and continue to apply strategic concepts and ways of thinking to space strategy. Despite having sixty years of space experience, humans still occupy only Earth. Furthermore, without celestial experience beyond that accorded to scientific endeavors, human activity in space is limited. Thus, to postulate about the strategic environment in space and to anticipate the future contained therein, authors and space advocates alike have necessarily drawn upon terrestrial-based analogies.

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[5] Colin S. Gray, "The Influence of Space Power Upon History," *Comparative Strategy* 15, no. 4 (1996): 307.

[6] Bernard Brodie, *A Guide to Naval Strategy* (Princeton, NJ: Princeton University Press, 1944), 292.

[7] Raoul Castex, *Strategic Theories* ed. Eugenia C. Kiesling, trans. Eugenia C. Kiesling (Annapolis, MD: Naval Institute Press, 1994), 23.

[8] Brodie, *Naval Strategy*, 293.

Vestiges of earthbound analogies even informed legal and normative frameworks for space activity. The United Nations' *Outer Space Treaty* (OST) and *Moon Agreement* echo the United Nations' *Convention on the Law of the Sea*.[9] Space, the great global commons, is viewed by some scholars as analogous to "the high seas, the atmosphere, and Antarctica."[10] It is a sanctuary and place for cooperation as the Director for the Center for International and Security Studies at Maryland, and space governance advocate, Dr. Nancy Gallagher noted in her 2010 article, "Space Governance and International Cooperation."[11] In response to such exhortations for cooperation, Dr. Everett C. Dolman, professor of comparative military studies at the US Air Force (USAF) Air Command and Staff College (ACSC), argued in 2012 that space is competitive and "contestation is imperative."[12] The analogy of the sea applies. Like the high seas of the past, space exhibits opportunities for cooperation and competition. To what extent space becomes like today's oceans, however, is unclear. Indeed, Dr. Robert L. Pfaltzgraff, professor of security studies at The Fletcher School at Tufts University, observed:

> We do not currently know whether outer space will reinforce the competitive dimension or create the need for greater cooperation within and among the emerging entities that will populate space. We may hypothesize that the demands of life in outer space may enhance the need for cooperation, but we may also consider the pursuit of clashing interests between contending groups for control

[9] United Nations, Office for Outer Space Affairs, *United Nations Treaties and Principles on Outer Space, Related General Assembly Resolutions and Other Documents* (New York: United Nations, 2015). There are three other conventions or agreements which govern the registration of spacecraft, the moral imperative to provide assistance to another nation's astronauts, and the convention on liability for damages resulting from another actor's space object. For a good synopsis of all five UN conventions on space, see also Linda Dawson, *War in Space: The Science and Technology Behind Our Next Theater of Conflict* (Chichester, England: Praxis, 2018), 88-93.

[10] Nancy Gallagher, "Space Governance and International Cooperation," *Astropolitics* 8, no. 2-3 (December 2010): 259. Note that the 1982 *Convention on the Law of the Se*a was presaged by three conferences on the same subject dating back to 1958. See also United Nations, Office of Legal Affairs, *Convention on the Law of the Sea* (New York: United Nations, 1982), accessed October 2, 2019, https://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf; United Nations, Office for Outer Space Affairs, *Principles on Outer Space*.

[11] Gallagher, "Space Governance," 256-279.

[12] Everett C. Dolman, "New Frontiers, Old Realities," *Strategic Studies Quarterly* 6, no. 1 (2012): 78-96.

of key space geopolitical positions and assets.[13]

To engender critical thinking about spacepower, Colin Gray made a clarion call for a comprehensive theory in the vein of Alfred T. Mahan's naval theory.[14] Strategic thinking about space, however, could not escape the gravity of the immediate problem of space weaponization. A mere five years after Sputnik, an on-orbit, nuclear detonation test, called *Starfish Prime*, knocked many satellites out of commission.[15] While the OST soon proscribed such activities, non-nuclear weapons were not prohibited, and the myriad threats and consequences of celestial weapons forged the majority of the strategic thinking about space.

In 1998, USAF Airpower Research Institute research fellow, David E. Lupton, suggested in *On Space Warfare*, that "virtually all issues of space strategy turn on broad questions related to weaponizing space."[16] Twenty years later, the literature has evolved but still generally coalesces around the same topic, space weaponization. On the topic of weaponization, however, space literature admitted new analogies as it seemed the maritime analogy no longer applied, and strategic thinking turned to international relations for insights.

Spacepower theory has roots in international relations, coalesced around four distinct schools of thought.[17] As Pfaltzgraff reasoned, "Because all international relations theories either describe or prescribe interactions and relationships, space becomes yet another arena in which to theorize about the behavior of the world's political units."[18] In other words, the historical

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[13] Robert L. Pfaltzgraff, Jr., "International Relations Theory and Spacepower," in *Towards a Theory of Spacepower*, ed. Peter L Hays and Charles D Lutes (Washington, DC: National Defense University Press, 2007), 41.

[14] Gray, "Influence of Space Power," 307.

[15] Klein, *Understanding Space Strategy*, 8.

[16] David E. Lupton, *On Space Warfare* (Maxwell AFB, AL: Air University Press, 1998), 98.

[17] Pfaltzgraff, "Theory and Spacepower," 29. See also Anne-Marie Slaughter, "International Relations, Principal Theories," Max Planck Encyclopedia of Public International Law, 129, 2011, accessed June 18, 2019, https://www.princeton.edu/~slaughtr/Articles/722_IntlRelPrincipalTheories_Slaughter_20110509zG.pdf.

[18] Pfaltzgraff, "Theory and Spacepower," 29.

understanding of statecraft and strategy suggest that human politics in space will mirror those on Earth.[19] Thinking "first about the extension of capabilities of states into space as a basis for enhancing their position on Earth," illuminates how "sociopolitical relationships might evolve between space-based entities far from Earth."[20] In essence, international theory not only derives spacepower theory; spacepower theory reciprocates and informs thinking about "near-term space issues, notably how space shapes the power of Earthly states," which is a significant focus of international relations theory.[21]

While international relations theory aided thinking about the strategic environment in general, it also helped strategists address specific changes in space, especially developments regarding space weaponization. Indeed, the 2007 Chinese shootdown of a decommissioned weather satellites demonstrated China's capability to hold American satellites at risk and acted as a demarcation point for how scholars thought about weaponization, even as China claimed it had no intention of weaponizing space. Before the test, Dr. Joan Johnson-Freese, Charles F. Bolden, Jr. Chair of Science, Space, and Technology at the US Naval War College, explained in *Space as a Strategic Asset*, that space actors make policies and take actions with cognizance of how other actors perceive such overtures.[22] With carefully chosen rhetoric and deeds, space could remain a sanctuary. The Chinese weapon test, however, validated her concerns and dispelled the notion that a sanctuary was possible. Dr. James C. Moltz, chair of the Department of National Security Affairs at the Naval Postgraduate School, wrote in 2011 that "fears that space powers with more developed capabilities...[would] develop weapons that could eventually hold several U.S. satellites 'hostage' in a crisis."[23] For Moltz, space as a sanctuary was not feasible, but

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[19] Klein, *Understanding Space Strategy*, 7.

[20] Pfaltzgraff, "Theory and Spacepower," 30.

[21] Ibid.

[22] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), vii-viii, 22, 239-240.

[23] James C. Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 2nd ed. (Stanford, CA: Stanford Security Studies, 2011), 1-2.

cooperation, through arms control, could at least preserve humanity's access to space's global commons environment.[24]

Since 2007, space actors demonstrated new ways to compete without resorting to kinetic weapons. Rather than taking a physical, escalatory action, China resorted to small but effective maneuvers to counter US space capabilities.[25] To address these actions, Elbridge A. Colby, former Director of the Defense Program at the Center for a New American Security, argued in his 2016 report, *From Sanctuary to Battlefield: A Framework for a U.S. Defense and Deterrence Strategy in Space*, that arms control was akin to a quixotic quest because interested parties view the forms and purposes of such controls differently.[26] Arms controls would not prevent non-kinetic attacks or other harassment measures. Thus, space actors should instead develop hedging strategies, involving disaggregated and resilient technologies and policies that reserve the right to respond to space attacks outside of the space domain, in a manner deemed appropriate by the nation.[27]

Despite the evolution of actions and concomitant thinking, the predominant topic in the space literature remained weaponization. Perhaps this result is not surprising, as international relations theories focus on the roles of the state within the international community as they relate to security and self-interest. To focus on the close relationship between space and national security activity makes sense because national security within space is primarily about space systems and their protection.[28] As human activity expands in space, however, security and

[24] Moltz, *Politics of Space Security*, 7, 42-65, 351-353; James C. Moltz, *Crowded Orbits: Conflict and Cooperation in Space* (New York: Columbia University Press, 2014), 169-193.

[25] Eric Heginbotham et al., *The US-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017* (Santa Monica, CA: RAND Corporation, 2015), 245-258.

[26] Elbridge Colby, *From Sanctuary to Battlefield: A Framework for a U.S. Defense and Deterrence Strategy in Space* (Washington, DC: Center for a New American Strategy, 2016), 16.

[27] Colby, *Sanctuary to Battlefield*, 16, 20-25.

[28] Moltz, *Politics of Space Security*, 40.

strategy debates may evolve.[29] Until that time, the space arena is still "an adjunct to the security and well-being of the primary" nation. Debating the acceptability and role of space weapons remains the center point for many scholars.[30]

Such a center point, however, is not spacepower's true center of gravity, and such weighting by previous scholars threw off the balance of strategic thought. As Dr. Bleddyn E. Bowen, an international relations lecturer at the University of Leicester, noted, the weaponization debate has had "an intellectually stifling quality" on the advancement of broader space strategy, especially since weapons "are but one part of the whole vista of spacepower."[31] Importantly, there are a handful of scholars who have furthered strategic thinking beyond space weaponization considerations.

In 2002, Everett Dolman published his *Astropolitik: Classical Geopolitics in the Space Age*. This book paralleled Halford MacKinder's "Heartland" geopolitical theory, wherein Dolman argued that in space, whoever controls the orbital high ground, could control "near-Earth space," and consequently, the Earth itself.[32] In space, the advantages of the high-ground are more pronounced than on Earth because escaping Earth's gravity well requires considerable energy expenditures to overcome, seizing orbit presents a barrier to space, and the field-of-view from atop an orbital position is unmatched.[33] Although Dolman's theory considered the question of how to advance national power in space through the seizure of space's high-ground, his writing's purpose was "to place a more stringent conceptual framework around and among the many

[29] Pfaltzgraff, "Theory and Spacepower," 30.

[30] Ibid., 31.

[31] Bleddyn E. Bowen, "Spacepower and Space Warfare the Continuation of Terran Politics by Other Means" (PhD diss., Aberystwyth University, 2015), 41.

[32] Everett C. Dolman, "Geostrategy in the Space Age," in *Geopolitics: Geography and Strategy*, ed. Colin S. Gray and Geoffrey Sloan (London: Frank Cass, 1999), 89-93; Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002), 6-7.

[33] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (Hoboken, NJ: Routledge, 2006), 86-87, 100-106.

vectors of space policies and chronicles."[34] Dolman's conceptual framework included adaptations of airpower theorists Alexander P. de Seversky's great-circle mapping concepts and William Mitchell's and Giulio Douhet's thoughts regarding vital centers and their targeting.[35] Aside from these inclusions, at its core, Dolman's theory is a seapower theory adapted for space.[36] Like Mahan a century earlier, Dolman specifically addressed how the application of his theory could benefit the United States.

Nevertheless, spacepower begets national power, and Dolman's theory applies to any spacefaring nation. While some scholars interpreted his theory as nationalism *in extremis*, close explication of Dolman's ideas reveals that his theory intended to spur spacepower theory development as well as to engender ideas on how to protect the global commons in space for all humankind. By seizing the high-ground and holding orbital chokepoints, Dolman suggested that Garrett Hardin's "tragedy of the commons" did not have to occur.[37] Similar to Dr. G. John Ikenberry's concept in *After Victory*, the United States, after claiming low-Earth orbit (LEO), could exercise strategic restraint as a benevolent hegemon while protecting the commons.[38] As thought-provoking as Dolman's theory is, the time to seize LEO has likely passed as other spacefaring nations now possess the capabilities to thwart such an endeavor.[39] Moreover, Dolman's treatment of airpower theory missed concepts useful in improving spacepower theory.

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[34] Dolman, *Astropolitik*, 2.

[35] Ibid., 36-42, 67.

[36] Ibid., 26-45.

[37] Dolman, *Astropolitik*, 101-105. Garrett Hardin's "The Tragedy of the Commons" explains how administration of the commons, as opposed to a *laissez-faire* approach may be necessary to preserve access for all. See Garrett Hardin, "The Tragedy of the Commons," *Science* 162 (December 13, 1968): 1243-1248.

[38] G. John Ikenberry, *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars* (Princeton, NJ: Princeton University Press, 2000); Dolman, *Astropolitik*, 104, 177. Low-Earth orbit generally consists of the altitude band extending from 150 to 600 kilometers from Earth. See Air Command and Staff College (ACSC) Space Research Electives Seminars, *AU-18 Space Primer* (Maxwell AFB, AL: Air University Press, 2009), 89-114.

[39] Dolman, "New Frontiers, Old Realities," 78-96; Everett C. Dolman, Astropolitik: A Case for Weapons in Space (lecture, USAF School of Advanced Air and Space Studies, Maxwell AFB, AL, March 7, 2016).

Like Dolman, strategist John Klein adapted seapower concepts for consideration in spacepower theory in his 2006 book, *Space Warfare*. Unlike Dolman, though, Klein built his theory following the broader maritime theory—of which naval theory is a subset—of Sir Julian Corbett in *Some Principles of Maritime Strategy*.[40] In choosing a maritime model, Klein averred that "a maritime inspired framework most fully embraces the strategic issue of space operations."[41] Klein's conclusion, however, lacked an in-depth evaluation of airpower theory. Still, Klein adapted Corbett's writings on lines of communication, blockades, offensive and defensive strategies, concentration and dispersal, strategic positions, and command of the sea for celestial purposes to develop thinking that is "relevant and appropriate" for understanding how spacepower theory can inform space strategy to enhance national power.[42] Klein reprised his theory in 2019's *Understanding Space Strategy*, and offered "strategies for great, medium, and emerging space powers."[43] While Klein's more recent writing exhibited prescriptive measures for spacefaring nations, his Corbettian-based theory is aspirational, like Mahan's exhortations in *The Influence of Sea Power Upon History, 1660-1783*. It speaks to what nations should do in the future but is less clear about just what to do presently for such a future. Moreover, his dismissal of airpower theory missed valuable contributions to spacepower theory.

Conversely, Dr. Brent L. Ziarnick, assistant professor of national security studies at ACSC, offered a prescriptive theory in *Developing National Power in Space: A Theoretical Model*. Ziarnick built upon James Holmes and Toshi Yoshihara's interpretation of Mahan's

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[40] This work uses the term seapower theory to incorporate both maritime and naval theory and to avoid categorical confusion. Sir Julian Corbett delineated between maritime strategy, or those "principles which govern a war in which sea is a substantial factor," and naval strategy, "which determines the movements of the fleet when maritime strategy has determined what part the fleet must play in relation to the action of the land forces." Thus, naval theory nests within maritime theory, which falls under seapower theory. See Julian Corbett, *Some Principles of Maritime Strategy* (Annapolis, MD: Naval Institute Press, 1988), 15.

[41] Klein, *Space Warfare*, 19.

[42] Ibid., 33-113, 160.

[43] Klein, *Understanding Space Strategy*, i, chap. 2, 5, 6, and 7.

theory, and Joseph Schumpeter's economic theory to develop his general spacepower theory.[44] For Ziarnick, "space power is simply the ability to do something in space,"—an adaptation of Mitchell's definition of airpower—and is manifest through the interaction of what Ziarnick labels as the "Grammar" and "Logic Deltas."[45] The "Grammar Delta" is "how space power is built," conditioned and enabled "to bring the Logic of Space Power to fruition through access to space.[46] Grammar garners access, which in turn gives rise to ability, the apex of Ziarnick's "Logic Delta."[47] According to Ziarnick, "Spacepower's ultimate purpose is to generate wealth from space activities, and commerce is the true path to national greatness in space."[48] Together, the two Deltas obtain the classical realist goal of increasing national power.[49] Once a nation has spacepower, that "spacepower must be applied in the economic, political and military sphere."[50] Despite Ziarnick's consideration of multiple instruments of power, his theory is an economic theory for space. Like Klein's theory, Ziarnick's treatment of airpower is only surface deep. Unlike Klein, however, and like its Mahanian exemplar, Ziarnick's theory prescribes pathways that nations can take now to further national spacepower.[51]

In 2015, Bleddyn Bowen offered the final and most recent spacepower theory whose theoretical apogee lay beyond the weaponization debate. Bowen argued that the "foundational analogy" for human space activity is Clausewitz's conception of war as a political, emotional, and chaotic activity—that space warfare is the continuation of Terran politics by other means.[52] Upon

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[44] Ziarnick, *Developing Space Power*, 3, 39-61.

[45] Ibid., 13-14.

[46] Ibid., 16-18.

[47] Ibid., 13-32.

[48] Ibid., 25.

[49] Ibid., 25, 33.

[50] Ibid., 32.

[51] Ibid., 201-241.

[52] Bleddyn E. Bowen, "From Sparta to Space: Astropolitics and IR Theory," DefenceResearch, September 26, 2016, accessed September 3, 2019, https://defenceindepth.co/2016/09/26/from-sparta-to-space-astropolitics-and-ir-theory/.

a Clausewitzian foundation, Bowen attempted to develop a comprehensive theory through the careful exposition of seven propositions.[53] "The seven propositions gravitate towards thinking about spacepower in a context of a competitive environment, of conflicting wills and agendas, and under the risks of the use of violence; it is about employing spacepower to impose will on another."[54] Despite such a stated goal, Bowen's theory is fundamentally a maritime theory clothed in a spacesuit that, like Ziarnick's above, attempted to address strategy at the grandest level. Bowen, too, considered other instruments of national power, especially economic power. Bowen's theory is unique in its correction to what Bowen averred are misapplications of Corbett and Mahan and by his weaving of Charles Callwell's and Raoul Castex's strategic concepts into his narrative.[55] Like other theorists, though, Bowen's treatment of airpower was surface deep.

Existing literature belies a binary nature. Scholars either focused on weaponization or where broader in their examination, they viewed space as an ocean.[56] While Dolman, Klein, Ziarnick, and Bowen each offered helpful frameworks for thinking comprehensively about spacepower, there exists a paucity of consideration of other strategic analogies. Notably, spacepower scholars scantly considered the applicability of ideas from the corpus on airpower. Klein noted that he did not argue that air strategy "cannot be used to develop a space strategy" but that such use did not provide the best framework for space.[57] This claim, however, is preceded by a cursory recount of airpower theory and suggested that because some airpower theorists viewed airpower in isolation and as primarily a military tool, that its theoretical descendants have

[53] Bowen, "Spacepower and Space Warfare," 1-8.

[54] Ibid., 75.

[55] Ibid., 127-128, esp. chap. 4 & 5.

[56] Loyd S. Swenson, James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, DC: NASA, 1966); William Burroughs, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998); Sam J. Tangredi, "Space is an Ocean," *Proceedings* 125, no. 1 (January 1999): 52-53.

[57] Klein, *Space Warfare*, 19.

no inheritance in spacepower theory.[58] Where Dolman and Ziarnick discussed airpower, it was primarily to draw parallels between early airpower theorists and advocates and their *doppelgängers* in spacepower. Finally, Bowen called upon airpower concepts, such as Giulio Douhet's views on the command of the air, but his application was purely military.[59] Airpower thinking, however, offers more to the conversation than presently acknowledged. Furthermore, the near-exclusive adoption of Mahanian and Corbettian theories, notwithstanding Bowen's inclusion of Callwell and Castex, begs the question if other seapower analogies can also inform spacepower theory or if previous treatment by scholars was sufficient.

It is essential to ask if it is even appropriate to apply seapower analogies—or airpower for that matter—to space. In 2005, Dr. John B. Sheldon, professor of space security and cybersecurity at SAASS, asserted the uncritical application of strategic analogies could lead the student and practitioner of strategy from the correct path.[60] Sheldon evaluated existing analogies and concluded that "adaptation [was] not possible."[61] Instead, Sheldon argued that only an inductive, creative development of spacepower theory could produce the correct path.[62]

Whereas Sheldon argued against using analogies using strategic theory, Dr. Elizabeth Mendenhall, assistant professor of marine affairs at the University of Rhode Island, extended the argument using a scientific rationale. In her 2018 article, "Treating Outer Space Like a Place: A Case for Rejecting Other Domain Analogies," Mendenhall contended that "using direct scientific evidence to construct a representation of the outer space environment [was] superior" to the use of analogical "planetary domains."[63] She recommended viewing space through a lens that casts

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[58] Klein, *Space Warfare*, 13-19.

[59] Bowen, "Spacepower and Space Warfare," 140-141.

[60] John B. Sheldon, "Reasoning By Strategic Analogy: Classical Strategic Thought and the Foundations of a Theory of Space Power" (PhD diss., University of Reading, 2005), 284-329.

[61] Ibid., 295.

[62] Ibid.

[63] Elizabeth Mendenhall, "Treating Outer Space Like a Place: A Case for Rejecting Other Domain Analogies," *Astropolitics* 16, no. 2 (2018): 114-115.

gravity, distance, inhospitable conditions, technological reliance, and the size of celestial bodies in stark relief against all other considerations.[64] Only then, could governments develop "sober and informed understanding about consequences for the space environment."[65]

Such a reminder is necessary. Strategic analogies "must in the end diverge."[66] However, as Colin Gray noted, "Geography is inescapable."[67] If "all strategy is geostrategy" that "cannot be evaded by...orbital overflight," and if human politics will continue to spread to the heavens just as they have pervaded the Earth, then it stands to reason, that viewing space as a place comports well with Gray's exhortation that "strategy and politics must be done within geography."[68] Nevertheless, Sheldon's and Mendenhall's words are necessary reminders to avoid oversimplifying space's strategic environment as the strategist attempts to understand space strategy via more ephemeral strategic analogs. Heeding such caution, scholars nevertheless must further examine atmospheric and sea analogs as they relate to spacefaring activity.

Into the Wild Blue: Spacepower Takes Flight

Spacepower theorist Dr. John Klein claimed that airpower theory's main shortfall in informing strategic theory for space was its sole focus on its military characteristics.[69] In other words, the strategic environment in space demands a theory that considers all instruments of national power, not merely the "light, handy rapier" found in the military instrument.[70] The discounting of airpower theory, however, because of an alleged spotlight-like focus on the use of

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[64] Mendenhall, "Treating Space Like a Place," 110-114.

[65] Ibid., 115.

[66] Klein, *Space Warfare*, 151.

[67] Colin S. Gray, "Inescapable Geography," in *Geopolitics: Geography and Strategy*, ed. Colin S. Gray and Geoffrey Sloan (London: Frank Cass, 1999), 175.

[68] Gray, "Inescapable Geography," 164-165, 175; Robert C. Harding, *Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier* (New York: Routledge, 2012), 19.

[69] Klein, *Space Warfare*, 18.

[70] Carl von Clausewitz, *On War*, ed. Michael Howard and Peter Paret, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), 606; Klein, *Space Warfare*, 18-19.

armed force has dispersed the very light spacepower theory should cast for the practicing strategist, thereby weakening theory's illuminative qualities. "Strategy for airpower is not all about targeting."[71] As Colin Gray noted, "Douhet was wrong."[72] So, too, was Klein. Moreover, airpower is not all about air superiority. Nevertheless, John Sheldon, in his analysis of air and sea as strategic analogies for space, focused solely on one aspect of airpower, air superiority.[73]

Klein's—and to a lesser extent, Sheldon's—evaluation of airpower theory's applicability to spacepower theory were superficial. By conflating the existing body of airpower thought with targeting and air superiority concepts, both claimed that airpower theory inadequately addressed the strategic environment. Their claims, however, ignored other airpower theorists—like oft-overlooked General of the Air Force Henry H. Arnold—who like Mahan for naval theory, advanced broader theories to launch airpower into the heavens than is accorded them. Importantly, "air power is not composed alone of the warmaking components of aviation. It is the total aviation activity — civilian and military, commercial and private, potential as well as existing."[74] Airpower is not solely about bombs; neither is its theory. While few airmen have "been accused of being thinkers" or recorded their ideas on airpower, airpower theory has ascendancy in spacepower thought.[75]

Furthermore, airpower's theoretical contributions to strategic thinking go beyond the adaptations employed by Bowen and Dolman. Put simply, their treatment of airpower theory concepts overlooked ideas that also have an inheritance in spacepower theory. Accordingly, the following section examines airpower concepts and offers six propositions that apply to strategy in

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[71] Colin S. Gray, *Airpower for Strategic Effect* (Maxwell AFB, AL: Air University Press, 2012), 294-295.

[72] Ibid.

[73] Sheldon, "Strategic Analogy," 258.

[74] US Army Air Forces, *Third Report of the Commanding General of the Army Air Forces to the Secretary of War.* (Baltimore: Schneidereith & Sons, 1945), 61.

[75] Phillip S. Meilinger, *Airmen and Air Theory* (Maxwell AFB, AL: Air University Press, 2001), 97.

a grander sense.

Proposition One: Spacepower is the ability to do something strategically useful

US Army Brigadier General William Mitchell averred that "air power is the ability to do something in or through the air."[76] Building upon Mitchell's concept, Brent Ziarnick suggested that "space power is simply the ability to do something in space."[77] The ability to do something, however, is not in and of itself evocative of power—at least not in the realm of strategy. Strategy is inherently a practical subject.[78] Any use of power which does not avail itself to achieving an end that policy requires is arguably an exercise in vanity.[79] Noting such a disconnect between that which is useful to policy versus that which is merely a display of power, Colin Gray modified Mitchell's definition of airpower by adding the adjectives "strategically useful" to that which airpower does in the air.[80]

After simplifying and adapting these definitions, it follows that spacepower is the ability to do something strategically useful in or through space.[81] Moreover, space is not the sole venue for spacepower. A space actor who achieves strategically useful aims via aspects of its terrestrial space capabilities wields spacepower. Space launch sites present such an example.[82] Land-based missile-warning systems present another.[83] A simple definition of spacepower runs counter to previous scholars' nuanced definitions. David E. Lupton defined spacepower as the "ability of a

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[76] William Mitchell, *Winged Defense* (1925; repr., Tuscaloosa: University of Alabama Press, 2009), 3-4.

[77] Ziarnick, *Developing Space Power*, 13.

[78] Colin S. Gray, *Categorical Confusion? The Strategic Implications of Recognizing Challenges Either as Irregular or Traditional* (Carlisle Barracks, PA: Strategic Studies Institute, 2012), ix.

[79] Colin S. Gray, "Why Strategy is Difficult," *Joint Force Quarterly*, no. 22 (3rd Quarter 1999): 7.

[80] Gray, *Airpower for Strategic Effect*, 8-10.

[81] Gray stated that spacepower "must always be useful" in "Influence of Space Power," 302.

[82] ACSC, "Space Primer," 108-109.

[83] ACSC, "Space Primer," 227-232.

nation to exploit the space environment in pursuit of national goals and purposes and includes the entire astronautical capabilities of the nation."[84] Dr. M. V. Smith, professor of strategic studies at the USAF's Air University, suggested that since space is not solely the domain of states, neither is spacepower wielded only by state actors; thus spacepower is used to achieve ends "on the world stage through…exploitation of the space environment."[85] Finally, even though this work built on Gray's definition of airpower, Gray's 1996 definition of spacepower was equally narrow as he wrote that "space power may be defined as the ability to use space while denying reliable use to any foe."[86]

Scholars' additional definitional qualifications concerning the exploitation of space, however, obfuscate a fundamental truth of strategy. Strategy is "a plan for attaining continuing advantage," which may not involve state actors, foes, or necessarily actions on the world stage.[87] Conversely, Ziarnick's straightforward but prosaic modification, begged the strategist's question, "So what?"[88] Thus, spacepower must be defined broadly enough to avail itself of strategic considerations beyond just military means while being simultaneously narrow in its focus toward achieving strategically useful ends. The definition offered here achieves both aims.

Proposition Two: Space covers all the Earth; its effects are global

While defining airpower, Mitchell noted that since "air covers the whole world, aircraft are able to go anywhere on the planet," implying airpower's effects were global.[89] Likewise, Giulio Douhet reasoned that, in the air, the restrictions manifested by terrain or by coastlines, no

[84] Lupton, *On Space Warfare,* 4.

[85] M. V. Smith, *Ten Propositions Regarding Spacepower* (Maxwell AFB, AL: Air University Press, 2002), 5.

[86] Gray, "Influence of Space Power," 293.

[87] Everett C. Dolman, *Pure Strategy* (New York: Frank Cass, 2005), 6.

[88] Gray, *Airpower for Strategic Effect,* 11.

[89] Mitchell, *Winged Defense,* 3-14.

longer hindered freedom of navigation—to him, the airplane had "complete freedom of action."[90] While the analogy is imperfect—the realities of orbital mechanics gravitate toward limits on space maneuvers—the proposition that space covers the Earth, and hence spacepower is global, is both prosaic yet significant. Unlike any other domain, no nation is wholly inoculated to spacepower's effects.[91] Beyond the ready example whereby humanity receives energy from the Sun every day, there exist myriad other examples of spacepower's penetrating effects into all parts of the globe. Whether transiting space parabolically in the vein of an intercontinental ballistic missile or monitoring tropical storms via weather-tracking satellites, spacepower can affect the entire planet.[92] Burgeoning efforts to explore outer space for rare resources suggests that future spacepower will continue to influence the whole Earth through economic endeavors.[93]

It is essential for the student of strategy to appreciate spacepower's ubiquity. As noted above, power projected through space can reach anywhere in the world with a speed that is only matched by the light speed quality of cyber power. Spacepower exhibits a "strategic ubiquity" as "a critical strategic enabler for land, sea, air power, as well as for cyber power and for nuclear operations, across the entire spectrum of conflict."[94] Today, a nation can wield significant influence across the entire diplomatic, information, military, and economic instruments of power by disrupting position, navigation, and timing systems in space. These systems not only guide terrestrial military systems, but provide vital timing signals for electronic financial transactions,

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[90] Giulio Douhet, *The Command of the Air* (Tuscaloosa: University of Alabama Press, 2009), 8-9.

[91] Compare spacepower's global nature to cyberpower. Cyber has global reach only in so far as there exists network connectivity.

[92] ACSC, "Space Primer," 201-212.

[93] "Space Solar Power," National Space Society, accessed November 4, 2019, https://space.nss.org/?s=space+solar+power; John S. Lewis, *Mining the Sky: Untold Riches From the Asteroids, Comets, and Planets* (Reading, MA: Helix Books, 1996); "Helium-3 Mining on the Lunar Surface / Energy," *European Space Agency*, 2016, accessed February 22, 2016, http://www.esa.int/Our_Activities/Preparing_for_the_Future/Space_for_Earth/Energy/Helium-3_mining_on_the_lunar_surface; "Asteroids Will Unlock the Solar System's Economy," *Planetary Resources.com*, 2016, accessed February 22, 2016, http://www.planetaryresources.com/asteroids/#asteroids-intro.

[94] Sheldon, "Strategic Analogy," 303.

enable strategic information flow, and support arms control monitoring capabilities.[95]

Certainly, spacepower's far-reaching effects do not mean it will necessarily be decisive.[96] Nevertheless, such interconnectedness between space-based systems and terrestrial activity merits the strategist's consideration. Spacepower's global nature extends beyond the capability to reach anywhere on the Earth. Namely, space powers' actions, in space especially, can have long-lasting, deleterious effects on all nations. One needs only to examine the extent of orbital debris to appreciate this truism.[97] To launch an anti-satellite missile or detonate a nuclear weapon on-orbit not only affects other space actors and creates environmental hazards in space, but these actions invariably "junk up" one's own "front yard."[98]

Nations may bring their "political-social baggage" to space, but to date, humanity has created plenty of new baggage in the space environment.[99] Proposition Two reminds the strategist and leader that actions taken in the name of space strategy must abide by what Dr. Edward N. Luttwak called the "logic of strategy" that is pervaded by paradox and nonlinearity.[100] Spacepower is not just far-reaching in its global quality; it has an enduring nature. As nations act in ways that damage the global commons of space, they potentially do so to their detriment. Indeed, the chances are high that any victory in space, purchased with kinetic means, will be Pyrrhic. Debris and other by-products of war in space, much like unexploded ordinance on land, exist well after conflict subsides, perhaps even more so given the persistent nature of the space

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[95] ACSC, "Space Primer," 163-257; Dawson, *War in Space*, 131-156.

[96] Gray, "Influence of Space Power," 303-304.

[97] "Debris Modeling," Orbital Debris Program Office, accessed November 5, 2019, https://orbitaldebris.jsc.nasa.gov/modeling/; Dawson, *War in Space*, 46-60.

[98] Moltz, *Politics of Space Security*, 64, 227.

[99] Bowen, "Spacepower and Space Warfare," 151-157.

[100] Edward N. Luttwak, *Strategy: The Logic of War and Peace* (Cambridge, MA: Belknap Press, 2001), 1-31, 258.

environment.[101] Thus, exercising spacepower provides both an opportunity for enduring global influence, but also risk if one ignores the potential nonlinear effects of actions made in the pursuit of expedience.

Proposition Three: Spacepower has currency only on Earth, for now

Proposition One defined spacepower as the ability to do something strategically useful while Proposition Two espoused the global nature of space using Mitchell's and Douhet's concepts for airpower. A third proposition follows naturally as a corollary. That is, spacepower at present has currency on Earth only. In other words, even in light of spacepower's global qualities and pervasive nature, it must be evaluated for its effects on Earth.[102]

Colin Gray's airpower theory is instructive in this regard. "Airpower is a strategic instrument in that it is a servant of politics" and thus must have "strategic and political meaning on land."[103] In a similar vein, spacepower, to be strategically useful, must have an "important territorial definition" since *terra firma* is currently humanity's only permanent domain.[104] To that end, Proposition Three allows for thinking of spacepower in its full global breadth but enjoins the strategist to remember that strategically useful spacepower must—at least until humans find the ability to live permanently beyond Earth—refer to the strategic and political gravitational forces emanating from Earth. Although potentially wielded from or through celestial means, spacepower's influence is still tellurian.

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[101] Robert E. Larned, *1994 Air and Space Doctrine Symposium* (Maxwell AFB, AL: Air University Press, 1994), 8-9; Bruce M. DeBlois, "Ascendant Realms: Characteristics of Airpower and Space Power," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Phillip S. Meilinger (Maxwell AFB, AL: Air University Press, 1997), 558; Bruce M. DeBlois, ed. *Beyond the Paths of Heaven* (Maxwell AFB, AL: Air University Press, 1999), ix; Moltz, *Politics of Space Security*, 343.

[102] Clausewitz, *On War*, 605.

[103] Gray, *Airpower for Strategic Effect*, 278; Colin S. Gray, *Always Strategic: Jointly Essential Landpower* (Carlisle Barracks, PA: Strategic Studies Institute, 2015), 8-9.

[104] Gray, *Airpower for Strategic Effect*, 72.

Proposition Four: Spacepower has strategic effect, but it is not inherently strategic

The preceding propositions frame spacepower's proper contemplation. Namely, spacepower, acting globally, is the ability to do something strategically useful towards ends as conceived for terrestrial purposes. Caution, though, is warranted. A careless reading may intimate that spacepower is inherently strategic. It is not. Rather, spacepower exhibits strategic effect, which follows naturally from this work's definition of spacepower. Exhibiting strategic effect, however, does not indicate the presence of an inherently strategic nature.

In his 2009 *Understanding Airpower: Bonfire of the Fallacies*, Colin Gray wrote that airpower is not inherently strategic.[105] Strategists must evaluate airpower for its strategic meaning, that is, for "consequences of (tactical) actual military behavior for the course and outcome of a conflict."[106] Similarly, spacepower's tools help adjoin all building blocks necessary for bridging present means to future political ends deemed desirable for enduring statecraft. While the carpenter's plane smooths the framework of a structure, it does not build the structure alone.

Such caveats, however, do not comport with airpower (or spacepower) as traditionally conceived. Indeed, USAF doctrine defined airpower as "the ability to project military power or influence through the control and exploitation of air, space, and cyberspace to achieve strategic, operational, or tactical objectives."[107] Moreover, the same doctrine claimed, "airpower is an inherently strategic force."[108] It is beyond the scope of this monograph to address the fallacy as

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[105] Colin S. Gray, *Understanding Airpower: Bonfire of the Fallacies* (Maxwell AFB, AL: Air University Press, 2009), 17-21.

[106] Gray, *Understanding Airpower*, 19.

[107] US Department of the Air Force, *Basic Doctrine* (Maxwell AFB, AL: Air University Press, 2015), 25.

[108] Ibid., 34.

stated literally; Gray skillfully addressed the waywardness of such thinking.[109] The logical deduction from the above doctrinal claims, however, are salient to spacepower thought. Taking the claims at face value—and ignoring the theoretical and operational confusion which tends to result from a remiss wording—one concludes that spacepower is inherently strategic.[110]

To think of spacepower as being inherently strategic, however, besmirches the tool doctrine sought to praise. Namely, such labeling forces "strategists to seek independent decision through [spacepower] because of their assertion of the uniquely strategic quality of their instrument," which creates an undue burden on space strategists due to a higher propensity for "demonstrable failure."[111] The propensity for failure manifests from the expectation that if the spacepower instrument is uniquely and inherently strategic, then uses thereof will necessarily deliver decisive results independent of other forms of national power. Rare is the occasion, however, where such success is possible because of the "complexity and variety" found in the "dialectic of wills" that is strategy.[112] Consequently, disappointment in the space instrument's efficacy follows when its use fails to meet such lofty claims of an inherently strategic and decisive nature. Therefore, one should avoid overstating and overpromising on spacepower's capabilities lest space advocates discredit the contributions spacepower can make.

Lacking an inherent, strategic nature, however, does not blunt the space implement. Instead, understanding that spacepower exhibits strategic effect but not an inherently strategic quality makes clear the prism through which the strategist must view spacepower. For example,

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[109] See Colin S. Gray, *Weapons Don't Make War: Policy, Strategy, and Military Technology* (Lawrence, KS: Univ Press of Kansas, 1993); Colin S. Gray, *Weapons for Strategic Effect: How Important is Technology?* (Maxwell AFB, AL: Air University Press, 2001); Gray, *Understanding Airpower*; Gray, *Airpower for Strategic Effect*.

[110] See DeBlois, "Ascendant Realms." DeBlois' evaluated the claim that spacepower is merely a theoretical and operational extension of airpower. He concludes quite convincingly that they are not the same and should be treated within their proper contexts.

[111] Gray, *Understanding Airpower*, 20.

[112] Gray, *Understanding Airpower*, 20; Heuser, *Evolution of Strategy*, 27-28; Klein, *Understanding Space Strategy*, 24.

the Corona satellite system enabled the United States to dispel the apparitions of a Soviet nuclear missile advantage, which buttressed a changing American foreign policy toward the Soviets.[113] Satellites, or any space capability, are not inherently strategic, no matter their label.[114] Additionally, the American Apollo space program sought to increase American prestige abroad, and by doing so, garnered significant international influence to challenge Soviet aspirations on-orbit and on Earth.[115] Here, spacepower had a lasting strategic effect. It is arguable, though, that sending humans to the Moon was inherently strategic.

A more recent example of spacepower's strategic effect warrants consideration. During Operations Odyssey Dawn and Unified Protector, the United Nations coalition utilized sixty-three various satellite systems to pinpoint Libyan forces and employ 2,844 satellite-guided weapons to help achieve the strategic aims of protecting Libyan civilians and toppling Muymar Quaddafi's regime.[116] Spacepower aided tactical victories on the battlefield that ultimately paved the way for strategic success, but spacepower was not decisive. Instead, spacepower—and arguably even airpower—was an "indispensable adjunct."[117] Nevertheless, these operations addressed Gray's question concerning whether spacepower would someday become a "leading edge" military capability and the "most potent source of military effectiveness."[118] Spacepower answered Gray

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[113] Dino A. Brugioni, *Eyes in the Sky: Eisenhower, the CIA and Cold War Aerial Espionage* (Annapolis, MD: Naval Institute Press, 2010), 387-391; Martin Van Creveld, *The Age of Airpower* (New York: PublicAffairs, 2011), 221-222.

[114] For examples wherein "strategic" is included in a system's name, see Dawson, *War in Space*, 148-150.

[115] Johnson-Freese, *Space as a Strategic Asset*, 8-11, 56; James E. Webb and Robert S. McNamara, Jr., *Recommendations for Our National Space Program: Changes, Policies, and Goals* (Washington, DC: White House, May 8, 1961), 1-12.

[116] Karl P. Mueller, "Examining the Air Campaign in Libya," in *Precision and Purpose: Airpower in the Libyan Civil War*, ed. Karl P. Mueller (Santa Monica, CA: RAND Corporation, 2015), 4; Robert C. Owen, "The US Experience: National Strategy and Campaign Support," in *Precision and Purpose: Airpower in the Libyan Civil War*, ed. Karl P. Mueller (Santa Monica, CA: RAND Corporation, 2015), 72-74, 97-98.

[117] Gray, "Influence of Space Power," 294-295. Gray, using historical analogy, explained how spacepower after Desert Storm was much like airpower following World War I. At each point, these military tools were indispensable in accomplishing strategic aims.

[118] Ibid., 303-304.

affirmatively while postponing an answer to his additional inquiry concerning spacepower's ability to be an independent war winner.[119]

Modifying Gray's notion of "leading edge" for broader application beyond the military realm demonstrates that spacepower has not yet achieved "leading edge" status. Spacepower has not yet "decided the course or outcome" of grand strategy.[120] Such status, though, is immaterial. Strategy is about the harnessing of all forms of power to influence actors and attain an enduring advantage. Whether as an adjunct, "leading edge," or sole guarantor of strategic success, spacepower's gravity is felt in the effects it achieves. Spacepower is not strategic because its perspective is global or because of its geographic-specific qualities; an instrument is only strategic in its consequences.[121] Spacepower possesses such consequences.

Proposition Five: Spacepower should be used as a general strategy

The previous four propositions situate this spacepower theory within strategic theory proper. Spacepower is subordinate to general strategy.[122] While covering, quite literally, the entirety of Earth—and having global effects with currency yet felt only on Earth—spacepower is not inherently strategic. Spacepower, however, wielded within a broad, holistic framework can yield the results intended by its political masters. In other words, as part of a general strategy, spacepower is indeed powerful.

As before, early airpower thinking informs this proposition. Exeter University professor of history, Dr. Richard J. Overy, wrote in *The Air War: 1939-1945* that "before 1939 a dichotomy was developing between air forces favoring limited, tactical air power and those favoring a more general air power."[123] A limited air strategy comprised those methods wherein the air force

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[119] Gray, "Influence of Space Power," 295, 299.

[120] Ibid., 303.

[121] Gray, *Understanding Airpower*, 19.

[122] Gray, *Airpower for Strategic Effect*, 275.

[123] Richard J. Overy, *The Air War: 1939-1945* (Washington, DC: Potomac Books, 2005), 45.

supported other services "to the practical exclusion of other alternative uses of air power."[124] Conversely, a general strategy entailed the use of "all areas of air power...simultaneously and in an inter-related way."[125] Specifically, Overy asserted that during World War II, Japan and Germany subordinated airpower solely to the role of supporting other services, namely the Japanese navy and German army. Conversely, Britain and the United States "practiced a general air strategy" that involved all facets of airpower while resourcing the instrument to "meet the demands of such a policy."[126] The general air strategy the Allies employed upheld the sanctity of airpower as an indivisible instrument and aided victory while contrasting with the piecemeal approach used by the Axis powers.[127] More generally, "air strategy should be indivisible," in part, because of the easily verifiable "geophysical unity" of the sky.[128] No physical barrier prevents traversing the globe via the air. Therefore, Gray insisted "without equivocation that the essential unity and distinctiveness of the aerial domain and the nature of aircraft imply that airpower should be employed in ways that exploit its nature rather than contradict it."[129]

The logic used to describe and advocate for the unity of airpower and its employ applies equally to spacepower. Spacepower is similarly indivisible. Moreover, spacepower, because of its indivisible nature, should be used as part of a general vice limited strategy. The reasons for

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[124] Overy, *The Air War*, 17.

[125] Ibid.

[126] Ibid., 203.

[127] Luttwak, *Strategy*, 177-178; Overy, *Air War*, 204-205. Airpower was not necessarily decisive during World War II, but for the student of strategy, such designation is irrelevant in many regards. Airpower was a necessary, but not sufficient, cause for allied victory in the European and Pacific theaters. See Richard J. Overy, *Why the Allies Won* (New York: W. W. Norton & Company, 1997); Phillips Payson O'Brien, *How the War Was Won: Air-Sea Power and Allied Victory in World II* (Cambridge: Cambridge University Press, 2015). That strategic bombing failed to force Germany's capitulation is not dispositive of the strategic usefulness of airpower employed amid a general strategy. The combination of strategic bombing, interdiction, air transport, and ground support, opened a second front for the Nazi regime, sustained allied war-making efforts, and virtually guaranteed a continental, European beachhead devoid of enemy aircraft on July 6, 1944. See Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas About Strategic Bombing, 1914-1945* (Princeton, NJ: Princeton University Press, 2004), chap. 5.

[128] Gray, *Airpower for Strategic Effect*, 286-287.

[129] Ibid., 286.

protecting the unity of spacepower follow from strategic theory's logic.

This logic, however, does not require centralizing control of space assets in the hands of a space operator. Just as Gray noted for airpower, the idea that "[space] is one and so is [space]power" does not require that spacepower "of whatever character, ought to be commanded and controlled centrally."[130] This assertion stands in contrast to theorists like M. V. Smith.[131] Parceling out aspects of spacepower to support single services or single theaters to the neglect of a broader strategy, as sometimes happened for airpower in World War II, negates the geographic nature of space.[132] In many cases, centralizing command is preferred. Yet, context matters. As Klein and Bowen noted, concentration and dispersal factor significantly in space strategy.[133] Usually, centralization and concentration are compatible. Dispersing forces amid the vastness of space, however, may necessitate decentralization of command and control.

The enjoinder to wield spacepower in general, rather than limited, ways follows from the indivisibility of space, the interconnectedness of its capabilities, and its global presence. The urging, however, is not for centralized command and control regardless of context. Spacepower can operate at all levels of war simultaneously, without being confined to military uses, and covers the spectrum of competition and conflict.[134] Indeed, service or theater-specific challenges will warrant support from the space instrument. However, the strategist must be wary of the luminance cast from enthralling but perhaps not strategically compelling conflagrations. These

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[130] Gray, *Airpower for Strategic Effect*, 287. For examples wherein theory is manipulated to justify centralizing spacepower under a single commander, see Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Maxwell AFB, AL: Air University Press, 1995); Smith, *Ten Propositions of Spacepower*; Mark E. Harter, "Ten Propositions Regarding Space Power: The Dawn of a Space Force," *Air & Space Power Journal* 20, no. 2 (Summer 2006): 64-78.

[131] Smith, *Ten Propositions of Spacepower*, 53-56. With the advent of the US Space Force, the idea that an airman would control space assets is likely no longer a real concern.

[132] Arthur W. Tedder, *Air Power in War* (1947; repr., Tuscaloosa: University of Alabama Press, 2010), 126; Robert S. Ehlers, Jr., *The Mediterranean Air War: Airpower and Allied Victory in World War II* (Lawrence, KS: University Press of Kansas, 2015), 259-280.

[133] Klein, *Space Warfare*, 107-115; Bowen, "Spacepower and Space Warfare," 260-284; Klein, *Understanding Space Strategy*, 34-36.

[134] Harter, "Ten Propositions," 68-70.

blazes can drown out the stars necessary for navigating strategy. Like celestial navigation, the strategist must orient to an inertial frame of reference, the maxims of theory, and wield spacepower holistically, amid a general strategy.

Proposition Six: Spacemindedness—a key to spacepower—is the mental lens through which to view space

Proper ordering and placement of theoretical ideas and concepts are essential. As Prussian military theorist, Carl von Clausewitz noted, "the function of theory is to put [things] in systematic order, clearly and comprehensively."[135] However, "theory cannot equip the mind with formulas for solving problems, nor can it mark the narrow path on which the sole solution is supposed to lie by planting a hedge of principles either side."[136] Therefore, while the previous propositions provide a framework for thinking about spacepower, they are not panaceas. They can, however, act as palliatives for the symptoms of astrategic thought and action. Indeed, to think correctly about spacepower, to appreciate its capabilities, and to champion its development, belies a mindedness herein deemed spacemindedness. Spacemindedness is foundational to spacepower.

Correct thinking concerning spacepower evidences a lineage in airpower theory. Airmindedness of yesteryear provides the airfoil for spacemindedness to take flight today. The first powered flight trumpeted in grandiose ideas of humankind's future technologic triumphs and adventures in the cosmos. Despite many figments of imagination, ideations aviation's potential evidenced a budding mental framework and enthusiasm amid those who believed in airpower's promise and future. This framework and enthusiasm, in part, helped forge airpower for the

[135] Clausewitz, *On War*, 578.

[136] Ibid., 578.

nations who allowed the heavens to captivate their imaginations.[137]

Oddly, modern USAF doctrine ignored the enthusiastic quality of airmindedness. Indeed, USAF doctrine described airmindedness as the province of those imbued with an airman's perspective.[138] Furthermore, doctrine suggested airmindedness "entails thinking beyond two dimensions" and enables airmen to think at all levels of war simultaneously to empower the "flexibility and utility of airpower."[139] Dr. Dale J. Hayden, researcher at the USAF Research Institute, suggested that airmindedness is a global, strategic mindset through which airmen perceive war and the battlespace.[140]

While Hayden asserted that airmindedness has a protean nature, both his definition and USAF doctrine missed that airmindedness and airpower as originally conceived entailed more than military might. Airmindedness connoted an appreciation, especially among those who had "slipped the surly bonds of Earth" for all that aviation could achieve, not just on the battlefield, but for all humankind, even when the promise was not yet evident to the greater public.[141] Of course, from these various definitions of airmindedness, one senses that airmindedness has often escaped definition because of the "chicken-and-the-egg" problem of grasping what airpower "does" versus what airpower "is," and thus how one should contemplate airpower. As recently as 2019, Dr. Jason M. Trew, dean of academics at the USAF Squadron Officer School, updated the definition to address contemporary influences. For Trew, airmindedness constituted a blend of

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[137] See especially Peter Fritzsche, *A Nation of Fliers: German Aviation and the Popular Imagination* (Cambridge: Harvard University Press, 1992); Robert Wohl, *A Passion for Wings: Aviation and the Western Imagination, 1908–1918* (New Haven: Yale University Press, 1994).

[138] USAF, "Basic Doctrine," 33. USAF doctrine incorrectly ascribed the term to General of the Air Force Henry H. Arnold. The term existed at least as early as 1927 when it was first documented in *The Oxford English Dictionary*. Brigadier-General Christopher J. Coates, Royal Canadian Air Force, offered evidence that attribution to Gen. Arnold helped tie doctrinal concepts to airpower's early founders. See Christopher J. Coates, "Airmindedness: An Essential Element of Air Power," *The Royal Canadian Air Force Journal* 3, no. 1 (Winter 2014): 70-84.

[139] USAF, "Basic Doctrine," 33.

[140] Dale L. Hayden, "Air-Mindedness," *Air & Space Power Journal* 22, no. 4 (2008): 44-45.

[141] John Gillespie Magee, Jr., "High Flight," line 1 (1941); Wohl, *Passion for Wings*.

"passion for cultivating airpower" with the proper "strategic perspective" to employ airpower proficiently.[142] Early airpower theorists understood that a unique perspective and mindset, coupled with an exuberance for airpower, were required to champion aviation if it were to take flight.

In *The Command of the Air,* Italian airpower theorist Giulio Douhet responded to the horrific loss of life from the Great War by suggesting that any future war would require the command of the air, both to ensure victory and to counter any enemy.[143] Accordingly, Douhet argued that a nation needed to combine and synchronize military and civilian aviation development to secure its command of the air.[144] Furthermore, to ensure that efforts remained focused upon the goal of developing airpower, "air-minded" individuals needed to lead the development.[145] Disappointingly, Douhet failed to define what such a term meant. Yet, within context, Douhet's concept suggested that airmindedness constituted an understanding of airpower's present and future utility coupled with an enthusiasm for its development.[146]

In America, enlisted infantryman turned pilot and eventual Army Air Corps Chief, Major General Benjamin D. Foulois, foresaw the promise of airpower and championed airmindedness to ensure the United States maintained a burgeoning strategic advantage.[147] Foulois' contemporary, William Mitchell, also carried the torch for airpower and "made Americans an air-minded people."[148] In writing about "air-going people," Mitchell observed that those who danced upon

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[142] Jason M. Trew, "Rescuing Icarus," *Air & Space Power Journal* 33, no. 2 (Summer 2019): 48-60.

[143] Douhet, *Command of the Air*, 7-23.

[144] Ibid., 87.

[145] Ibid., 88.

[146] Phillip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory," in *The Paths of Heaven: The Evolution of Airpower Theory,* ed. Phillip S. Meilinger (Maxwell AFB, AL: Air University Press, 1997), 17; Douhet, *Command of the Air*, 71, 101-103, 175-177.

[147] Benjamin D. Foulois and C.V. Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Major General Benjamin D. Foulois* (New York: McGraw Hill, 1968), 1-6, 42-59.

[148] Robert S. Ehlers, Jr. quoted in Mitchell, *Winged Defense*, vi.

the clouds contemplated aviation differently and appreciated what airpower meant for the future of the nation.[149] Although Mitchell did not use the term airmindedness, he recognized that advancing airpower necessitated a different mindset. Indeed, Mitchell, like Douhet, argued that developing airpower required a whole-nation approach driven by a vision "of at least seven years ahead."[150] Mitchell's purpose was, as General Arnold later summarized, about convincing the nation that airpower was more than airplanes or even an air force.[151] Airmindedness was about taking a whole-of-nation approach toward airpower, especially in light of its potential applications. Major Alexander P. de Seversky captured such a frame of mind when he tried to spark airminded thinking in the American populace.

> A nation content to imitate and "catch up" must in the nature of the case remain backward...As far as the aircraft of tomorrow is concerned, all nations are starting from scratch. America is more richly endowed with the resources of brains, materials, personnel, and industrial efficiency than any other country...Whether it utilizes these potentialities, or once more allows itself to trail along imitatively, depends on how quickly and thoroughly we comprehend the nature of the new weapon—and on how quickly and thoroughly we cleanse our air power from the accretions of conservatism, timidity, and astigmatic leadership...Above all, I hope to convey the sense of air power as a dynamic, expanding force, the growth of which must be anticipated by courageous minds.[152]

De Seversky's airmindedness reverberated within the US Congress, where his enthusiasm engendered debate on the need to get out of "rut mind" to prepare America's airpower.[153] Despite congressional attention, advocates felt compelled to renew public pleas centered upon sparking a hopeful enthusiasm for airpower's development. As General Arnold noted:

> Since military air power depends for its existence upon the aviation industry and the air-mindedness of the Nation, the Air Forces must promote the development of American civil air power in all of its forms, both commercial and private...No

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[149] Mitchell, *Winged Defense*, 6.

[150] Mitchell, *Winged Defense*, 198.

[151] Henry H. Arnold, *Global Mission* (New York: Harper, 1949), 100.

[152] Alexander P. de Seversky, *Victory Through Air Power* (New York: Simon and Schuster, 1942), 4-6.

[153] *Congressional Record*, 77th Cong., 2nd sess., 1942, vol. 88, pt. 3: 3745-3748.

> activity having to do with aviation in any form can be considered as being completely independent of national security. Civil aviation must be encouraged, both internally and internationally.[154]

Both de Seversky's and Arnold's thoughts conveyed the realization that civil, commercial, and military, aviation development were symbiotic processes. One could not advance airpower by simply cultivating just one aspect of it. To truly foster growth, all three areas required tending as developments in one tended to sprout new prospects in the other legs of the trinity. Such a realization obtained beyond the so-called prophets of airpower. The lay airman also recognized the intertwining of threads that constituted the very mantle demanded of a truly ascendant airpower—airpower that would satisfy the "Jules Verne imagination" that would cross any frontier, to include space.[155] Being airminded was more than merely advocating for airpower or understanding its proper use in strategy. Perhaps most importantly, being airminded entailed displaying a vision for what airpower could be. Airmindedness was practical; it was also aspirational.

It is the juxtaposition of these concepts, and the amalgamation thereof, that offers a helpful definition of spacemindedness. Combining Trew's updated definition with original conceptions is useful for spacepower theory. Spacemindedness "is a lens [through] which the mind's eye views the vast potential of space, and in recognizing this potential, advocates for the 'constant development and experimentation' of space-going capabilities to harness the latent power of space in the continuing pursuit of national power."[156] Moreover, in contemplating space warfare, spacemindedness is the "lens through which [space operators] perceive warfare and view the battlespace," in space.[157] Being spaceminded means possessing equal doses of a

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[154] Henry H. Arnold, "Air Power for Peace," *National Geographic Magazine*, February 1946, 193.

[155] Cy Caldwell, *Air Power and Total War* (New York: Coward-McCann Inc., 1943), ix, 242.

[156] Ryan A. Sanford, "Space-Mindedness: The Application of Space Power," The Sir Richard Williams Foundation - The Central Blue, July 22, 2018, accessed December 4, 2019, http://centralblue.williamsfoundation.org.au/space-mindedness-the-application-of-space-power-ryan-sandford/.

[157] Dale L. Hayden, "Air-Mindedness," *Air & Space Power Journal* 22, no. 4 (2008), 44-45.

mind rooted in reality—that is, one that remains cognizant of the present's requirements for practicality—admixed with a spark of imagination that yearns to see spacepower reach its full potential. Spacemindedness is the dutiful Daedalus and the imaginative Icarus.[158] It is the prism through which one views spacepower. This prism focuses the eye not only on spacepower's present use but also on the promise of spacepower's future usefulness.[159] Similarly, spacemindedness epitomizes both a passion for the cultivation of spacepower and the sober-minded consideration of how such power, available now, can influence other actors for the achievement of political aims deemed presently necessary.

Of course, it is easy to define spacemindedness. It is altogether a separate task to cultivate it. Indeed, Dr. Wendy Whitman Cobb, associate professor of strategy and security studies at SAASS, noted in 2011 that "those supporting space activities must broaden the appeal of space, making it more accessible and understandable for those with whom the issue does not have much saliency."[160] In other words, support for space activity follows from an enthusiasm for space, which comes through making it more relevant and understandable.[161] Without such broad support, space activity remains a niche hobby. Developing spacepower requires a whole-of-nation approach, founded on a public's enthusiasm for space.

How, then, may space actors cultivate spaceminded thinking? Bleddyn Bowen suggested that military and strategic cultures influence such growth as both illuminate—and even clarify or blur—how each actor views spacepower.[162] Spacepower theory must recognize this truism.[163] Even so, Bowen's recognition of the formative power of culture upon spacepower does not

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[158] Trew, "Rescuing Icarus," 48-49.

[159] Trew, "Rescuing Icarus," 55-56.

[160] Wendy N. Whitman Cobb, "Who's Supporting Space Activities? An 'Issue Public' for US Space Policy," *Space Policy* 27, no. 4 (2011): 234.

[161] Ibid., 238.

[162] Bowen, "Spacepower and Space Warfare," 254-259.

[163] Ibid., 259.

prepare the ground for cultivating the spaceminded. Fortunately, other scholars like Klein and Ziarnick advocated for higher-learning institutions to stimulate proper thinking about space.[164] For both scholars, though, their recommended solutions to hewing the framework for spacemindedness entailed only one of the three pillars of spacepower. Namely, they recommended establishing a space war college focused solely on the battlefield quality of the space domain. While any formal educational institution is arguably better than its complete absence, such a war college would address only the former of the Daedalus-Icarus dual-nature that is spacemindedness. In other words, a space war college curriculum may well hone the spacepower instrument in preparation for warfare by establishing "wise and sound" thinking about space to help wade through "extraordinary outpouring of feeling" and "utopian hopes and gnawing fears."[165] Such education, however, would not necessarily imbue or even excite a passion for spacepower—a passion that appreciates the potential of space and seeks to bring to fruition such potential. It is not enough to understand the principles and applications of spacepower. Spacepower development requires both practicality and passion.

Dr. Peter Fritzsche, associate professor of history at the University of Illinois, evaluated German aviation development by examining the accompanying popular ideas and public imaginations regarding airpower. In *A Nation of Fliers: German Aviation and the Popular Imagination*, Fritzsche explained how public interest in aviation evolved in Germany under different governments and *zeitgeists*. In particular, Fritzsche recorded Nazi efforts to engender a passion for aviation through formal educational programs.[166] Aside from the poverty of Nazi ideology, the pragmatism behind such education did not spark the imagination as hoped.[167] As may be the case for space war colleges, formal schooling can husband practical thinkers—many

[164] Klein, *Space Warfare*, 151-152; Ziarnick, *Developing Space Power*, 235-237.

[165] Wohl, *Passion for Wings*, 1.

[166] Wohl, *Passion for Wings*, 200-203.

[167] Ibid., 215-219.

of whose minds eyes twinkle for space—but it cannot occasion imagination. Creativity abhors formality.

Therefore, perhaps the only way to truly ignite a passion for space is to parallel the flight paths of generals Henry H. Arnold and Ira C. Eaker. The duo co-authored three books which explained airpower to the public, while Arnold tried to instill "aeromania" in American youth by championing the adventure of aviation.[168] Arnold and others recognized that a nation's people needed to embrace airpower to ensure its development.

> Air Power will always be the business of every American citizen. The Army Air Forces recognizes its duty in formulating intelligent programs of education to the end that the public will understand aviation in all its forms as well as realize the danger of unpreparedness in the air. Propaganda has no place in this program. Public relations must give the public a thorough understanding of...Air Power.[169]

For Arnold, airmindedness derived from public awareness events, education programs, and other outreach efforts.[170] These efforts set to inspire in the hearts and minds of the American public the belief that airpower was necessary and worthwhile. Perchance, today's Elon Musks and Richard Bransons can inspire similar feelings for spacepower. As Bowen noted, though, spacemindedness will form according to the strategic culture of the public it serves.[171] Moreover, it is unlikely “an upsurge in public support for [a] space program could serve as a panacea.”[172] Spacemindedness will spur spacepower on for the nations who think on such things. Recognizing

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[168] Henry H. Arnold and Ira C. Eaker, *Winged Warfare*, 3rd ed. (New York: Funk & Wagnalls Company, 1941); Henry H. Arnold and Ira C. Eaker, *Army Flyer*, 3rd ed. (New York: Harper & Brothers, 1942); Henry H. Arnold and Ira C. Eaker, *This Flying Game*, 3rd ed. (New York: Funk & Wagnalls Company, 1943); Peter R. Faber, “Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower,” in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Phillip S. Meilinger (Maxwell AFB, AL: Air University Press, 1997), 188-189; Dik A. Daso, *Hap Arnold and the Evolution of American Airpower* (Washington, DC: Smithsonian Institution Press, 2000), 297.

[169] US Army Air Forces, *Commanding General Report*, 71-72.

[170] David K. Vaughan, “Hap Arnold’s Bill Bruce Books: Promoting Air Service Awareness in America,” *Air Power History* 40, no. 4 (1993): 43, 49; Faber, “Incubators of American Airpower,” 228n25.

[171] Bowen, “Spacepower and Space Warfare,” 254-259.

[172] Cobb, “Who’s Supporting Space?”, 238.

this fact, this section recalls the coda written by Arnold and Eaker in *Winged Warfare*. The coda, with the score's key adjusted for space, resonates today. "Popular support [for space] cannot be maintained over the long period of time" for a "superior [spacepower]" unless there is a demonstrated "national will" and "universal public determination to have one. [Spacepower] in reality is a national state of mind."[173]

The beguiling nature of analogy caused many theorists to overlook an ancestral theory found in airpower—whose hereditary traits partially obtained in the physical realm of aerospace operations—because of the apparent kinship between the open ocean and outer space. On the other hand, other spacepower theories treated airpower only superficially by viewing theory and targeting concepts as synonymous.

A wholesale adoption of airpower thinking, however, is not wise. Dr. Bruce M. DeBlois, former professor of air and space technology at SAASS, argued that the characteristics of air and space power are different enough to prevent such a bijection between their respective theories.[174] Yet, he admitted, and this section has shown, that there exists an injection from airpower to spacepower thought. Some ideas map from one domain to the other.[175] The physical geographies are distinct, but there is harmony between airminded and spaceminded thinking, especially if both schools of thought remain subordinate to the logic of strategic theory writ large. "Correct thinking is the basis of all successful strategy."[176] The propositions contained herein will not help derive answers formulaically, but they will suggest in which direction those making and executing strategy should go.

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[173] Arnold and Eaker, *Winged Warfare*, 260.

[174] DeBlois, “Ascendant Realms,” 563-565.

[175] One should note the abuse of mathematical language and excuse the author, who as a mathematician, knows better but desires for simplicity to avoid a tangent on the use of set theory terminology.

[176] Arnold and Eaker, *Winged Warfare*, 141.

Anchors Aweigh: Spacepower Sets Sail

"Space is an ocean," according to Dr. Samuel J. Tangredi, Leidos Chair of Future Warfare Studies at the US Naval War College.[177] Tangredi was not speaking metaphorically. Instead, Tangredi argued that rather than viewing space as an extension of the air, it was more appropriate to view space as a vast body like the ocean whose geophysical characteristics warranted a navalist mindset to address future strategic challenges of space.[178] If space and the sea are homeomorphic, strategic environments—Sheldon would beg to differ— then such seapower ideas as competing for the command of the sea, through manipulation and control of sea lines of communication, would apply equally as well in space.[179] Dr. Jeremy Straub, assistant professor of computer science at North Dakota State University, however, believed the analogy was appropriate but incomplete. His 2015 article, "Application of a Maritime Framework to Space: Deep Space Conflict and Warfare Scenario," espoused the view that maritime models apply equally well to deep space, not just near-Earth.[180] Moreover, Ziarnick's theory also addressed space strategy beyond Earth's orbit.[181] Thus, scholars addressed near and deep space, and it seems seapower concepts, as currently applied, cover the entirety of spacepower thought.

Space, however, is practically infinite. The sea is not. From a mathematical perspective, a finite domain cannot cover an infinite range and still be well-defined. Thus, there will be newly discovered qualities of space activity that seapower—or any Earth-bound—theory cannot address. Furthermore, previous mapping of seapower concepts was not exhaustive; scholars failed to map some ideas that presently apply to the space domain. Consequently, this section evaluates

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[177] Tangredi, "Space is an Ocean," 52.

[178] Tangredi, "Space is an Ocean," 53.

[179] Sheldon, "Strategic Analogy," 146, 206, 295-299.

[180] Jeremy Straub, "Application of a Maritime Framework to Space: Deep Space Conflict and Warfare Scenario," *Astropolitics* 13, no. 1 (2015): 65-77.

[181] See Ziarnick, *Developing Space Power*.

seapower thinking and offers propositions that further advance spacepower theory.

Proposition Seven: There is strength in weakness: a fleet-in-being approach is not simply for inferior forces

Admiral Philip Colomb of the English Royal Navy, in his 1690 exposition of the Nine Years' War, coined the term and concept of a fleet-in-being.[182] The term generally conveyed the pursuit of a defensive strategy without sacrificing opportunities to contest for command of the sea actively through: "raiding campaigns, intended to wear away the enemy;" attacking enemy commerce; denying the decisive battle through avoidance; and seeking merely to survive against a stronger fleet.[183] British Army Major General and military theorist, Charles E. Callwell, added that a fleet-in-being must be "a perpetual menace to...the enemy, who cannot tell when a blow may fall, and who is...compelled to retard his operations until that fleet can be...neutralised."[184] Sir Julian Corbett, in his exposition of a defensive strategy, fleshed out the concept of a fleet-in-being, and it was Corbett's concept that John Klein adapted for space with his term "force in being."[185]

Overall, Klein's force-in-being concept accounted well for the strategic environment in space. Namely, he observed the critical fact that, in space, forces-in-being could influence other actors through physical and nonphysical means.[186] While Klein did not explicitly limit a force-in-being approach to a "medium space power," his theory intimated that a superior space force need not employ such an approach.[187] This implicit limitation to lesser-matched space powers

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[182] John B. Hattendorf, "The Idea of a 'Fleet in Being' in Historical Perspective," *Naval War College Review* 67, no. 1 (Winter 2014): 44.

[183] Geoffrey Till, *Seapower: A Guide for the Twenty-First Century* (New York: Routledge, 2012), 173.

[184] Charles E. Callwell, *Military Operations and Maritime Preponderance: Their Relations and Interdependence* (Edinburgh: William Blackwood and Sons, 1905), 203.

[185] Corbett, *Principles of Maritime Strategy*, 209-227; Klein, *Space Warfare*, 122-123.

[186] Klein, *Space Warfare*, 122-123.

[187] Klein, *Space Warfare*, 28, 122-123; Klein, *Understanding Space Strategy*, 124-142.

missed a key adaptation of seapower's fleet-in-being analogy. Dr. Geoffrey Till, Dudley W. Knox Chair for Naval History and Strategy at the US Naval War College, noted that the fleet-in-being approach "is of particular value for a fleet that knows it is inferior, yet "it is by no means restricted to [inferior forces]."[188] A stronger fleet could resort to such an approach in some instances, such as a local "limited defensive."[189] Corbett, importantly, did not exclude such use to inferior forces only. Additionally, Corbett argued that keeping a fleet-in-being is primarily for "avoiding decisive action" until the situation turns favorable and an opportunity for counterattack materializes.[190]

On the seas, and in space, however, opportunity does not come to those who wait. Instead, a fleet-in-being must be "active and vigorous," or as French Navy admiral and theorist, Raoul Castex, noted, a fleet-in-being "must give proof of life" and "act to impose its will to the extent that its means allow. It must take as much initiative as possible, even if nothing decisive results."[191] Note the lack of restrictions concerning relative strength in either Corbett's or Castex's theories. At the risk of banality, fleet-in-being approaches present viable options for superior forces, especially in space. On the sea, if an inferior force decides to retire completely, it allows the enemy to secure "the ulterior object, which is the control of sea communications."[192] Thus, the superior force retains command of the sea without effort. If the inferior force decides to avail itself of a decisive battle, the superior force is unlikely to resort to a fleet-in-being approach since it should attain victory in battle—at least in theory. In essence, rarely would a superior naval force need to resort to a fleet-in-being approach.

In space, however, force size and strength do not automatically convey superiority, and a fleet-in-being approach bears greater relevance. "Intrinsic strength does not give importance, if

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[188] Till, *Seapower*, 173.

[189] Till, *Seapower*, 173. See also Corbett, *Principles of Maritime Strategy*, 106.

[190] Corbett, *Principles of Maritime Strategy*, 211.

[191] Corbett, *Principles of Maritime Strategy*, 212; Castex, *Strategic Theories*, 344.

[192] Corbett, *Principles of Maritime Strategy*, 212.

the position has not strategic value."[193] In a medium wherein "warfare is about the command of space," and "the command of space is about manipulating celestial lines of communication," the ability to control mission-essential orbits, orbital transition points, and choke points enables, if not general and persistent command, then temporary, localized command of "celestial lines of communication."[194] In other words, greater numbers may enable the ability to disperse over a broader area and allow concentration at critical nodes to command lines of communication. Moreover, "a state that has overwhelming spacepower may successfully dissuade another actor from competing militarily in space."[195] Sun Tzu's reminder, however, is appropriate: "Numbers alone confer no advantage. Do not advance relying on sheer military power."[196] Quite importantly, experience shows that overwhelming spacepower has not dissuaded other actors' aggressive actions in space.[197]

Since sheer numerical superiority fails to dissuade aggression, M. V. Smith suggests that a superior spacepower could either resort to asymmetric or violent means and recommends the latter as a force-in-being approach. Yet, while space is contested and competitive—a fact the strategist ignores to their peril—using violent means against uninhabited satellites, even if consistent with "the spirit and intent of the law of armed conflict," would be escalatory.[198] Moreover, depending on the weapon and target type, such actions run antipodal to an actor's aims considering the space debris produced by kinetic attacks. Instead, this work suggests choosing the

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[193] Alfred T. Mahan, *The Influence of Sea Power Upon History, 1660-1783,* 5th ed. (Mineola, NY: Dover Publications, 1987), 373.

[194] Bowen, "Spacepower and Space Warfare," 135-150, 171-180; Klein, *Understanding Space Strategy*, 23-24.

[195] M. V. Smith, "Spacepower and the Strategist," in *Strategy: Context and Adaptation From Archidamus to Airpower,* ed. Richard J. Bailey, James W. Forsyth, and Mark O. Yeisley (Annapolis, MD: Naval Institute Press, 2016), 168.

[196] Sun Tzu, *The Illustrated Art of War,* trans. Samuel B. Griffith (Oxford, England: Oxford University Press, 2005), 192.

[197] Todd Harrison, Kaitlyn Johnson, and Thomas G. Roberts, *Space Threat Assessment 2018* (Washington, DC: Center for Strategic & International Studies, 2018), 1-25.

[198] Smith, "Spacepower and the Strategist," 168.

former of Smith's two options, the asymmetric response as part of a fleet-in-being approach. If overwhelming spacepower cannot dissuade competitors' aggressive actions, perchance using nonphysical, asymmetric means can, without being overtly escalatory. Interestingly, a fleet-in-being approach need not use space assets at all. Indeed, a superior power could use cyberspace to affect a competitor's space network or interfere with overhead image and signal collection processing to deny the aims of an adversary's satellite overflight. Undoubtedly, such actions have the potential to invoke escalated responses, but just as there appears to be a threshold below which aggression is considered "acceptable" in the cyber domain, a similar threshold prevails in space.

Absent active responses to competitors' aggression, the only other potential recourse is to rely on the international community to impose political costs upon aggressors. Arms control and long-awaited international legal regimes and norms, however, have not dissuaded aggressors yet.[199] Nevertheless, open, physical hostility is untenable too. Therefore, a fleet-in-being approach that travails the middle ground may be most appropriate.

As in seapower theory, the space actor who retires into harbor, who does not react to aggression, effectively cedes command of celestial lines of communication to its competitor. A space actor employing a fleet-in-being approach must compete actively since "the mere existence of such a fleet" may not impress "those who [choose] to act in spite of the fleet-in-being."[200] In other words, a superior spacepower cannot rely on size and strength alone. It must give "proof of life" by disputing command, through asymmetric means, knowing that command is rarely absolute.[201] "[I]t is as a threat, that the fleet-in-being is chiefly formidable," but it is only through vigorous action that the fleet can "potentially serve as a temporary deterrent in one area, if for a

[199] The Outer Space Treaty provides the sole, internationally recognized and agreed-to legal framework for space behavior. Since its inception, however, many have advocated for a better, more detailed framework only to find hopes left unfulfilled. See Colby, *Sanctuary to Battlefield*, 15-16.

[200] Castex, *Strategic Theories*, 343.

[201] Corbett, *Principles of Maritime Strategy*, 103-105, 166, 224; Castex, *Strategic Theories*, 344.

very limited time."[202] Without such vigor, adversaries learn that within the shadows of such a threat, there exists no substance to incur upon them costs or induce in them caution.[203]

Proposition Eight: The concept of space blocking, for now, is geocentric and may be less relevant in the future

Like the previous proposition, this eighth proposition corrects existing spacepower thought. Theorist John Klein offered significant contributions to the body of spacepower theory with his adaptation of the maritime concept of blocking. As noted above, command of space is about control of celestial lines of communication, and one such way to dispute command is through blocking key positions and communications.[204] However, as Bleddyn Bowen noted, "the strategic analogy of blockade can be taken too far."[205] To wit, in space, blocking celestial lines of communication is inherently geocentric—not solely in effect, which follows from this work's third proposition, but in theoretical conception as well. Importantly, a geocentric conception, however, may be less relevant in the future.

In *Space Warfare*, Klein discussed the various considerations for space blockades, determining that while the naval analogy is imperfect, "the strategic concept of blocking is fundamentally different from the strategy of the naval blockade."[206] That is, his theory admitted the intricacies of a naval blockade are inherently different from blocking celestial lines of communication. What is noteworthy, however, is that blocking—at least in theory—is a strategic concept worth considering amid the strategist's tool chest. In the Corbettian fashion, Klein distinguished between close and distant blocking, where "close blocking is obstructing or interfering with space communications within the proximity of uplinks, downlinks, crosslinks,

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[202] Alfred Thayer Mahan quoted in Callwell, *Maritime Preponderance*, 219; Hattendorf, "Fleet in Being," 57.

[203] Callwell, *Maritime Preponderance*, 219; Brodie, *Naval Strategy*, 116.

[204] Klein, *Space Warfare*, 91-99.

[205] Bowen, "Spacepower and Space Warfare," 177.

[206] Klein, *Space Warfare*, 98.

launching facilities, or any hubs of activity."[207] "Distant blocking is the denial or disruption of space communications far away from the hubs of distribution, but still along celestial lines of communication."[208] Bowen noted, however, "celestial lines of communication may move or change their composition, so an analogy of a...blockade may not be particularly apt."[209]

Klein's space blocking concept, however, revolved around the space systems situated on-Earth or on-orbit and focused on blocking's terrestrial effects. In other words, Klein's blocking is geocentric. On the sea, however, close versus distant blocking relates to the proximity to the enemy—it is enemy-centric.[210] Importantly, Klein overlooked that many space systems today are distributed and redundant, thus obviating the ability to block by negating a single hub as can be done in the maritime domain. Notwithstanding such an admission, Dr. Bernard Brodie observed that distant naval blockades offer no "blockade at all."[211] At best, a distant blockade threatens the enemy with punishment and interception, and it can only protect in so far as intercepting the enemy is possible.[212] Finally, Klein's concept involved the physical measure of distance from the Earth. In space, however, the meaning of distance becomes less clear. If space blocking includes blocking enemy lines of communication, and such communications rely exclusively on information transmissions at light-speed, distance is largely irrelevant in Klein's geocentric scenario. Moreover, the combination of hubless space systems and the tyranny of orbital mechanics and the time and fuel restrictions they impose, suggest that Klein's adaptation of maritime blocking is not appropriate as explicated.

Even if future technology decreases the experienced vastness of space, Klein's description still fails. In that case, geocentrism would no longer be appropriate since, with such technology,

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[207] Klein, *Space Warfare*, 94.

[208] Ibid., 95.

[209] Bowen, "Spacepower and Space Warfare," 175.

[210] Brodie, *Naval Strategy*, 98.

[211] Ibid., 96.

[212] Ibid., 96-97.

one could posit that humankind has expanded beyond the Earth. Consequently, close or distant blocking would more closely parallel the maritime analog as being enemy-centric than it does presently because a space power could harness technology to impose an enduring, close blockade, or travel at enough speed to respond as part of a distant cover.

Klein's, however, work is helpful; "'space blockade's thinking in terms of denying lines of communication at points of convergence or highly valuable celestial lines of communications is still useful."[213] However, analysis of Klein's conception of celestial blocking shows the direct mapping of maritime terminology to space invites confusion over what constitutes close versus distant. Moreover, Klein's conceptual adaptation for space is still Earth-centric. For the practitioner of strategy, clarity is paramount. "Much of what appears to be wise and indeed is prudent as high theory is unhelpful to the poor warrior who actually has to do strategy."[214] Importantly, future space conflict may require denying an ability to use lines of communication, whether close or distant to the enemy or near or far from the Earth.

Proposition Nine: Spacepower strategy is sequential and cumulative

Whereas the previous proposition offered a correction to Klein's concept of space blocking, this proposition builds on a corollary to Proposition Five and Klein's adaptation of Rear Admiral J. C. Wylie's cumulative strategy approach. To that end, Wylie, a US Navy officer and military theorist, developed two methods to executing strategy: a sequential and cumulative approach. Wylie offered that in a sequential strategy, the overarching design contained a "series of discrete steps," foreknown to the strategist, whose results were predictable.[215] However, "there is another way to prosecute a war."[216] This other way entails an "entire pattern...made up

[213] Bowen, "Spacepower and Space Warfare," 177.

[214] Gray, "Why Strategy is Difficult," 7.

[215] Joseph C. Wylie, *Military Strategy: A General Theory of Power Control* (Annapolis, MD: Naval Institute Press, 1989), 22-23.

[216] Ibid., 23.

of a collection of lesser actions" that are not sequentially interdependent.[217] Despite the distinction between sequential and cumulative strategies, they are not mutually exclusive but are "usually interdependent in their strategic result."[218]

Wylie recognized that cumulative strategy was a characteristic of seapower, and because of the similarities between sea and space domains, Klein applied the concept to spacepower.[219] Klein suggested that while the idea of a cumulative strategy applies to all space actors, he considered the concept to be a likely "centerpiece" for emerging space powers, mainly because emerging powers often cannot employ a sequential strategy at the outset.[220] Still, both Wylie and Klein noted that the "strength of the cumulative strategy" factored considerably into the success of its sequential sibling.[221]

The above assertion leads to this work's ninth proposition. Put simply, it is the accumulation of spacepower, through cumulative strategy—that is, "the less perceptible minute accumulation of little items piling" up that reach critical mass—that enables a sequential strategy to succeed.[222] With perspective, one sees that the dyad of sequential and cumulative strategies nest within the conception of a general strategy as exposited in Proposition Five. That is, the combination of cumulative and sequential aspects of space strategy wield all forms of spacepower, as demanded by general strategy. Moreover, spacepower is indivisible and thus should be wielded as part of a general strategy, wherein spacepower, in all its forms, helps accomplish policy's aims. Thus, it is a false dilemma to choose cumulative or sequential strategies within a space strategy. The student of strategy employs both.

Furthermore, both cumulative and sequential strategies look outward, to adjudge the

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[217] Wylie, *Military Strategy*, 23.

[218] Ibid., 24-25.

[219] Klein, *Understanding Space Strategy*, 155-160.

[220] Ibid., 155, 159.

[221] Wylie, *Military Strategy*, 25; Klein, *Understanding Space Strategy*, 156.

[222] Wylie, *Military Strategy*, 24.

environment and adversaries; however, cumulative strategy exhibits an inward-tending quality as well. Cumulative space strategies cultivate the capability for future sequential strategies. Such cultivation requires forethought and forbearing care. Mahan exhorted the United States to take seapower seriously over a century ago. He claimed, "in such anticipation, such forethought...lies the best hope of the best solution."[223] Spacepower is grown, as Klein noted, by "instilling national pride" and developing a "technically educated workforce."[224] Additionally, a nation must " 'strike down roots' deep into the heart of its country...to lay the foundation...to build" spacepower, and make space "part of its national character."[225] In other words, spacepower accretes gradually, through careful cultivation of space capability founded upon a nation's spacemindedness as delineated in Proposition Six.

Certainly, an actor may wield spacepower within a sequential strategy. One need only look at discrete events like the Chinese anti-satellite test in 2007. The power reserve from which sequential strategy draws, however, is fashioned by an inward-looking, cumulative strategy that seeks to grow spacepower for the future. Conversely, success with sequential strategies makes available opportunities—new pastures—to harvest spacepower. Cumulative and sequential space strategies are, much like spacepower, essentially indivisible, nestled under the general employ of a broad, holistic strategy.

Conclusion

"Where is the Mahan for the final frontier?"[226] As Brian DeBlois suggested, perhaps there cannot be one without a proper environment to incubate such ideas.

That is, one cannot build space power theory and doctrine in general upon

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[223] Alfred T. Mahan, *The Interest of America in Sea Power, Present and Future* (1897; repr., Boston: Little, Brown, and Company, 1918), 177.

[224] Klein, *Understanding Space Strategy*, 160-161.

[225] Trevor Brown, "Space and the Sea: Strategic Considerations for the Commons," *Astropolitics* 10, no. 3 (2012): 239-240. See the maritime analog in Mahan, *Influence of Sea Power*, 50-58.

[226] Gray, "Influence of Space Power," 307.

> airpower theory and doctrine...space power clearly requires fundamental, bottom-up, theoretical and doctrinal development. The most conducive environment for such development remains a separate space corps or service.[227]

Conversely, John B. Sheldon, believed "the making of a theory of space power...is one that will take place over a long period of time involving many people...for this reason alone, the development of a theory of space power will always be a team effort that builds on and corrects that which has gone before...[thus] there can be no Mahan for the final frontier."[228]

Perhaps having a comprehensive theory for space in the vein of Mahan is not required. In the twenty years since DeBlois's words, many theorists provided helpful and insightful thoughts on spacepower, its meaning, and its use. Still, analogical reasoning is imperfect. The absence of a comprehensive, bottom-up theory, however, hints at the implausibility of the task to build one, especially if theory-building occurs in a relative vacuum of space experience.

Nevertheless, as terrestrial "political-cultural baggage" makes its way into the celestial domain, one cannot help but conclude that until humanity makes space a permanent home, there will always be strategic theory's terrestrial vestiges present.[229] People may tend to forget the past, but strategy continues on as part of the human condition.[230] Even if spacepower theory requires a clean slate, adept thinking need not be restricted to a separate military service, especially if as this

monograph claims, spacepower entails the full complement of instruments of power. Thus, Luttwak's words are still appropriate when he stated, "the way of strategy is not given to all—and certainly not to those who would approach its truths from the perspective of a narrow-minded

[227] DeBlois, "Ascendant Realms," 564-565.

[228] Sheldon, "Strategic Analogy," 328-329.

[229] Bowen, "Spacepower and Space Warfare," 157, 181, 239.

[230] B. H. Liddell Hart, *Why Don't We Learn From History?,* Revised ed. (New York: Hawthorn Books Inc., 1971); Colin S. Gray, *The Future of Strategy* (Cambridge, England: Polity, 2015), 11-14, 22.

bureaucratic interest."[231]

To that end, this monograph has approached the truths of spacepower while looking beyond bureaucratic or even military interests. Perhaps it is ironic, that in this reevaluation of airpower and seapower theories, seven of the above propositions speak to spacepower under a broader strategic banner. Furthermore, all six airpower-based precepts exhibit panoramas more extensive than mere military vantages. Additionally, this work uncovered two maritime-based propositions whose applications rest solely within the military domain, namely the concepts of space fleets-in-being and blocking celestial lines of communication. Recall that previous theorists asserted that airpower theory's shortcoming "is that it primarily has a military focus."[232] Despite this juxtaposition of broad versus military-focused strategic concepts, previous theoretical concepts still prove useful. The propositions contained above build upon such concepts and place in proper orbital position, new ideas that revolve around the central truths of strategic theory by defining what spacepower is; categorizing characteristics of spacepower; explaining spacepower's effects on humanity's experience; connecting it to other fields of strategic thought; and anticipating the future of human space activity.[233] While the ideas contained herein are not exhaustive nor comprehensive, this reevaluation of strategic antecedents of spacepower has hopefully advanced theory by acting similar to a rocket booster, gathering velocity for a future, celestial rendezvous with the next spacepower theorist.

[231] Edward N. Luttwak, *On the Meaning of Victory: Essays on Strategy* (New York: Simon & Schuster, 1986), 103.

[232] Klein, *Space Warfare*, 18.

[233] Winton, “An Imperfect Jewel,” 854-858.

Bibliography

Air Command and Staff College (ACSC) Space Research Electives Seminars. *AU-18 Space Primer*. Maxwell AFB, AL: Air University Press, 2009.

Arnold, Henry H. "Air Power for Peace." *National Geographic Magazine*, February 1946, 137-194.

———. *Global Mission*. New York: Harper, 1949.

Arnold, Henry H. and Ira C. Eaker. *Army Flyer*. 3rd ed. New York: Harper & Brothers, 1942.

———. *This Flying Game*. 3rd ed. New York: Funk & Wagnalls Company, 1943.

———. *Winged Warfare*. 3rd ed. New York: Funk & Wagnalls Company, 1941.

Biddle, Tami Davis. *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas About Strategic Bombing, 1914-1945*. Princeton, NJ: Princeton University Press, 2004.

Bowen, Bleddyn E. "Spacepower and Space Warfare the Continuation of Terran Politics by Other Means." PhD diss., Aberystwyth University, 2015.

Brodie, Bernard. *A Guide to Naval Strategy*. Princeton, NJ: Princeton University Press, 1944.

Brown, Trevor. "Space and the Sea: Strategic Considerations for the Commons." *Astropolitics* 10, no. 3 (2012): 234-247.

Brugioni, Dino A. *Eyes in the Sky: Eisenhower, the CIA and Cold War Aerial Espionage*. Annapolis, MD: Naval Institute Press, 2010.

Burroughs, William. *This New Ocean: The Story of the First Space Age*. New York: Random House, 1998.

Caldwell, Cy. *Air Power and Total War*. New York: Coward-McCann Inc., 1943.

Callwell, Charles E. *Military Operations and Maritime Preponderance: Their Relations and Interdependence*. Edinburgh: William Blackwood and Sons, 1905.

Castex, Raoul. *Strategic Theories*. Edited and Translated by Eugenia C. Kiesling. Annapolis, MD: Naval Institute Press, 1994.

Clausewitz, Carl von. *On War*. Edited and Translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1989.

Coates, Christopher J. "Airmindedness: An Essential Element of Air Power." *The Royal Canadian Air Force Journal* 3, no. 1 (Winter 2014): 70-84.

Cobb, Wendy N. Whitman. "Who's Supporting Space Activities? An 'Issue Public' for US Space Policy." *Space Policy* 27, no. 4 (2011): 234-239.

Colby, Elbridge. *From Sanctuary to Battlefield: A Framework for a U.S. Defense and Deterrence Strategy in Space*. Washington, DC: Center for a New American Strategy, 2016.

Corbett, Julian. *Some Principles of Maritime Strategy*. Annapolis, MD: Naval Institute Press, 1988.

Creveld, Martin Van. *The Age of Airpower*. New York: PublicAffairs, 2011.

Daso, Dik A. *Hap Arnold and the Evolution of American Airpower*. Washington, DC: Smithsonian Institution Press, 2000.

Dawson, Linda. *War in Space: The Science and Technology behind Our Next Theater of Conflict*. Chichester, England: Praxis, 2018.

DeBlois, Bruce M. "Ascendant Realms: Characteristics of Airpower and Space Power." In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Phillip S. Meilinger, 529-578. Maxwell AFB, AL: Air University Press, 1997.

DeBlois, Bruce M., ed. *Beyond the Paths of Heaven.* Maxwell AFB, AL: Air University Press, 1999.

Dolman, Everett C. *Astropolitik: Classical Geopolitics in the Space Age*. London: Frank Cass, 2002.

———. "Geostrategy in the Space Age." In *Geopolitics: Geography and Strategy*, edited by Colin S. Gray and Geoffrey Sloan, 83-106. London: Frank Cass, 1999.

———. "New Frontiers, Old Realities." *Strategic Studies Quarterly* 6, no. 1 (2012): 78-96.

———. *Pure Strategy*. New York: Frank Cass, 2005.

Douhet, Giulio. *The Command of the Air*. Tuscaloosa: University of Alabama Press, 2009.

Ehlers, Robert S., Jr. *The Mediterranean Air War: Airpower and Allied Victory in World War II*. Lawrence, KS: University Press of Kansas, 2015.

Faber, Peter R. "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower." In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Phillip S. Meilinger, 183-238. Maxwell AFB, AL: Air University Press, 1997.

Foulois, Benjamin D. and C.V. Glines. *From the Wright Brothers to the Astronauts: The Memoirs of Major General Benjamin D. Foulois*. New York: McGraw Hill, 1968.

Fritzsche, Peter. *A Nation of Fliers: German Aviation and the Popular Imagination*. Cambridge: Harvard University Press, 1992.

Gallagher, Nancy. "Space Governance and International Cooperation." *Astropolitics* 8, no. 2-3 (December 2010): 256-279.

Gray, Colin S. *Airpower for Strategic Effect*. Maxwell AFB, AL: Air University Press, 2012.

———. *Always Strategic: Jointly Essential Landpower*. Carlisle Barracks, PA: Strategic Studies Institute, 2015.

———. *Categorical Confusion? The Strategic Implications of Recognizing Challenges Either as Irregular or Traditional*. Carlisle Barracks, PA: Strategic Studies Institute, 2012.

———. *The Future of Strategy*. Cambridge, England: Polity, 2015.

———. "Inescapable Geography." In *Geopolitics: Geography and Strategy*, edited by Colin S. Gray and Geoffrey Sloan, 161-177. London: Frank Cass, 1999.

———. "The Influence of Space Power Upon History." *Comparative Strategy* 15, no. 4 (1996): 293-308.

———. *Understanding Airpower: Bonfire of the Fallacies*. Maxwell AFB, AL: Air University Press, 2009.

———. *Weapons Don't Make War: Policy, Strategy, and Military Technology*. Lawrence, KS: Univ Press of Kansas, 1993.

———. *Weapons for Strategic Effect: How Important is Technology?* Maxwell AFB, AL: Air University Press, 2001.

———. "Why Strategy is Difficult." *Joint Force Quarterly*, no. 22 (3rd Quarter 1999): 7-12.

Hardin, Garrett. "The Tragedy of the Commons." *Science* 162 (December 13, 1968): 1243-1248.

Harding, Robert C. *Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier*. New York: Routledge, 2012.

Harrison, Todd, Kaitlyn Johnson, and Thomas G. Roberts. *Space Threat Assessment 2018*. Washington, DC: Center for Strategic & International Studies, 2018.

Harter, Mark E. "Ten Propositions Regarding Space Power: The Dawn of a Space Force." *Air & Space Power Journal* 20, no. 2 (Summer 2006): 64-78.

Hattendorf, John B. "The Idea of a 'Fleet in Being' in Historical Perspective." *Naval War College Review* 67, no. 1 (Winter 2014): 43-60.

Hayden, Dale L. "Air-Mindedness." *Air & Space Power Journal* 22, no. 4 (2008): 44-45.

Heginbotham, Eric, Michael Nixon, Forrest E. Morgan, Jacob L. Heim, Jeff Hagen, Sheng Li, Jeffrey Engstrom et al. *The US-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996-2017*. Santa Monica, CA: RAND Corporation, 2015.

Heuser, Beatrice. *The Evolution of Strategy: Thinking War From Antiquity to the Present*. Cambridge: Cambridge University Press, 2010.

Ikenberry, G. John. *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars*. Princeton, NJ: Princeton University Press, 2000.

Johnson-Freese, Joan. *Space as a Strategic Asset*. New York: Columbia University Press, 2007.

Klein, John J. *Space Warfare: Strategy, Principles and Policy*. Hoboken, NJ: Routledge, 2006.

———. *Understanding Space Strategy: The Art of War in Space*. London: Routledge, 2019.

Larned, Robert E. *1994 Air and Space Doctrine Symposium*. Maxwell AFB, AL: Air University Press, 1994.

Lewis, John S. *Mining the Sky: Untold Riches From the Asteroids, Comets, and Planets*. Reading, MA: Helix Books, 1996.

Liddell Hart, B. H. *Why Don't We Learn From History?* Revised ed. New York: Hawthorn Books Inc., 1971.

Lupton, David E. *On Space Warfare*. Maxwell AFB, AL: Air University Press, 1998.

Luttwak, Edward N. *On the Meaning of Victory: Essays on Strategy*. New York: Simon & Schuster, 1986.

———. *Strategy: The Logic of War and Peace*. Cambridge, MA: Belknap Press, 2001.

Magee, John Gillespie, Jr. "High Flight." 1941.

Mahan, Alfred T. *The Influence of Sea Power Upon History, 1660-1783*. 5th ed. Mineola, NY: Dover Publications, 1987.

———. *The Interest of America in Sea Power, Present and Future*. 1897. Reprint, Boston: Little, Brown, and Company, 1918.

Mantz, Michael R. *The New Sword: A Theory of Space Combat Power*. Maxwell AFB, AL: Air University Press, 1995.

Meilinger, Phillip S. *Airmen and Air Theory*. Maxwell AFB, AL: Air University Press, 2001.

———. "Giulio Douhet and the Origins of Airpower Theory." In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Phillip S. Meilinger, 1-40. Maxwell AFB, AL: Air University Press, 1997.

Mendenhall, Elizabeth. "Treating Outer Space Like a Place: A Case for Rejecting Other Domain Analogies." *Astropolitics* 16, no. 2 (2018): 97-118.

Mitchell, William. *Winged Defense*. 1925. Reprint, Tuscaloosa: University of Alabama Press, 2009.

Moltz, James C. *Crowded Orbits: Conflict and Cooperation in Space*. New York: Columbia University Press, 2014.

———. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. 2nd ed. Stanford, CA: Stanford Security Studies, 2011.

Mueller, Karl P. "Examining the Air Campaign in Libya." In *Precision and Purpose: Airpower in the Libyan Civil War*, edited by Karl P. Mueller, 1-10. Santa Monica, CA: RAND Corporation, 2015.

O'Brien, Phillips Payson. *How the War Was Won: Air-Sea Power and Allied Victory in World II.* Cambridge: Cambridge University Press, 2015.

Overy, Richard J. *The Air War: 1939-1945*. Washington, DC: Potomac Books, 2005.

———. *Why the Allies Won*. New York: W. W. Norton & Company, 1997.

Owen, Robert C. "The US Experience: National Strategy and Campaign Support." In *Precision*

and Purpose: Airpower in the Libyan Civil War, edited by Karl P. Mueller, 69-106. Santa Monica, CA: RAND Corporation, 2015.

Pfaltzgraff, Robert L., Jr. "International Relations Theory and Spacepower." In *Towards a Theory of Spacepower*, edited by Peter L Hays and Charles D Lutes, 29-44. Washington, DC: National Defense University Press, 2007.

de Seversky, Alexander P. *Victory Through Air Power*. New York: Simon and Schuster, 1942.

Sheldon, John B. "Reasoning By Strategic Analogy: Classical Strategic Thought and the Foundations of a Theory of Space Power." PhD diss., University of Reading, 2005.

Smith, M. V. "Spacepower and the Strategist." In *Strategy: Context and Adaptation From Archidamus to Airpower*, edited by Richard J. Bailey, James W. Forsyth, and Mark O. Yeisley, 157-185. Annapolis, MD: Naval Institute Press, 2016.

———. *Ten Propositions Regarding Spacepower*. Maxwell AFB, AL: Air University Press, 2002.

Straub, Jeremy. "Application of a Maritime Framework to Space: Deep Space Conflict and Warfare Scenario." *Astropolitics* 13, no. 1 (2015): 65-77.

Swenson, Loyd S., James M. Grimwood, and Charles C. Alexander. *This New Ocean: A History of Project Mercury*. Washington, DC: NASA, 1966.

Tangredi, Sam J. "Space is an Ocean." *Proceedings* 125, no. 1 (January 1999): 52-53.

Tedder, Arthur W. *Air Power in War*. 1947. Reprint, Tuscaloosa: University of Alabama Press, 2010.

Till, Geoffrey. *Seapower: A Guide for the Twenty-First Century*. New York: Routledge, 2012.

Trew, Jason M. "Rescuing Icarus." *Air & Space Power Journal* 33, no. 2 (Summer 2019): 48-60.

Tzu, Sun. *The Illustrated Art of War*. Translated by Samuel B. Griffith. Oxford, England: Oxford University Press, 2005.

United Nations. Office of Legal Affairs. *Convention on the Law of the Sea.* New York: United Nations, 1982. Accessed October 2, 2019. https://www.un.org/Depts/los/convention _agreements/texts/unclos/unclos_e.pdf.

———. Office for Outer Space Affairs. *United Nations Treaties and Principles on Outer Space, Related General Assembly Resolutions and Other Documents.* New York: United Nations, 2015.

US Army Air Forces. *Third Report of the Commanding General of the Army Air Forces to the Secretary of War.* Baltimore: Schneidereith & Sons, 1945.

US Congress. *Congressional Record.* 77th Cong., 2nd sess., 1942. Vol. 88, pt. 3.

US Department of the Air Force, USAF. *Basic Doctrine*. Maxwell AFB, AL: Air University Press, 2015.

Vaughan, David K. "Hap Arnold's Bill Bruce Books: Promoting Air Service Awareness in

America." *Air Power History* 40, no. 4 (1993): 43-49.

Webb, James E., and Robert S. McNamara, Jr. *Recommendations for Our National Space Program: Changes, Policies, and Goals*. Washington, DC: White House, May 8, 1961.

Willmott, H. P. *When Men Lost Faith in Reason: Reflections on War and Society in the 20th Century*. Westport, CT: Praeger, 2002.

Winton, Harold R. "An Imperfect Jewel: Military Theory and the Military Profession." *Journal of Strategic Studies* 34, no. 6 (2011): 853-877.

Wohl, Robert. *A Passion for Wings: Aviation and the Western Imagination, 1908–1918*. New Haven: Yale University Press, 1994.

Wylie, Joseph C. *Military Strategy: A General Theory of Power Control*. Annapolis, MD: Naval Institute Press, 1989.

Ziarnick, Brent. *Developing National Power in Space: A Theoretical Model*. Jefferson City, NC: McFarland, 2015.