From Aerospace to Cyberspace: The Evolution of Domains of Warfare

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

Bryan James Nakayama

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
Doctor of Philosophy

Ronald Krebs

February, 2018

Acknowledgements

Graduate school and the writing of this dissertation was a long and strange journey. Such a journey was only possible because of my colleagues in the Department of Political Science at the University of Minnesota—Twin Cities, who were instrumental in keeping me on course as well as happy, healthy, and sane. That being said, I by no means wish to diminish the support of those outside of the Department, I owe them the same debt of gratitude. In that regard, it is an impossible task to properly thank let alone acknowledge the support that they have provided me over the last six years. It would be an understatement to say that I could not have completed graduate school nor written the dissertation without them. Given these various and sundry debts, this accounting will necessarily be incomplete and unable to capture the full depth of my gratitude.

Ronald Krebs, my advisor, deserves special thanks for guiding and supporting me through the various hoops of graduate school and the dissertation process. With mirth, generosity, and a sharp eye he was able to shape my impulsive and wandering curiosity into the following dissertation. In particular, I would like to thank Ron for constantly pushing me to see the forest for the trees, suffering through my rambling, and keeping me on track over the last four years. It would be an understatement to say that without his help I would not have completed the program or the dissertation. In this regard, Nancy Luxon also deserves a special thanks for guiding me through my first two years of graduate school. Her generous spirit and keen focus helped turn me from a flailing student into a budding scholar. My committee also provided crucial support at various points for this project, Bud Duvall pushed me to consider the broader context of warfare and dynamics of power, Mark Bell served as a challenging theoretical foil, and Hiromi Mizuno pushed me to think about the social effects of technology.

My journey to writing this dissertation did not begin in graduate school, and so I also give gratitude to the various professors at Reed College who helped me in the nascent stages

of my intellectual journey. First among them is Jeanne Morefield, my thesis advisor, who helped me hone my scholarly instincts and pushed me to follow my passions. Darius Rejali also deserves special credit as he taught me about the basics of qualitative research. Finally, Antina von Schnitzler, who taught me how to trace the political consequences of ideas, has perhaps had the greatest subterranean influence on the genesis of this project.

Additionally, I could not have written this without the support of my fellow graduate students. They served as sounding boards, intellectual partners, editors, office-mates, conspirators, and most importantly friends. I owe an embarassing amount of my intellectual development to the errant and meandering conversations we had in the office and out. The members of Ronald Krebs' dissertation group—Jen Spindel, Robert Ralston, Elif Kalaycioglu, Tracey Blasenheim, and Florencia Montal—also deserve thanks for reading various chapter drafts and providing trenchant and probing questions and comments. Other graduate students who deserve acknowledgement are: David Temin, Charmaine Chua, Chase Hobbs-Morgen, Maria-Jose Mendez, Elena Gambino, Adam Dahl, and Brooke Coe; all of whom buoyed my spirits and through countless conversations helped shape me and this project.

Crucial financial support in the form of fellowships and research funding also came from the Departmenf of Political Science, University of Minnesota—Twin Cities. The original archival research conducted for this project could not have occurred without the Department's generosity. Of course, this research also could not have happened without the help of the wonderful archivists and managers of the Library of Congress Manuscripts Division, NASA Historical Office, and Air Force Historical Research Association.

While a product of and for the academe, this dissertation also could not have happened without the support of friends in Minneapolis and elsewhere. Erin Moore deserves special credit for proofreading the final draft on short notice. Amy Goldsmith—one of my oldest and best friends—through good and bad kept me company on Skype over the last six years. Godfre Leung and Alex Alisauskas were wonderful neighbors who provided me encouragement, career advice, and morale support. Anna Seaberg, who was my roommate and friend for most of the dissertation, deserves a special thanks for suffering through the incessant pacing, excited erruptions, and long-winded rambling which are central to my writing process. Finally, Anna Hendrickson deserves particular recognition for keeping me sane and on track as I finished the dissertation. Her generous spirit, mirth, and approach to life has made happy in ways I could not have imagined. Thank you.

Finally, none of this would have been possible without my family. To my mother I owe my political and moral sensisibility. To my father I owe my unabiding and expansive curiosity. What they gave me were foundational to the formation of this project.

Dedication

To those fighting for a world free of suffering.

Abstract

In this dissertation I explain how military domainsair, land, sea, space, and cyberspacedevelop. The military domain, I aver, is a fundamental organizing category employed by states and their militaries to distinguish between suites of technological capabilities (ships vs planes) and ways of warfare (blockades vs strategic bombardment.) I argue that the development of military domains are the consequence of advocates, inspired by technological change, developing and working to realize a new theory of warfare within a military bureaucracy. These advocates argue that the newly enabled domain provides new ways of waging strategic warfare. However, not all attempts to develop a domain for strategic warfare are successful, and I argue that the success of a domain project is the function of three intervening variables: senior leader- ship interest, interservice rivalry, and civilian intervention. Utilizing original archival research, I explain these patterns of development across three case studies: the development of air, space, and cyberspace within the United States military. Through these case studies I demonstrate that the beliefs developed about the relationship between the future of technology and warfare are consequential for the development of military capabilities and the structure of the international security environment. Explaining the contingent process by which military domains develop, I argue, is critical to understanding the future of conflict in an age of rapid technological change.

Contents

List of Figures

List of Abbreviations

ABM	Anti-Ballistic Missile
ADC	Air Defense Command
AEF	American Expeditionary Forces
AFSC	Air Systems Command
AIA	Air Intelligence Agency
ARDC	Air Research and Development Command
ARPA	Advanced Research and Projects Agency
ARPANET	Advanced Research and Projects Agency Network
ASTS	Air Service Tactical School
BMD	Ballistic Missile Defense
C2	Command and Control
CIA	Central Intelligence Agency
CNA	Computer Network Attack
CND	Computer Network Defense
CNE	Computer Network Exploitation
CNO	Computer Network Operations
CSS	Central Security Service
DARPA	Defense Advanced Research Projects Agency
DEW	Directed Energy Weapon
DIRNSA	Director NSA
DNI	Director of National Intelligence
DoD	Department of Defense
EW	Electronic Warfare

GHQ-AF	General Headquarters-Air Force
ICBM	Intercontinental Ballistic Missile
IOTC	Information Operations Technologies Center
IRBM	Intermediate Range Ballistic Missile
IW	Information Warfare
JCS	Joint Chiefs of Staff
JFCC-NW	Joint Functional Component Command-Network Warfare
JIC	Joint Intelligence Center
JSSG	Joint Special Studies Group
JTF-CND	Joint Task Force-Computer Network Defense
JTF-CNO	Joint Task Force-Computer Network Operations
MAD	Mutually Assured Destruction
MOL	Manned Orbiting Laboratory
MOP	Memorandum of Policy
NASA	National Aeronautics and Space Administration
NSA	National Security Agency
NSC	National Security Council
NSPD	National Security Presidential Directive
OPSEC	Operational Security
ORDCIT	Army Ordnance/California Institute of Technology
PSYOP	Psychological Operations
RMA	Revolution in Military Affairs
SAC	Strategic Air Command
SCE	Service Cryptologic Element
SDI	Strategic Defense Initiative
SIGINT	Signals Intelligence
STO	Special Technical Operation
TCP/IP	Transmission Control Protocol/Internet Protocol

Chapter 1

Introduction

The relationship between technology and warfare is intimate, the basic activities of warfare—fighting and dying—have hinged on the use of implements for most of recorded human history. But this connection is not just a matter of cannons to fire, battleships to sail, and swords to slice; technology also influences how war is conceived and conducted. Martin van Creveld, in *Technology and War*, provides a comprehensive account of the many facets of this relationship:

> The causes that lead to wars and the goals for which they are fought; the blows with which campaigns open and the victories with which they (sometimes) end; the relationship between the armed forces and the societies that they serve; planning and preparation and execution and evaluation; operations and intelligence and organization and supply; objectives and methods and capabilities and missions; command and leadership and strategy and tactics; and even the very conceptual framework adopted by our brains in order to think about war and its conduct—all are and will be affected by technology.[1]

What Creveld invites us to see is that the set of relationships between technology and war is not a matter of instrumentalization, rather they are intertwined. In this project I seek to explain a subset of this multifaceted relationship: how technology influences the conceptual frameworks of warfare. Specifically, I develop an argument over how technological change impacts the conceptual underpinnings of *where* wars are fought. Of course, war is fought between states

1. Martin Van Creveld, *Technology and War: From 2000 B.C. to the Present* (New York, New York: Free Press, 1991), 311

and other social collectivites in the world, but the way that a navy fights wars on the sea is fundamentally different from how an air force fights in the air.

This is not to argue that war and ways of war are purely a function of technology. War is fundamentally a social and political process as the oft-repeated Clausewitzian aphorism reminds us "war is the continuation of politics with other means."[2] The nature of belligerent violence between social collectivities and what ends inspire that violence is neither static nor determined. What is valued and why, what is targeted and why, who kills and who dies, and how violence is employed is a function of the contingency of human sociality. Thus, in this project I do not seek to reify technology as a deterministic force that reshapes warfare. Rather, I seek to understand how the social imagination of warfare is inspired by technological change to produce new domains of warfare—a foundational spatial category of military perception.

1.1 Domains of Warfare

> The invention of military technology occurs simultaneously with the invention of a space to be defended and secured, invaded and colonised, weaponised and commercialised.
> —Natalie Bormann[3]

> The first reality about new domains is that they are not self-defining.
> —William M. Nolte[4]

In 1996 John Perry Barlow, an Internet activist, published "A Declaration of the Independence of Cyberspace." Writing from the perspective of the users of the nascent Internet, he warned politicians that "You do not know us, nor do you know our world. Cyberspace does not lie within your borders. Do not think you can bulid it, as though it were a public construction project.

2. Carl von Clausewitz, *On War* (Princeton, New Jersey: Princeton University Press, 1989), 69; See also: Immanuel Kant, "Perpetual Peace: A Philosophical Sketch," in *Kant: Political Writings*, ed. H.S. Reiss (New York, New York: Cambridge University Press, 1991), 93–130; Thomas Hobbes, *Leviathan*, ed. C.B. MacPherson (New York, New York: Penguin, 1982); Jean-Jacues Rousseau, "The State of War," in *The Basic Political Writings*, 2nd, ed. Donald A. Cress (Indianapolis, Indiana: Hackett, 2011), 253–255; Thucydides, *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War*, ed. Robert B. Strassler (New York, New York: Touchstone, 1998)

3. Natalie Bormann, "Introduction," in *Securing Outer Space: International Relations Theory and the Politics of Space*, ed. Natalie Bormann and Michael Sheehan (London, United Kingdom: Routledge, 2009), 8

4. William M. Nolte, "Anticipating Cyberspace Security: NSA's Experience 1992-1997," *Cryptologic Quarterly*, 2012, 28

You cannot."[5] Barlow, in this passage and throughout the declaration warns governments that "Cyberspace" cannot and should not be understood in terms of infrastructure but rather as a new type of space that exceeds the conceptual boundaries of state sovereignty. The status of "Cyberspace" as a *space*, for Barlow, renders prior notions of war, peace, and sovereign control moot. However, Barlow's spatial interpretation of "Cyberspace" was not unique to the cyber-utopian movement, while governments may have been publicly treating the Internet as a mere collection of infrastructures, the United States military was increasingly not.

Some two years after Barlow issued his declaration, the United States Department of Defense activated the Joint Task Force-Computer Network Defense in response to a series of highly publicized breaches of government networks. Over next few years the task force rapidly expanded in size and scope leading the Department of Defense General Counsel to intervene on their activities in 2000. The counsel's intervention was not the product of familiar concerns over civil liberties but rather a fear that their actions would violate the 1878 Posse Comitatus Act which prohibits the use of the military to enforce federal law within the territorial boundaries of the United States.[6] The virtual space of the Internet and domestic computer networks, in this view, were treated as a manifestation of the territorial sovereignty of the United States. While accepting the spatial status of "Cyberspace" this restriction was also founded on understanding a cyber-attack by a foreign entity in the grammar of law enforcement and not war. The next fifteen years would see this understanding become supplanted by a perspective that both treated "Cyberspace" as a domain of warfare and computer network attacks as military operations.

Exemplifying this conceptual shift is former NSA Director Michael Hayden's reflection in the fall 2011 issue of *Strategic Studies Quarterly* where he states:

> Like everyone else who is or has been in a US military uniform, I think of cyber as a domain. It is now enshrined in doctrine: land, sea, air, space, cyber. It trips off the tongue, and frankly I have found the concept liberating when I think about operationalizing this domain. But the other domains are natural, created by God, and this one is the creation of man. Man can actually change this geography, and anything that happens there actually creates a change in someones physical space.

5. John Perry Barlow, *A Declaration of the Independence of Cyberspace*, 1996, accessed October 15, 2016, `https://projects.eff.org/%7B~%7Dbarlow/Declaration-Final.html`

6. Jason Healey, *A Fierce Domain: Conflict in Cyberspace 1986-2012* (Baltimore, Maryland: The Atlantic Council, 2013), 60

Are these differences important enough for us to rethink our doctrine?[7]

Hayden, like Barlow, demands that we base our perception of the Internet not as the construction of an information infrastructure but rather as the creation of an entirely new geography through technology. While Barlow sees this new geography as exceeding and challenging the grasp of state sovereignty, for Hayden this spatial understanding grounds it firmly within existing categories of military perception: Cyberspace—despite its built status—is a military domain. The distance between these perspectives exposes the contingent status of cyberspace, the Utopian claims of the global village have now given way to the fears of a "digital Pearl Harbor." Hayden's view from 2011 was not speculative: the previous decade had seen a growing number of states in the international system move from administrative IT Departments to military units tasked with defending the "digital frontier."

Hayden's admonition to consider the potentially disqualifying nature of the built status of the cyber domain serves as a provocation to consider more deeply the fundamental military category of domain which under-girds both the organization of military services and the ways in which wars are fought. Hayden juxtaposes the supposed unnatural status of cyberspace with other domains that map easily onto commonly accepted geophysical distinctions belying their own built status. For example, the political and scientific maneuvering accompanying the successful launch of the Sputniks by the Soviet Union included extended debates on how to conceptually understand the boundary between the atmosphere and what we now call orbital or outer space. Orbital space has a similar non-territorial status as Barlow's conception of Cyberspace: it exceeds the basis of sovereignty in the physical terrain of the Earth and thereby necessitates social mediation. Some argued that the boundary should be defined by the point at which aircraft can no longer fly under their own power, others argued that it should be just below the lowest point at which a stable orbit could be sustained. Both positions relied not on a "natural" boundary but rather on velocity and aerodynamics; to wit, they were a function of technology and not of nature. Some, such as the United States Air Force, argued against *any* distinction, proposing instead that the atmosphere and space exist in a physical continuum called Aerospace.[8] The boundary between the atmosphere and orbital space eventually came to be commonly defined by the Kármán Line—the point at which aircraft can no longer

7. Michael V. Hayden, "The Future of Things "Cyber"," *Strategic Studies Quarterly*, 2011, 3

8. A view that continues to be maintained but not operationalized see: Chapter 4.

fly under their own power—a distinction which is functionally arbitrary.[9] Alongside this distinction came a shared recognition that sovereign boundaries ended where orbital space began, thereby enshrining the peaceful overflight of foreign satellites and the tacit approval of adversary states using orbital space for remote sensing. Thus, orbital and outer space as distinct from the air/atmosphere was the product of social mediation and not the consequence of a clearly apprehended physical boundary.

Therefore, unlike Hayden, I argue that the other military domains are also not strictly "natural" insofar as there was nothing inevitable in how they were mobilized and operated in by militaries, but instead *they are made to seem natural*.[10] Military domains are only created after the underlying technologies and doctrine have been developed and mobilized to operate within them. The concept of domain functions as a category of military spatial perception, and the conceptual content of *a* domain—air, land, sea, space, cyber—is socially mediated.[11] My core contention is that they are developed by advocacy, inspired by technological change, mediated through the organizational politics of military bureaucracies. This stands in contradistinction with the deterministic perspective that undergirds much of extant literature on military capabilities: that the contemporary military articulation of air, space, and cyber are to be viewed as the natural outcome of the development of technology. If the Air Force had been successful in the early 1960s in promoting the Aerospace domain then space would likely have been weaponized, thereby differently circumscribing a set of shared assumptions about the potential military uses of space. That is, it is not clear whether the norm of peaceful overflight would have been maintained had the Air Force been successful in their Aerospace domain concept. This failure was not the product of technological limits: operationalizing the Aerospace domain rested on the acquisition of a hybrid rocket-aircraft called Dyna-soar which was technologically feasible but could not be justified by the Air Force senior leadership.[12] Likewise, there was nothing fated about the conceptual and organizational development of independent air warfare by the United

9. Walter A. McDougall, *...the Heavens and the Earth* (Baltimore, Maryland: Johns Hopkins University Press, 1985), 186 See also: Andrew G. Haley, *Space Law and Government* (New York, New York: Meredith Publishing Company, 1963), Chapter 4

10. With the exception of land and to an extent sea, given their long-standing place in human warfare.

11. Michael Hayden, in his 2016 book *Playing to the Edge*, somewhat agrees with this characterization. "Actually, when you convince a GI that something is a domain, a lot of things click. He doesn't clutter his mind with extraneous concepts like networks, bandwidth, and the like. It's a domain, an operational environment, and—just like all other domains—it has its own characteristics." Michael V. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror* (New York, New York: Penguin, 2016), 128

12. See Chapter 4

States Air Corps in the run up to World War II. The air arm of their main European adversary, the German Luftwaffe, had primarily developed and organized in support of ground forces. The consequences of this doctrinal, organizational, and technological difference in capabilities is not trivial: if Germany had prepared an independent strategic bombing force like the United States then Germany could have struck an early knockout blow to the United Kingdom's air arm and opened the path for an invasion across the English Channel.[13] Moreover, the perceived failure of the Luftwaffe to fully realize the potential of an independently organized air force and the perceived success of the United States Army Air Forces in World War II was consequential for the development of the U.S. security architecture of the early Cold War.[14] Elements of this fundamental belief in strategic air power continue to undergird U.S. Military air operations, for example in the "Shock and Awe" bombing campaign that opened the 2003 Iraq War.[15] One of my core claims is that domains are not only a socially produced category but that they also organize suites of technological capabilities and define ways of fighting wars.

The consequences of how and whether a domain of warfare is developed is not just significant for arm-chair military historians engaging in counterfactuals but also scholars of international politics as the status of a military domain informs the common sense and patterns of belligerent behavior between states in the international system. Forms of military action and belligerent behavior viewed as permissible by states are partly defined through the existence of domains by generating the grounds for strategic, operational, or other military actions. Neither the use of orbital space for remote sensing nor the use of aircraft primarily for strategic bombardment were the consequence of a technological development but rather a political process. Moreover, I aver that understanding the patterns of development of military domains outside of land and sea is critical to understanding the future of conflict. Two domains of the greatest contemporary military interest are orbital space and cyber, both of which are defined by forms of a-territoriality and full dependence on technology for operations within them.[16] As great

13. R.J. Overy, "From 'uralbomber' to 'amerikabomber': The Luftwaffe and Strategic Bombing," *Journal of Strategic Studies* I, no. 2 (1978): 154–178

14. For example, see the assessment in Carl Spaatz, "Strategic Air Power: Fulfillment of a Concept," *Foreign Affairs* 24, no. 1 (1945): 385; See also: Lawrence Freedman, *The Evolution of Nuclear Strategy*, vol. Third (New York, New York: Palgrave Macmillan, 2003), 21-23, 51-53; Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960* (Maxwell Air Force Base, Alabama: Air University Press, 1989), 214-219

15. For modern doctrine see: Air Force Doctrine Working Group, *Strategic Attack: Air Force Doctrine Document 3-70* (Secretary of the Air Force, 2007)

16. E.g.: Mark Galeotti, *Putin is Waging Information Warfare. Here's How to Fight Back*, 2016, accessed December 14, 2016, `http://www.nytimes.com/2016/12/14/opinion/putin-is-waging-`

power competition has increasingly come to be expressed through activities in these domains it is critical to understand the historical patterns of their development in order to shed light on future dynamics.

How domains of warfare and their underlying technologies are articulated by existing and emerging powers circumscribes the range of what is possible in warfare and defines the threats states face and must prepare for in their security environment. But, the existence of these domains in military and state perception is not the natural outcome of deterministic technological change, rather I argue that they are a social category developed through the mediation of technologically inspired advocacy by the organizational politics of militaries. Understanding the social process by which domains come into existence is therefore crucial for scholars of international politics in understanding the past and future of interstate conflict.

Thus, the theoretical account of military domains I develop in the following pages has two overarching implications. First, it demonstrates that how states wage war is neither inevitable nor natural. Ways of war through different military domains are the contingent product of attempts to grapple with the impact of technological change in human imagination. Moreover, the creation of these ways of war implicate not just the uses of technology but what parts of others states—populations, infrastructures, military forces—are subject to attack. Therefore, my theory of domain development sheds light on how social processes generate large-scale change in the international security environment. Second, casting patterns in the development of military domains as a social process helps to avoid a helpless form of technological determinism. I demonstrate in my case studies that the rise of independent strategic warfare through the air, the designation of cyberspace as a domain, and maintaining a norm of peaceful overflight in orbital space are political and military *choices*. Our contemporary moment is defined by rapid technological change, giving rise to concerns such as the ethics of autonomous military robotics, drone usage, and artificial intelligence. The scale of these changes demand that we keep front and center the understanding that the development and use of military technologies are contingent and not fated.

`information-warfare-heres-how-to-fight-back.html`; Kevin Pollpeter, "Space, the New Domain: Space Operations and Chinese Military Reforms," *Journal of Strategic Studies* 39, nos. 5-6 (2016): 709–727

1.2 Overview of Chapters

In the next chapter, "Theory of Domain Development," I unfurl my theoretical claims. I begin by assessing the extant literature on the relationship between warfare and technological/military innovation. Existing literature, I argue, is unable to explain the large-scale innovation that a new domain represents. I then go on to analytically refine the concept of domain, distinguishing between "strategic domains" and "support domains." The former are military domains in which states have prepared for strategic warfare by maintaining autonomous standing forces. The latter are domains that are primarily developed to support warfare in other domains. After creating this distinction, I then explain my theory of domain development. I argue that domains are the product of technologically inspired advocacy mediated by the organizational environment of the military. Based on accounts of military organizations, I identify three stages of domain development: advocacy, visioning, and realization. After describing these stages I identify three intervening variables—senior leadership interest, inter-service rivalry, and civilian intervention—and outline what effects they will have at each stage of domain development. I conclude this chapter by discussing case selection and research methodology.

My first case study, entitled "Thinking War in a Third Dimension," traces the development of the air domain by advocates emerging out of the United States Army. The rise of the air domain demonstrates how slow-developing "bottom-up" advocacy can drive macro-level changes in the international security by creating a new strategic domain. The first major section traces the development of advocacy by Army aviators from 1907-1914, the first Army aviators came to believe that aircraft represented a fundamentally new method of prosecuting war. However, as will be seen in the second section, from 1915-1935, this belief was not appreciated by the senior officer corps of the War Department. During this period I also trace the conceptual development of a completely new theory of warfare by the aviation advocates. The final section, from 1936-1945, shows how the aviation advocates capitalized on the run-up to World War II to develop the beginnings of a fully autonomous Air Force.

The second case study, "What's a Heaven For?," explains why orbital space developed into a support domain but not a strategic domain. I argue in this chapter that this outcome was the consequence of the operation of the three intervening variables, in particular the delegitimization that the services faced following intense periods of inter-service rivalry. The first

major section, explains how the service rivalry from 1945-1960 over space-enabling technologies undermined service claims to militarizing space in the wake of the Sputnik Crisis. I also trace how the RAND Corporation came to influence U.S. space policy during this period, resulting in a civilian-surveillance support vision of space. The second major section examines two attempts to revise this support status of orbital space: the promotion of "Aerospace" by the Air Force during the 1960s and the Strategic Defense Initiative during the 1980s. I argue that both of these attempts failed because of the dynamics of service identity and the entrenched social acceptance of "space for peaceful purpose."

The final case study, "This New Geography," argues that cyber is currently is in the realization phase of domain development. While many features of this case are ultimately theoretically unexpected, I argue that there is a discernible line of advocacy that emerges from joint-intelligence organizations that possesses many theoretically expected dynamics. The first section, examines two waves of advocacy for cyber-attacks as force from 1983-1995. These waves show how different intelligence organizations cross-pollinated beliefs about the potential for using cyber-attacks to generate force. The second section examines how successive NSA directors and intelligence officials, drawn from these waves of advocacy, turned the NSA into the dominant cyber organization in the United States military between 1996-2008. I conclude this chapter with a discussion of potential trends towards the realization of cyber as a strategic domain.

In the concluding chapter I lay out two sets of implications that can be drawn from this dissertation. The first set—theoretical—focuses on how the domain development process contributes to theoretical accounts of military innovation, cyberspace and international politics, and military sociology. I also identify what avenues for further research are suggested by the case studies. The second set—substantive—discusses how these various domain development processes impacted international political life. In particular, I focus on the generation of new forms of vulnerability and the political consequences of different domain statuses. I conclude with a brief discussion of what, if anything, is different about cyber.

Chapter 2

Theory of Domain Development

> Politics, not technology, sets the limits of what technology is allowed to achieve.
> —Brenda Forman[1]
>
> Technology begets doctrine, and doctrine begets organization.
> —Anonymous Air Force Officer[2]

2.1 Introduction

A military domain represents more than just a conceptual category used by states and their militaries to divide the world into different spaces of warfare, it also organizes how and why specific suites of technological capabilities are used by militaries. All Great Powers maintain substantial standing military forces to wage distinct types of strategic warfare within at least three domains—air, land, sea. The ways of warfare that are planned and prepared for within each of these domains unfolds with a distinct grammar and set of beliefs of how to achieve victory through the unique space of the domain. While these divisions of the physical world readily conform to commonly accepted geo-physical boundaries, Great Powers are also increasingly treating "cyberspace" as a military domain akin to air, land, and sea. This is puzzling because "cyberspace" isn't a physical *space* in the same sense as other domains. What this inclusion

1. Quoted in William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York, New York: Random House, 1998), 506

2. Quoted in Clarence A. Robinson JR., "Information Operations Center Provides Attack Thwarting Tools," *Signal Magazine* 52, no. 11 (1998)

indicates, I argue, is that domains cannot be considered a natural or inevitable way of differentiating spaces and types of warfare by states, rather they are created through a social process.

In the following chapter I unfold the argument that the development of a domain of warfare is the product of an intertwined social and organizational process triggered by technological change, the course of which is dependent on the operation of three intervening variables. Before elaborating my theoretical claims over the patterns of development in military domains, I will first evaluate existing approaches to technological and doctrinal innovation within militaries. Unlike the majority of existing approaches, my argument centers the role relationship between technological change and social imagination in altering the ways in which wars are prepared for and fought by states. Next, I provide a conceptual elaboration of how to define a military domain. Due to a dearth of conceptual discussion of what constitutes a domain I propose an analytical distinction between strategic and support domains on the basis of how militaries prepare to operate within them. After elaborating my definition of a domain, I then explain my theory of domain development. Based on theoretical accounts of military organizations, I posit that the process by which strategic domains develop has three stages: advocacy, visioning, and realization. I argue that in each stage intervening variables determine the pattern of domain development and explain whether we see the rise of a new strategic domain, the use of the domain for tactical or strategic support, or the integration of the new technology into existing command structures and ways of warfare. I conclude the chapter with a discussion of methodology and case selection.

2.2 Existing literature and Domains of Warfare

My argument over the process by which military domains develop intersects with three core bodies of scholarship: structural explanations of military policy, military innovation studies, and finally a loosely organized body of scholarship that explores the impact of cyberspace on international politics. These bodies of scholarship all present different ways of understanding how and/or why militaries adopt new technologies or ways of warfare. The argument I present later in this chapter touches on all of these bodies of scholarship because the development of a new military domain signals a large-scale shift the security arrangements of states, and in particular Great Powers. Many of these studies center the development of innovative doctrine

and/or technology as a key aspect of these changing arrangement. I argue that the development of a military domain represents a special type of major military innovation because the development of a domain not only includes new military capabilities, training regimes, and organizational forms; it also restructures the relationship between service arms, industry, political actors within and between states.[3]

The first set of arguments are those that rely upon on structural pressure as the primary motor of change for militaries. The classic explanation from the neo-realist tradition is found in Kenneth Waltz's *Theory of International Politics*. Waltz argues that "Competition produces a tendency towards the sameness of competitors . . . Contending states imitate the military innovations contrived by the country of the greatest capability and ingenuity. And so the weapons of major contenders, and even their strategies, begin to look much the same all over the world."[4] In the Waltzian view of the spread of military innovation, the development of a domain is part of a reactive process whereby states come to emulate the security arrangements of leading states within the overall system. João Resende-Santos extends Waltz's claim in *Neorealism, States, and the Modern Mass Army* by specifying the conditions under which states seeks to emulate each other. Resende-Santos argues that emulative practices are driven by a "competitive security logic" wherein states copy the military practices of great powers that have recently won a major conflict. Whereas Waltz sees the pressure to emulate originating in the overall security environment, Resende-Santos argues that emulation is driven by the local security environment. Thus, the greater the potential local strategic threat, the faster and deeper emulation occurs.[5] Joseph M. Parent and Sebastian Rosato likewise focus on the local environment, however, unlike Santos-Resende they argue that both the emulated practices and the pressure to do so are a function of the local strategic environment.[6] While these structural explanations differ in the locus of emulation, they generally agree that local or systemic structure is what drives military

3. Notably there is no commonly accepted definition within Military Innovation Studies as to what exactly constitutes an "innovation". This partly due to focus, some scholars focus on innovation at the level of the employment of individual weapons systems, whereas others study strategic realignments. The most useful definition is provided by Grissom 2006 (907) which relies on three dimensions to describe a military innovation: 1) that it "changes the manner in which military formations function in the field; 2) it is "significant in scope or impact"; and 3) it is "tacitly equated with greater military effectiveness." For further discussion see Adam Grissom, "The future of Military Innovation Studies," *Journal of Strategic Studies* 29, no. 5 (2006): 906-907

4. Kenneth M. Waltz, *Theory of International Politics* (New York, New York: McGraw-Hill, 1979), 127

5. João Resende-Santos, *Neorealism, States, and the Modern Mass Army* (New York, New York: Cambridge University Press)

6. Joseph M. Parent and Sebastian Rosato, "Balancing in Neorealism," *International Security* 40, no. 2 (2015): 64-65

change by states.

However, this structural perspective has little explanatory leverage over the development of a military domain for three reasons. First, it has limited traction because it can explain why the (n+1)th state adopts domain specific capabilities and doctrine but not why they are developed in the first place. Second, the competitive pressure to develop and emulate specific capabilities will not necessarily lead to the creation of a domain nor decide that those capabilities will be used independently for strategic warfare. The development of diesel submarines armed with accurate torpedoes during the first half of the twentieth century was viewed by some as rendering surface naval warfare obsolete. However, the two wars which saw the greatest number of submarines in the inventories of belligerents and involved major surface fleet battles—World War I and II—saw limited development of submarine warfare outside of the German Kriegsmarine. The limited usage of submarines, particularly during the first World War, was not a function of widespread technological limitations but rather a shared bias towards a conception of naval warfare that rested on surface engagements.[7] Third, structural pressure writ more broadly would seem to imply that there would be a linear technological and organizational ratcheting effect between leading powers in the development of a domain. That is, as the consequences for warfare of a technology become increasingly apparent states will emulate and drive forward the development of a technology towards enabling certain types of warfare within a new domain. However, domain development does not exhibit that level of linearity. For example, anti-satellite weapons have been pursued on and off by states since the early 1960s while at the same time leading militaries came to increasingly rely upon the support functions of remote sensing technologies deployed in space.[8] If technological adoption was roughly linear, then we would expect states to have spent considerably more time actively pursuing anti-satellite capabilities.

Starting from a similar set of theoretical commitments, Barry Posen also argues that structural factors spur military innovation. In *The Sources of Military Doctrine* Posen advances the argument that civilian policymakers rationally assessing the security environment will intervene in military organizations to spur innovative doctrine in response to changes in the security environment. Civilian intervention is necessary because, Posen argues, military organizations

7. Nachman Ben-Yehuda, *Atrocity, Deviance, and Submarine Warfare* (Ann Arbor, Michigan: University of Michigan Press, 2013), 101

8. *passim* Michael Sheehan, *The International Politics of Space* (London, United Kingdom: Routledge, 2007), 109-124

tend to be sclerotic and reticent to change. This reticence necessitates external civilian intervention, with the aid of "maverick" officers, to spur change.[9] Deborah Avant, in "The Institutional Sources of Military Doctrine," further refines Posen's core mechanism by arguing that the degree to which civilian politicians are successful at intervening in doctrine is a function of the civil-military institutional structure. If civilian control over the military is institutionally divided then the intervention is likely to fail, whereas if the control is unified then intervention is likely to succeed.[10] While these studies have a scope (acute change) that might limit their applicability to domain development, the mechanism that initiates change—civilian policy-makers—has potential traction on the development of military domains. For example, the Chinese military was pushed to develop cyber capabilities after witnessing the performance of the U.S. military during the Gulf War.[11] Likewise, the Army Air Forces only gained strategic autonomy because of President Franklin D. Roosevelt's demands for a massive expansion in its size following the Munich Crisis. However, the air warfare plan that was mobilized in response to Roosevelt's demand was not the product of his intervention, rather the innovative doctrine of precision strategic bombing had already been in existence for several years. Roosevelt may have acted as a powerful ally to the advocates of the plan, but his action was not instrumental to its development.[12]

These arguments can account for some aspects of the development of a domain but cannot explain the overall process as the development of domains happens across relatively large time scales (decades) whereas the civilians of Posen and Avant's argument are reacting to acute structural conditions. Additionally, it ignores that the changes in doctrine that are mobilized are contingent, the air warfare plans of the Army Air Forces were not fated but rather the process of a long development process. This is symptomatic of the fact that military technologies are instrumental in Posen and Avant's account, they are a function of doctrinal overhauls. However, the role of civilian policymakers is no doubt significant for the development of a military domain given their control over the statutory definition of military service arms and the budget shares allocated to each, but they cannot explain how militaries respond to demands for change.

9. Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars* (Ithaca, New York: Cornell University Press, 1986)

10. Deborah D. Avant, "The Institutional Sources of Military Doctrine: Hegemons in Peripheral Wars," *International Studies Quarterly* 37, no. 4 (1993): 409–430

11. Jon R. Lindsay, "Introduction: China and Cybersecurity: Controvery and Context," in *China and Cybersecurity: Espionage, Strategy, and Politics in the Digital Domain*, ed. Derek Reveron, Tai Ming Cheung, and Jon R. Lindsay (Oxford, United Kingdom: Oxford University Press, 2015), 15

12. See Chapter 3

The second body of scholarship is military innovation studies, which seeks to directly understand the patterns of military change and innovation through factors endogenous to military organization. As I argued above, domains are a type of major military innovation not only because of their technological/doctrinal basis but also how they restructure the relationships external and internal to states and their militaries. When this scholarship addresses technology, it is typically understood as the outcome of a social or bureaucratic process as opposed to spurring the process itself. Moreover, this literature typically explains narrow innovations, such as a specific weapons system or body of doctrine. While this blinds it to some dynamics exposed by my theory of domain development, the military innovation literature contributes important insights into the operation of military bureaucracy. However, these insights are limited in two ways: by ignoring the role that technology plays in inspiring new doctrine and/or focusing on small scale innovations. The five potentially relevant endogenous explanations advanced in this literature are: inter-service rivalry, intra-service rivalry, advocacy networks, institutional capacity, and ideational change.

The first explanation, inter-service rivalry, argues that the relationship between military service arms drives innovation. This perspective focuses on how budgetary constraints drive service arms to compete over new mission areas in order to secure new sources of funding. The organizational imperatives faced by service arms drive them to develop innovative weapons systems or doctrines to capture the new mission area. The paradigmatic study of inter-service rivalry driving technological and doctrinal innovation is Harvey Sapolsky's *Polaris Systems Development*.[13] The development of the POLARIS SLBM by the U.S. was catalyzed and driven along by intense inter-service rivalry over the development of the nuclear triad during the early stages of the Cold War. Not wanting to be left out, the Navy began their own missile program and through an organizational alliance with the Army and minute bureaucratic maneuvering the Navy was able to secure funding and gain mission authority for the development of the POLARIS SLBM.

13. Harvey Sapolsky, *The Polaris System Development: Bureaucratic and Programmatic Success in Government* (Cambridge, Massachusetts: Harvard University Press, 1972); See also: Michael H. Armacost, *The Politics of Weapons Innovation: The Thor-Jupiter Controversy* (New York, New York: Columbia University Press, 1969); Edmund Beard, *Developing the ICBM: A Study in Bureaucratic Politics* (New York, New York: Columbia University Press, 1976) Owen Cote, "The Politics of Innovative Military Doctrine: The U.S. Navy and Fleet Ballistic Missiles" (PhD diss., Massachusetts Institute of Technology, 2005); Samuel P. Huntington, "Interservice Competition and the Roles of the Armed Services," *American Political Science Review* 55, no. 1 (1961): 40–52; Samuel P. Huntington, *The Common Defense: Strategic Programs in National Politics* (New York, New York: Columbia University Press, 1961), 369-394;

The inter-service rivalry school of military innovation relies on two insights into the operation of military organizations. First, military service arms seek to maintain and demonstrate their independence by arrogating to themselves strategic missions. Second, budgetary share serves as a key yardstick that senior leadership uses for measuring relative status vis-a-vis other independent service arms. These lead service arms to engage in bureaucratic maneuvering and technological/doctrinal innovation to either secure or expand sources of funding. The explanatory insights of the inter-service rivalry literature has some potential leverage on the production of domains of warfare, as the development of a major new technology can certainly generate new mission areas. However, it presents a "pull" model of innovation whereby new mission areas drive innovation where domain development involves a "push" by advocates for the recognition of new mission(s). Strategic bombardment, as a mission, didn't exist prior to the operationalization of strategic bombing doctrine in the autonomous Army Air Forces. Moreover, to the extent that organizational autonomy is necessary for a domain specific strategic warfare plan, inter-service rivalry predicts that service arms would do all that they can to prevent the creation of a distinct domain. These dynamics can be seen by the promotion of Aerospace by the Air Force: the Air Force leadership sought to arrogate to themselves military orbital space missions by arguing that air and space are continuous. Inter-service rivalry, while it may speak to smaller scale innovations, generates dynamics that stem the development of a new military domain.

The second factor, intra-service rivalry, drills down to the internal politics of individual service arms to find sources of innovation. Stephen Rosen in *Winning the Next War* focuses on the political struggles internal to service arms to define doctrines, missions, and roles. He argues that patterns of military innovation are explained by the political alignments of senior leadership, junior officers, and their institutional contexts that enable the development of an innovative technology or doctrine.[14] In particular, this alignment is the product of senior officers developing a "new theory of victory" which is "an explanation of what the next war will look like and how officers must fight if it is to be won."[15] Senior officers advance this "theory of victory" by building organizational alliances and creating pathways for promotion of junior officers specializing in technological or doctrinal innovations that undergird this theory of victory. An innovation in technology or doctrine is therefore the child of an internal ideological struggle

14. Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, New York: Cornell University Press, 1994)

15. ibid., 20

over the terms by which a service arm fulfills its mission.

The core insight of the intra-service rivalry explanation is that military service arms should first and foremost be viewed as political communities that "determine who will live, who will die, and how; who will be honored and who will sit on the sidelines when war occurs."[16] The internal political dynamics of service arms over new theories of victory could plausibly explain some aspects of domain development, because a critical part of developing a domain is advancing a distinct vision of strategic warfare or "new theory of victory" that relies on the domain enabling technology. However, the creation of a new form of strategic warfare that operates through a distinct domain exceeds the redefinition of a service and is therefore *revolutionary* in nature. For example, the American conception of strategic air warfare developed out of the U.S. Army's air arm, a mission that both exceeded the overall land focused Army and sought to supplant it. While Rosen's argument is most useful for explaining *evolutionary* change in the self definition of a service arm, it develops important insights for how early advocates for a new domain have to work inside of military bureaucracies to realize their vision.

The next explanation focuses on the institutional capacity for change by a military: Michael Horowitz in the *The Diffusion of Military Power* argues that patterns in the spread of military capabilities can be explained by the demands placed on states and their military organizations by innovations. Horowitz argues that there are two key demands placed by an innovative military technology that determines its spread—cost and organizational capital. Cost is the financial intensity of adopting a new capability, and organizational capital is the degree to which military organizations need to restructure themselves to incorporate the new capability. From this Horowitz derives "adoption-capacity theory" which argues that "for those states who attempt to adopt an innovation, the key determinant of success is whether the financial and organizational requirements for implementing the innovation 'match' the capabilities of the states pursuing an adoption strategy." He argues that great powers tend to have ossified organizations but high amounts of financial capital, making them unlikely to adopt innovations that demand large-scale organizational change. Whereas lesser powers have few financial resources but large amounts of organizational capital, allowing them to adopt innovations that require substantial organizational change but little financial investment.[17]

16. Stephen Peter Rosen, "New Ways of War: Understanding Military Innovation," *International Security* 13, no. 1 (1988): 141

17. Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics*

In the terms of Horowitz's argument a new military domain would demand large amounts of both organizational and financial capital. This would help explain why military domains are advanced by great powers but take a significant amount of time to develop. The cost of developing the underlying technology makes it hard for smaller states to drive the development of new domains, while already powerful states have militaries reticent to change. My theory of domain development complements Horowitz's work by highlighting the ways in which advocacy over time can lead to substantial shifts in the ossified military bureaucracies of great powers.

Benjamin Jensen in *Forging the Sword*, presenting a similar claim to Horowitz, argues that innovation or change is a function of institutional capacity. However, unlike Horowitz, Jensen focuses on internally driven evolutionary change and argues that the motor of change can be "baked into" the organizational structure of a military.[18] Jensen argues that the pattern of evolutionary innovation in the United States Army is the consequence of two interlocking features of Army bureaucracy. First, the intentional creation of incubators which provide a forum for officers to develop the conceptual basis for a new theory of victory. This new theory of victory, and demands for structural reforms to operationalize it, are then diffused through advocacy networks which cut across the sub-units and departments of the Army Bureaucracy. Widespread acceptance is therefore achieved by the formation of cross-cutting alliances that build broad constituencies across the military bureaucracy. The new theory of victory is realized when it is accepted by senior leaders, who promote it in speeches, articles, and other public forums.[19] Jensen's sociological approach to military innovation helps to shed light on the "bottom-up" patterns of military innovation through his focus on the role that advocacy work plays in producing large scale change.

This study complements Jensen's approach by examining the formation of new theories of warfare from a bottom-up perspective. However, in contrast with the intentional innovators of Jensen, I argue in the theory of domain development that larger military organizations can unintentionally generate incubators through neglect. These unintentional incubators are the function of officers inspired by technological change coming to believe that they have distinct

(Princeton, New Jersey: Princeton University Press, 2010)

18. Jensen's argument is superficially similar to Rosen's, however, Jensen does not see internal rivalry as consequential for change.

19. Benjamin Jensen, *Forging the Sword: Doctrinal Change in the U.S. Army* (Stanford, California: Stanford Security Studies, 2016)

prerogatives from the overarching bureaucracy. This sense of distinction leads the officers to begin developing new theories of warfare to advance their vision for operationalizing a new domain. These unintentional incubators then drive large-scale military innovation that exceed the scope of their parent organization.

The ideational or constructivist military innovation literature goes a step further in examining the power of the normative content of the ideologies and struggles over self-definition within military organizations. The constructivist perspective in military innovation studies most closely associated with the work of Theo Farrell. Farrell's work has largely focused on the production and diffusion of norms between militaries rather than the discursive production of certain military arrangements within those very organizations.[20] The diffusion of military norms of appropriateness certainly give an alternative explanation for the observed isomorphism of military utilization of domains across the world. Moreover, to a large extent the development of a domain requires not only technological development but also conceptual and discursive development of how to use the potentialities afforded by that domain, so we could expect436 to see military staff borrowing or learning from foreign militaries when developing claims about the utility of a domain. However, Farrell's work has the same limitations of the Waltzian structural perspective: it doesn't tell us why a domain comes to be articulated in a particular way, just how those articulations may travel.

While Farrell focuses on the diffusion of norms at the system level, in "From Mercenary to Citizen Armies: Explaining Change in the Practice of War" Deborah Avant focuses on the potentials for ideational change at the state level. Avant argues that dis-junctural change in the practice of warfare is a function of societal ideational change paired with material turmoil. In Avant's account of the shift from mercenary to citizen armies by France, Prussia, and Great Britain she demonstrates how beliefs about the relationship between the state and citizenry were able to take as a consequence of material shocks that opened the path for dis-junctural change in the practice of war. Avant posits that new beliefs about the practice of war take hold following a military defeat and when domestic political coalitions are fractured. These create the opening that advocates for a new practice of warfare are able to exploit.[21]

20. Theo Farrell, *The Norms of War: Cultural Beliefs and Modern Conflict* (Boulder, Colorado: Lynne Reinner, 2005); See various Theo Farrell, *The Norms of War: Cultural Beliefs and Modern Conflict* (Boulder: Lynne Rienner Publishers, 2005)

21. Deborah D. Avant, "From Mercenary to Citizen Armies: Explaining Change in the Practice of War," *International Organization* 54, no. 1 (2000): 41–72

Zooming into the cultures of military organizations and their civilian masters, Elizabeth Kier in *Imagining War* argues that military doctrine is a function of the interplay of the beliefs of civilian policymakers and military organizations. Civilian policymakers hold a set of beliefs about the relationship between the state and its military, in particular how power is distributed between civilian policymakers and the military. These lead policymakers to set constraints on the development of military doctrine and capabilities. These constraints are then filtered through the unique organizational culture of the military. The military's response to civilian demands are filtered through their unique organizational culture to produce patterns in doctrinal formation.[22]

Kier and Avant's ideational accounts help to provide clarity onto why certain beliefs about warfare become operationalized in military doctrine and organization. However, they generally have little to say about the sources of these beliefs within military organizations. The development of a domain requires the formation of a revolutionary theory of victory—one which exceeds the scope of existing military missions and roles. While these explanations can help shed insight into dis-junctural change in the practice of warfare neither can fully account for the development of a military domain. This study complements these ideational accounts by explaining how spatial conceptual frameworks of warfare develop.

Overall, the limited utility of the military innovation literature to explain patterns of military domain development is a function of two features of the literature. First, when discussing technology it either treats that technology as the product of a pattern of innovation or something that is instrumentalized in service of new doctrine. I argue that to understand patterns of domain development necessitates understanding the role that technology can play in inspiring innovative doctrine and new theories of warfare. Second, the focus on (relatively) minute changes in military organization, whether it is the creation and development of a weapons platform or alterations to military doctrine. The development of a domain requires a large scale restructuring of a military establishment. Despite these two limitations, the military innovation literature has helped connect how the organizational politics of militaries can drive outcomes in the security arrangements of states. While these arguments grant insight into various dynamics of the development of domains they can only provide partial explanations. Unlike existing scholarship I draw on the ways in which technological change intertwines with advocacy to produce new types of service identity, new theories of warfare, and organizational forms in the

22. Elizabeth Kier, *Imagining War: French and British Military Doctrine between the Wars* (Princeton, New Jersey: Princeton University Press, 1997)

security arrangements of states.

The last body of scholarship variously seeks to understand the relationship between the growth of networked information and communication technologies and international political life. This work has largely focused on whether cyberspace will substantially alter the patterns and forms of conflict that states engage in. Many of these works advance a revolutionary thesis, claiming that cyberspace will fundamentally alter the international security environment and patterns of interstate conflict in various ways.[23] The revolutionary thesis is limited however, in that it relies on the unfolding of empirical reality. Given that the effects of cyberspace can only be realistically assessed on an empirical basis there are several recent works that shed light on the effect that cyberspace *has* had. For example, Thomas Rid in the provocatively titled *Cyberwar Will Not Happen* draws upon Clausewitz to argue that cyberwar cannot by definition take place. Instead, he argues cyberattacks will follow familiar patterns of espionage, sabotage and subversion.[24] A similar reality check is provided by Brandon Valeriano and Ryan Maness in their book *Cyber War versus Cyber Realities* which argues that cyberattacks are old wine in new bottles. Drawing on an original data-set of cyberattacks between states they argue that cyber is not revolutionary and attacks follow observable geopolitical dynamics.[25] Two articles also help to shed light on the consequences of perhaps the most famous computer network attack to date—Stuxnet. Jon Lindsay and Eric Gartzke separately have argued that the effects of the Stuxnet attack were both far less revolutionary and far less consequential than has been commonly portrayed.[26] Altogether, these latter authors have advanced an anti-revolutionary thesis: that the uses of cyberspace by states fit familiar patterns.

My theory and case work contributes to this rapidly growing body of scholarship in two ways. First, historicizing the rise of cyber as a domain and placing it into comparison with other major military innovations. Assessing cyber alongside other military technologies avoids treating it as sui generis and instead forces us to consider it alongside other technologies that were

23. E.g.: David Betz and Tim Stevens, *Cyberspace and the State: Towards a Strategy for Cyber-Power* (Abingdon, United Kingdom: Routledge, 2011); Nazli Choucri, *Cyberpolitics in International Relations* (Cambridge, Massachusetts: MIT Press, 2012), 320; Lucas Kello, "The Shape of Cyber Danger," *International Security*, 2014, Joseph S Nye Jr, "Nuclear Lessons for Cyber Security?," *Strategic Studies Quarterly* 5, no. 4 (2011): 18–38; John Stone, "Cyber War Take Place!," *Journal of Strategic Studies*, 2012, 1–8

24. Thomas Rid, *Cyber War Will Not Take Place* (New York, New York: Oxford University Press, 2013)

25. Brandon Valeriano and Ryan C Maness, *Cyber War versus Cyber Realities: Cyber Conflict in the International System* (New York, New York: Oxford University Press, 2015)

26. Erik Gartzke, "The Myth of Cyberwar: Bringing War in Cyberspace Back Down to Earth," *International Security* 38, no. 2 (2013): 41–73; Jon R. Lindsay, "Stuxnet and the Limits of Cyber Warfare," *Security Studies* 22, no. 3 (2013): 365–404

thought to herald change. Second, I bring into the foreground how social processes have shaped cyber for the purposes of warfare. The scholarship that has advanced the anti-revolutionary thesis has generally taken that states treat cyberspace as a domain as a given without explaining how cyber came to be perceived as a significant feature of the security environment. My case study on development of cyber as a domain helps to resolve this oversight in the literature.

Overall, my project contributes to literature explaining the development and spread of military capabilities in three ways. First, I show how the development of major military innovations can be spurred by advocacy inspired by technological change. Most scholarship either treats the development of technology as the outcome of innovation or something to be instrumentalized in innovative doctrine. I develop a "push" account that exposes how technological change drives the creation of innovative mission areas. Second, I show how this bottom-up process of advocacy can lead to substantial alterations of the international security environment. The operationalization by a state of a theory of independent strategic warfare in a new domain is a difference of kind and not degree for the range of existing potential belligerent actions. And finally, I explain the patterns of development of a largely unexplored major category of military and state perception—domains.

2.2.1 Defining Military Domains

Despite its frequent usage and foundational importance for conceptualizing divisions of labor between service arms the term "domain" remains thinly elaborated within U.S. official military documentation (the term is not defined within JP 1-02 "Department of Defense Dictionary of Military and Associated Terms") as well as military and civilian scholarship. This is perhaps a consequence of the fact that the traditional tripartite division of military domains operated in by distinct services arms—air, land, and sea—maps intuitively onto commonly accepted and easily differentiable geo-spatial regions. Buttressing this intuition is the fact that the only substantial work to elaborate what is meant by "domain" in military contexts has occurred in reaction to the moves to denote "cyberspace" as a domain of warfare.

These approaches tend to rely to on various and sundry dictionary definitions or allusions to the creation of an independent air force.[27] Instead, I propose instead to understand

27. E.g.: Betz and Stevens, *Cyberspace and the State: Towards a Strategy for Cyber-Power*; Choucri, *Cyberpolitics in International Relations*; Hayden, "The Future of Things "Cyber""; Martin Libicki, "Cyberspace is a not a Warfighting Domain," *I/S: A Journal of Law and Policy for the Information Society* 8, no. 1 (2012): 321–336

domains on the basis by which militaries have prepared to actually operate within them. This is because, as I argued in the introduction, domains are social categories that exist only insofar as they are defined in military perception. Recall the example of Aerospace, a domain concept that was advanced by the Air Force that resisted distinguishing between air and space. For the purpose of this project I propose to understand a domain generally as: "a declared space of military operation for which multiple states maintain standing forces with a distinct operating doctrine for exclusive activities within that space." However, not all domains are prepared for on the basis of independent military operations and therefore I argue that we need to analytically distinguish strategic and support domains.

Strategic versus Support Domains

While militaries only use "domain" as an undifferentiated category, I argue there is utility in analytically distinguishing between two different types of domains—combat and support. The key hinge of this distinction lies in whether a military has doctrinally and organizationally prepared for either strategic warfare or support activities within the domain. Using this is as an analytical wedge to categorize domains is useful for two reasons; first, the existence of a "domain" can be easily be speculated upon or proclaimed but these rhetorical claims are meaningless without actual preparation to operate within that domain (e.g.: "information" or "infosphere" in the 1990s, or the "Electromagnetic Spectrum" in the 1980s.) For example, the Air Force's promotion of the Aerospace domain concept at the dawn of the Space age has also been characterized as a public relations exercise with little serious military thought.[28] And second, looking to whether a military is preparing for either a strategic or support role for the domain provides a sharper focus on whether and when a domain of warfare will substantially alter the way in which a military fights war.

The types of activities that are anticipated and prepared for in a domain will be reflected in the organizational form that is responsible for operating in a domain. A strategic domain will be operated in by an organization with high levels of autonomy whereas a support domain will be operated in by an organization that is tightly controlled. The analytical wedge of organizational and doctrinal preparation helps us to both distinguish between types of domains and whether to take seriously claims about their existence: that is, whether they are a public relations stunt or will have a role in actual warfare. Therefore, to help impose order on the category

28. McDougall, *...the Heavens and the Earth*, 168

of domains I utilize this typology:

Strategic: This is a domain that is considered to be "independent," that is, a domain wherein combat operations can be planned for and conducted independent of other domains. Critically, these independent operations include plans for strategic action against an adversary through the domain: for example, the strategic bombardment of industrial centers. At its most mature militaries of great powers will maintain services branches exclusively for activities within that domain. Examples of strategic domains are: air, land, and sea.

Support: This type of domain is one in which there is unlikely to be a large-scale confrontation between adversaries. The primary uses of this domain are for strategic or tactical support, that is they support the pursuit of strategic or tactical objectives in strategic domains. The highest level organizational form that a support domain can take in a modern military is the equivalent of a functional combatant command (in US military hierarchy). Examples of this type of domain are: Orbital Space and the electro-magnetic spectrum.

The key distinguishing feature of a strategic domain is that there are established or nascent capabilities for use in that domain which militaries believe will generate strategic effects. While in practice the distinction between the strategic and tactical levels of warfare can be blurred, insofar as strategic actions can have tactical benefits and vice-versa, it is important to clearly distinguish them because capabilities and doctrine are developed alongside tactical and strategic considerations. For the purposes of this distinction I follow the description of tactical and strategic levels of warfare developed by Clausewitz in "On War". Clausewitz argues that "tactics teaches the use of armed forces in engagement; strategy, the use of engagements for the object of the war."[29] Therefore, the use of capabilities in a strategic domain must be viewed as capable of generating effects that impact the overall ability of an adversary to conduct war. This includes such effects as disrupting commerce, reducing national morale, destroying critical war industries, neutralizing key military installations, etc. In other words, if we are to follow Clausewitz in viewing war as "the continuation of politics by other means" then a strategic capability will allow a state to further its political objectives in war whereas a tactical capability may influence the outcome of a particular battle or engagement. Using the capacity for strategic action as wedge between types of domains highlights that not all military domains substantially reconfigure ways of warfare between states.

29. This definition roughly accords with modern military interpretations of strategy vs tactics, see JP 1-02 "strategic level of war" and "tactical level of war". Clausewitz, *On War*, 128

2.3 Theorizing the Development of Strategic Domains

In this section I will lay out my theoretical claim as to why domains develop when they do, and under what conditions the project of developing a domain stalls, retards, or otherwise fails. My argument has two core parts—first, the progress of a body of advocates within a military organization to develop and enact a conceptually distinct theory of warfare that envisions the employment of a domain enabling technology for strategic military action; and second, the dynamics of the military and civilian organizational environment that these advocates are operating within. These dynamics take the form of three intervening variables: senior leadership interest, inter-service rivalry, and civilian interventionism. The form and intensity of each of these variables determine whether a body of advocates inspired by technological change will be able to develop, advance, and realize a new vision of warfare through a strategically independent military organization responsible for operating within a new domain. The intervening variables are capable of producing two auxiliary outcomes as well: first, is the creation of an integrated capability where the technology is integrated by the senior leadership of the parent service arm into their dominant conception of war. Second, is that the advocates fail to advance an independent vision of warfare and the technology is used to enable a support domain. The three potential outcomes—strategic domain, support domain, and integrated capability—are determined by the operation of the intervening variables on the advocates at different stages of the development of a military domain.

The theory of domain development is only applicable to certain types of military technology acquired by Great Powers. These are technologies that have a high degree of social anticipation in their time and come to be acquired by a military service arm. The social anticipation of these technologies means that they are heralded as revolutionary by military and civilian prognosticators. However, the theory of domain development does not try to explain why a service arm decides to acquire a military technology and when. The circumstances preceding the initial acquisition are too subject to chance to be theorizable. For example, the Army only acquired advanced rocketry after capturing V-2 rockets and much of the staff of the German Peenemünde military complex at the end of World War II.[30] Rather, the theory of domain development can only explain what happens after the initial acquisition and whether that sets in motion the process by which advocates are able to successfully develop a new strategic domain.

30. See: Chapter 4

The "success" of advocates is understood in both organizational and discursive terms, that is whether they are able to both progressively grow an organizational unit and subunits and promulgate new doctrine and strategic plans that reflect their distinct theory of warfare. This is for three reasons: first, military organizations are by their nature conservative and possess structural characteristics that make them resistant to organizational and conceptual change.[31] This is partly a consequence of military organization's tendency to provide prescriptive guidelines over all aspects of their member's lives as well as their pyramidal structure, whereby promotion and advancement only occur internally within a single service branch. These dimensions place a premium on junior officers conforming to and building alliances with senior staff, leading to a tendency for these organizations to breed social and institutional conformity.[32] This conformity also breeds a strong allegiance to the overarching service as a corporate entity that overrides the parochial interests of particular unit or command. Samuel Huntington likens this allegiance to that of a citizen to their nation-state, insofar as the status change of a citizen moving between social groupings within a nation-state is of a substantially lesser order than moving between nation-states, likewise an Army soldier moving from infantry to supply is of a lesser scale than a infantryman becoming a mariner.[33]

This allegiance and conformity to overarching service prerogatives is a consequence of the fact that military organizations generate and are socially governed by an overarching identity.[34] This identity is the raison d'etre for the service and its members and is to a large degree a reflection of the underlying service's concept of war, or what I term "war imaginary." For example, after World War II the Air Force was dominated by leaders who believed in the fundamental role of strategic air power in winning future conflicts. This was both the product of the independence struggles of the Air Force in the 1930s and the perceived success of strategic bombing campaigns against Germany in World War II.[35] The dominance of the strategic bombing advocates in the Air Force leadership meant that the overall budgeting and planning

31. Jensen invokes the Weberian "iron cage" to describe this resistance to change. See Jensen, *Forging the Sword: Doctrinal Change in the U.S. Army*, 3

32. William A Lucas and Raymond H. Dawson, *The Organizational Politics of Defense* (Pittsburgh, Pennsylvania: International Studies Association, 1974); Harvey Sapolsky, "On the Theory of Military Innovation," *Breakthroughs* IX, no. 1 (2000): 37; Rosen, "New Ways of War: Understanding Military Innovation," 136-141

33. Huntington, *The Common Defense: Strategic Programs in National Politics*, 404-407

34. Carl H Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore, Maryland: Johns Hopkins University Press, 1989), 3-43; Huntington, *The Common Defense: Strategic Programs in National Politics*, 402

35. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 214-219; Spaatz, "Strategic Air Power: Fulfillment of a Concept"

decisions by the post-war air force was dominated by the Strategic Air Command to the detriment of Tactical Air Command.[36] Therefore, successful advocacy for changes to the service's organizational structure and doctrine signal the degree to which the advocates have been able to advance their interests against those of the more conservative senior leadership.

Second, discourses surrounding the use of military technology in warfare and the organizational form in which those discourses are realized have an "intimate connection" in military contexts for three reasons.[37] First, much of military organization is functional, that is units are organized according to a specific task or function. A tank cannot be crewed and maintained by any group of soldiers just as a mechanic cannot fly an aircraft; the very ability for a modern state military to operate depends on minute divisions of labor. Second, in the context of prosecuting a war or military engagement the composition of forces includes elements of different service branches depending on the objectives sought. In modern combined arms warfare the ability to assign various units to create a task force depends on their differential scopes of activity. Finally, organization delimits the extent to which a military technology is expected to be used alone or in conjunction with other military elements. Attack aviation units, for example, are developed with an eye towards being directed by ground commanders.

Finally, there may be many competing visions for how to best utilize a potential domain but organizations speak louder than words. Which is to say, a state cannot rapidly generate out of whole cloth an organization that operates within a potential domain under the parameters of a specific vision for use. Procurement and training cycles take years, and this issue is intensified by the attempt to integrate a new technology. The domain vision that has a firm organizational footing will be the only one that could be effectively mobilized when war comes.

Before elaborating the intervening variables and their impact on the success or failure of the advocates in advancing a war imaginary that incorporates a strategic vision for the use of the domain, I will give a general account of how strategic domains develop. This general account is necessary for two reasons: first it serves as a guide to understand how a domain develops given the unique features of the military organizational environment. And second, it matters theoretically because the intensity and form of the three intervening variables—senior leadership interest, interservice rivalry, and civilian interventionism—will produce differential

36. Builder, *The Masks of War: American Military Styles in Strategy and Analysis* , 129-133

37. Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941* (Washington, District of Columbia: Office of Air Force History, 1985), 1; See also Builder, *The Masks of War: American Military Styles in Strategy and Analysis* , Ch. 12

outcomes depending upon the stage of development. Whether the advocate's project to realize a strategic domain proceeds, stalls, retards, or fails will differ based on the organizational and decision-making environment advocates face at different stages of their project to advance a new domain and vision of warfare within a military organization.

2.3.1 Domain Development

In this section I develop a general account of how a strategic domain develops in order to identify the key moments and underlying processes in the development of a strategic domain by advocates. There are three key phases in the development of a domain of combat: advocacy, visioning, and realization. Each of these phases is bounded by a critical organizational development or augmentation that advances the potential for the independent strategic utilization of the developing domain. To be clear, this is not to make a teleological claim, each of these stages present opportunities for the development process to accelerate, retard, or fail. In the next section, I will use this account of domain development to show how intervening variables produce differential outcomes depending on their presence and sequence across these phases.

Advocacy

The first phase of the development of a domain of combat is critical for the development of a body of domain advocates. The body of advocates form from those who are initially assigned to test or develop the newly acquired technology. These initial operators are given great latitude by the senior leadership or general staff of their respective service arm to develop and assess potential missions and uses for the new technology.

The latitude granted to the body of advocates and a relative lack of senior leadership interest leads them to develop a pioneering spirit and the beginnings of a distinct set of prerogatives. The advocates, through experimentation and internal debate, begin to develop concepts and ideas for how to use the technology to achieve tactical, operational, and strategic objectives. What is critical then, is that the advocates are either intentionally or inadvertently given "breathing space" to develop their own sense of professional identity vis-a-vis the domain enabling technology.

The stirrings of a distinct corporate identity and unique set of prerogatives surrounding the use of this technology in warfare becomes critical in the run-up to the creation of the

first operational unit for employing the technology. If the advocates had been able to freely experiment and test out the new technology, then they will have a great degree of influence over the mission the first operational units are designed for. This grants the conceptual work of the advocates legitimacy, and gives them cover for influencing the further development of both the technology and future potential missions.

This period has two critical moments for the development of a strategic domain and one critical process. The first moment is the initial acquisition of the technology, if the technology becomes an extension of the prerogatives and interests of the senior leadership then the early operators will not have the space to begin developing a distinct corporate identity. The second, is the creation of the first operational units which should reflect the interests of the body of advocates. The critical process during this period is the advocate's beginning to develop a sense of distinct corporate identity that defines the operators of the technology. This identity helps to form the grounds for the development of a vision of how to independently use the technology in a war.

Vision

After the initial operational units for using the domain-enabling technology have been created, what is crucial is the process of (en)visioning how independent strategic warfare involving the domain-enabling technology will occur. The process of developing a vision of independent strategic warfare contributes to the creation of a broader war imaginary that posits the role that the new technology will play in the conflicts of the future. The imaginary is more than just the promulgation of doctrine that is favorable to the proposed uses of the technology posited by the advocates, it is a series of wagers about the nature of society, warfare, and how on the basis of these wagers strategic military action can occur in the new domain. This imaginary is distinct from the parent service arm's concept of war, and articulates a new framework for how to achieve the overall objectives of war. For example, the air war imaginary advanced at the beginning of World War II by the Army Air Forces of which strategic bombing was a key pillar, argued that modern industrial society was susceptible to cascading disruptions through the destruction of key industries. This was distinct from the overarching strategic objective of the Army, which was the destruction of enemy forces in the field.[38] The progressive development of this vision serves as a critical template for the argumentative strategies employed by

38. See Chapter 3

the advocates in further organizational struggles as well the composition of those expansions.

As the visioning process moves from the initial concepts for employment developed during the advocacy stage, they will begin to take on a more expansive character. Due to a great deal of uncertainty of what impact the domain enabling technology will have, initial visioning will be protean as the advocates try to develop the conceptual basis for a theory of warfare in the new domain. As the conceptual framework for employing the domain enabling technology grows, the advocates begin to articulate how the technology can resolve tactical and operational issues in order to justify further expansion of their organization.

As the advocates further expand their organization, it is critical that the visioning process continues in formalized settings. Whereas in the advocacy stage the advocates were inadvertently given space to experiment with the technology, during this stage the more senior advocates need to establish specialized bodies (such as service academies or think tanks) that provide a forum for debating and elaborating theories and concepts that underpin strategic warfare in the new domain. It is in these settings the advocates further develop their unique war imaginary. This imaginary develops out of prognostication, pitched debate, and conceptual refinement conducted by the officers responsible for the technology outside of the view of senior leadership. The growing imaginary is composed of a series of discourses about the potentials and realities of the technology, how it has and will change the nature of warfare, and how to use this technology to effect a strategic victory in the context of a vision of contemporary and future society.

These centers of envisioning new forms of warfare are crucial because they provide testing grounds for the development of new doctrine to govern the use of the domain enabling technology. The new doctrine that advocates develop will not be fully representative of the more expansive or revolutionary aspects of the theories of warfare being developed, but rather will incrementally articulate new dimensions of the imaginary within the existing strategic framework of the parent service arm. For example, early doctrine created by advocates of an independent air force within the Army articulated a variety of ways in which independent aerial operations could contribute to the victory of the infantry instead of leading to victory on their own. This is because to be promulgated, doctrine must meet the approval of the senior leadership of the parent service arm.

The discourses of the war imaginary will also filter into the arguments that the advocates present for organizational expansions. As the war imaginary coheres, the advocates will

increasingly argue that they should receive operational autonomy for operating the technology during a war. This autonomy would mean that the domain enabling technology is still subject to the overall strategic objectives of the service arm but that the advocates are given a great degree of control in how they pursue the overall strategic plan of the service arm.

During this period of the development of a strategic domain, the most important process is the development of a vision of how the technology will independently decide a war. This period should then see the full development of a war imaginary and its accompanying discourses. The advocates' development of this imaginary is crucial because it guides the types of wartimes roles that the advocates pursue and hence the organizational morphology. Moreover, it informs the acquisition process for technological systems, the doctrine derived from the war imaginary guide what avenues of development are emphasized in developing technological systems for operating within the domain. The critical organizational battle of this period is the attainment of operational autonomy, which substantially enhances the advocates' legitimacy as the rightful operator of the domain enabling technology.

Realization

The final period of the development of a strategic domain is when the body of advocates press for and realize an organization that has a strategic mission that is fully independent of its parent service arm. This period sees the full operationalization in organization and training of the war imaginary developed during the previous stage. The advocates are able to implement their war imaginary because of the legitimacy granted in gaining operational autonomy, which gives credence to their own conceptual and doctrinal production.

A strategic domain is fully realized when the advocates are granted an organizational form that has strategic autonomy. This autonomy is characterized by three features: first, the body of advocates gain the ability to represent their interests directly to civilian leadership. This directness is either through the creation of a distinct service and accompanying civilian appointed office or the creation of a statutory office whose remit is representation of the interests of the advocates. Gaining the ability to directly represent their interests to civilian leadership amounts to a recognition that the interests of the advocates are fully distinct from the overarching service arm.

Second, the organization responsible for operating within the domain is granted exclusive authority to promulgate doctrine for operation in the domain. This authority allows for the

advocates to fully operationalize their war imaginary and its accompanying doctrine by giving them full control over how they train and organize for independent operations during a war.

And finally, that while the operators in the new domain may be called upon to participate in combined arms warfare or joint planning, they are granted a statutorily defined independent strategic mission. This mission allows the advocates to fully pursue their conceptualization of how war will be fought and won in the new domain. Moreover, it signifies a forced recognition or acceptance of the vision that the advocates had been developing as legitimate by other services and civilian leadership.

Overall, the development of a strategic domain progresses along two dimensions: ideational and organizational. This is because, as I argued in the previous section, concepts for employment and organizational patterns have an "intimate connection." The prognostication of an officer is meaningless without the organizational preparations to realize it: a bomber cannot be used effectively without a doctrine that elaborates where to bomb and why. Whether a strategic domain is realized is a contingent process, each of the stages outlined contain opportunities for the direction of the development to be accelerated, altered, stalled, or regress. The contingent path that the development of a strategic domain takes is the consequence of the operation of the three intervening variables, which I will discuss in the next section.

2.3.2 Intervening Variables

The success or failure of the advocates in developing a strategic domain is mediated by three intervening variables: senior leadership interest, interservice rivalry, and civilian intervention. My argument is that depending on the timing and intensity of the operation of these variables a body of advocates could either realize an independent strategic domain, a support domain develops, or the technology becomes an integrated capability.

Senior Leadership Interest: This is the degree to which the senior leadership of a military service arm is actively interested in and intervenes in the development and uses of the domain enabling technology. My claim is that the extent of senior leadership interest and when is critical because they have the power to define missions, restrict or direct doctrinal development, decide officer succession or commissioning policies, provide or withhold support during negotiations with civilians, and determine budget and staffing levels. A highly antagonistic or deeply interested senior leadership can actively intervene to halt or otherwise shape the evolution of the advocates and the development of a unique war imaginary to their own interests.

The impact of senior leadership interest will differ across the three stages previously outlined. If the senior leadership becomes deeply interested in the technology during the advocacy phase, particularly during the initial acquisition, then a body of advocates is unlikely to coalesce. This is the consequence of the senior leadership viewing the domain enabling technology as challenging the core mission of the service and in so doing threatening the raison d'etre of the service itself. The perceived threat leads the senior leadership to pursue a variety of strategies to fully domesticate the technology. I argue that the core strategies that impact the advocacy stage are controlling the mission the technology is developed for or intervening in staffing decisions for early operators. These have the consequence that the subsequent development of the technology and potential advocates are hewed to existing service prerogatives preventing experimentation and the potential for the beginnings of a distinct corporate identity. For example, the senior leadership of the Navy took an early interest in the development of aviation, and in particular how it could be used to extend sea power. This meant that they intervened to guide the development of early naval aviation to fulfill their concept of sea power and in so doing prevented the formation of a body of advocates.[39] While I do not attempt to theorize how or why a domain enabling technology is initially acquired, the decision to acquire may involve some degree of senior leadership interest. My claim is that what matters is whether the question of potential uses is left to the initial operators after the initial acquisition. Therefore, senior leadership interest does the most to prevent further advocacy if they deeply intervene at the moment of the creation of initial operational units as it cements their vision for how the technology should be employed. The preventative impacts of high levels of interest is most clearly born out in the development of the Luftwaffe in Germany during the 1930s. The Luftwaffe never gained meaningful independence from the Wehrmacht because its development was guided to fulfill the needs of combined arms warfare rather than independent strategic warfare. This doctrinal orientation was the consequence of the Wehrmacht staffing the senior officer corps of the Luftwaffe with ground commanders who maintained their doctrinal preferences.[40]

Next, I argue that senior leadership interest is crucial during the visioning stage, because greater organizational expansion will necessitate the senior leadership's cooperation as budget and staffing allocations expand. Some degree of senior leadership interest is endemic to this phase because of the growth of the advocate's organization and their desires to promulgate

39. See Section 3.3.4 in Chapter 3

40. Overy, "From 'uralbomber' to 'amerikabomber': The Luftwaffe and Strategic Bombing"

doctrine. This interest can take one of two forms either antagonistic or helpful due to their having established a relationship with the body of advocates. If the senior leadership of the service is highly antagonistic towards the advocates then they will have trouble winning organizational concessions or expansions. Moreover, because the senior leadership of services generally have veto power over doctrine, this will limit the ability for advocates to incorporate elements of their envisioned concepts for employment into the overall doctrine of the service. The antagonism of senior leadership is a reason why, for example, many major naval powers in the first half of the twentieth century had operational submarine units but little to no established doctrine or operational plans to use them. The challenge that submarines posed to the mission of surface fleets derived from Alfred Mahan meant that the senior staff of navies were loath to use them and actively prevented the promulgation of doctrine that would grant them a role outside of surface fleet defense.[41] If the senior leadership is helpful, then the advocates potentially gain an ally for organizational expansions and the increased budget share that would coincide with them. It is therefore critical that the senior leadership be interested in non-antagonistic fashion when the advocates fight for operational autonomy because it will necessitate the senior leadership giving up degrees of control and re-allocating budget shares.

The realization stage requires a high degree of helpful senior leadership interest. This is the consequence of generational turn-over in senior staff which brings less conservative officers into positions of leadership or the sway from new positions created during the battle for operational autonomy. I argue that this interest is critical for the advocates to gain greater degrees of organizational autonomy because of the clout brought by the senior leadership in debates over organizational expansion. The alliances and clout brought by senior leadership grant the advocates greater legitimacy when demanding an independent strategic mission for the domain enabling technology.

Interservice Rivalry: Inter-service rivalry is generated when the new domain enabling technology is initially acquired or developed by multiple services whose senior leadership have a high degree of interest stemming from a potential threat to their core mission. This is most likely to happen when civilians establish a common funding pool or clearly defined mission for the new technology.[42] My claim is that this generates incentives for service leaders to make expansive

41. *Passim* Ben-Yehuda, *Atrocity, Deviance, and Submarine Warfare*

42. This account is adapted from Huntington's discussion of the period of high levels of inter-service rivalry following World War II in *The Common Defense*. Huntington argues that prior to defense unification following World War II, the War and Navy Departments had distinct political universes and therefore few points of friction

claims on why they should have authority over the use of the technology to get the largest budget share possible. For example, during congressional hearings after the Soviet Union launched Sputnik, the Air Force claimed that they needed a "lunar assault vehicle" and the Army developed plans for lunar outposts.[43] Therefore this rivalry drives high levels of senior leader intervention into the development process in order to bolster their claims to the technology. I argue that inter-service rivalry is only possible during the advocacy and visioning stages of domain development because by the time a group of advocates are successful in achieving operational autonomy questions of authority will have been resolved.

Rivalrous dynamics will have the greatest impact during the advocacy stage of domain development as this is the period in which there is the greatest uncertainty over who will control the technology and what to what ends it will be used. I argue that high levels of inter-service rivalry during the advocacy stage will lead to many of the effects caused by high levels of senior leadership interest.[44] As each service seeks to arrogate to itself the budget share devoted to the new technology, the early operators and developers of the technology will be subject to high degrees of control from senior leadership in order to ensure that the rivalry is resolved in favor of the parent service. The consequence is that the body of advocates is not able to form as the early operators and developers are bent to serve the interests of senior leadership.

High levels of rivalry during the visioning stage is similarly disruptive. My claim is that if the advocates of multiple services are competing for operational autonomy and the budget share that goes along with responsibility for new technology then they have incentives to hew to their parent service's interests and corporate identity. This is the because the main antagonist of the advocates is not a recalcitrant or conservative senior staff but rather a rival service. The consequence of this is that it diminishes the motivation to develop a unique war imaginary and prerogatives with leading to the development of a support domain or integrated capability.

Civilian Intervention: Civilians seek to intervene on the development of the domain enabling

---

that could generate rivalry. What points of friction there were—was over the development of aircraft for their respective air organizations. This friction was alleviated by both separate funding streams and the Joint Army-Navy Board on Aeronautics, a point I will similarly argue in my chapter on the Air domain. See Huntington, *The Common Defense: Strategic Programs in National Politics*, 369-394; see also pp 116-126 in Richard Betts, *Soldiers, Statesman, and Cold War Crises* (Cambridge, Massachussetts: Harvard University Press, 1977) for an account that primarily explains this pattern of rivalry through the rise of deterrence as an overarching mission for the military services.

43. See Chapter 4

44. While these two intervening variables are similar there can be instances in which senior leadership has low interest in the technology but responds to the incentives provided by the development of a new mission area.

technology when either there is a large scale demonstration of the technology by a competitor state which leads civilian leadership to "check up" on or intervene in the military's development of the technology[45] or there are a widely reported and highly publicized set of failures of the operation of the technology. Both of these lead civilians to investigate and potentially intervene on the military's development of the technology. I argue that the consequences of these investigations can be both positive (increased funding/staffing or organizational expansion) or negative (removal of authority for the technology) depending on what phase this intervention falls.

If civilians are drawn to intervene during the advocacy phase of domain development then civilian leadership will press the senior leadership of the service to accelerate or otherwise modify the development of the domain enabling technology. My claim is that pressure on and from senior leadership will mean that the technology will be rushed to fit the prevailing interests of the service in responding to civilian leadership. However, civilian intervention driven by technological pressure during the visioning stage can have differential consequences. If there has been a high degree of service rivalry and therefore multiple sites of advocacy I argue that civilian leadership will give the center of advocacy that aligns most closely with their overarching policy interests authority over the technology. For example, after the Sputnik launch the Navy, Army, and Air Force each advanced a different vision of how to develop space, but since all of these services had been competing with grandiose claims about using space Eisenhower initially denied all of them a military space mission. The vision that Eisenhower operationalized led to space being articulated as a support domain.[46] However, if there is a single body of advocates then they will receive greater funding and organizational concessions, as they have the greatest legitimacy in defining the potential uses of the domain.

Civilian intervention becomes most critical for the realization phase of domain development because realization requires the largest concession to the advocates—an independent strategic mission. I argue that an assertive civilian intervention after the visioning stage provides venues for the organizational struggle by the advocates for an independent strategic mission. This is because granting the advocates an independent mission will necessarily collide with the interests of the senior leadership of multiple services as it will of necessity reconfigure the budget share and role of extant services in national defense. For example after the Munich

45. This model of civilian intervention is similar to that posed in Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars*

46. See Chapter 4

Crisis, Roosevelt chose to meet with leaders of the Army Air Corps in addition to the War Department General Staff to discuss how to conduct the build-up of aircraft prior to World War II.[47] Civilian intervention during this period allows for the advocates to form powerful alliances with civilian leadership who advance their interests as the sole legitimate operator in that domain.

While it is unclear whether a strategic domain has ever empirically appeared after passing into one of the auxiliary outcomes (integrated capability or support domain), the process of technological development for the extant domains continues apace. If a strategic domain were to appear either from a civilian dominated domain or entrenched support domain it will likely be due to a competitor state demonstrating the combat usage of that domain. This is because the status of domains helps to inform the "rules of the road" for how states interact in that domain. For example, there has long been an informal norm against destroying the orbital satellites of competitor states but that norm could be challenged by a new entrant into the domain of orbital space stationing anti-satellite weapons in orbit.

2.3.3 The Argument

Altogether, I argue that a body of advocates will only be successful in developing a strategic domain of warfare if they are able to develop and operationalize a unique war imaginary for the usage of the domain under the following conditions across each stage of development: advocacy, this period is characterized by an absence of civilian intervention, low senior leadership interest, and a lack of inter-service rivalry. These conditions allow the early formation of a body of advocates and grants freedom for the advocates to develop unique missions for the technology. Critically, this leads the first operational units to reflect the interests of the advocates. If a body of advocates has coalesced then the first operational units and the doctrine to integrate them into the larger mission of the overarching service will reflect the concepts developed by the advocates. However, if the body of advocates do not coalesce due to high levels of senior leadership interest, inter-service rivalry, and civilian intervention then the technology will either become an integrated capability or develop into a support domain. This is because the early operators of the technology are fully subordinated to the interests of senior military or civilian leadership and are not able to develop the beginnings of a distinct corporate identity and war imaginary.

The next stage—visioning—must be defined by moderate senior leadership interest,

47. See Chapter 3

lower inter-service rivalry, and some civilian intervention. This environment allows the advocates to agitate for further organizational expansions in accordance with their own interests. These interests, I argue, are derived from the ongoing visioning process in the institutional crucible of the service academies and training schools that are established to train officers and staff to command and operate this technology. This development of a war imaginary becomes critical to the fight to gain operational autonomy within the service arm because it allows the advocates to articulate what they are able to accomplish independent of field commanders. The failure to achieve operational autonomy or to organizationally expand due to periods of inter-service rivalry or civilian intervention may lead to an alternative domain vision taking hold. This is for two reason: first, inter-service rivalry may corrode civilian trust in the military's ability to decide how to use the technology, leading them to choose a non-military vision. Or second, a weak organization may not have the credibility both in terms of experience and depth of vision to propose a satisfying account of how operationalize the potential domain during when civilians the agenda for substantial change.

And finally, a realization phase characterized by periods of highly interventionist civilians and high senior leadership interest. I argue that civilian interventions grant the advocates venues to publicly advance their imaginary and arguments over independent strategic warfare in the new domain. The support of senior leadership is then critical to achieve a fully independent strategic mission, because the overarching service will necessarily have to admit the legitimacy of the advocates vision if they are to be granted an independent strategic mission. My claim is that these two variables propel the achievement of an operationalized strategic domain with a defined independent strategic mission.

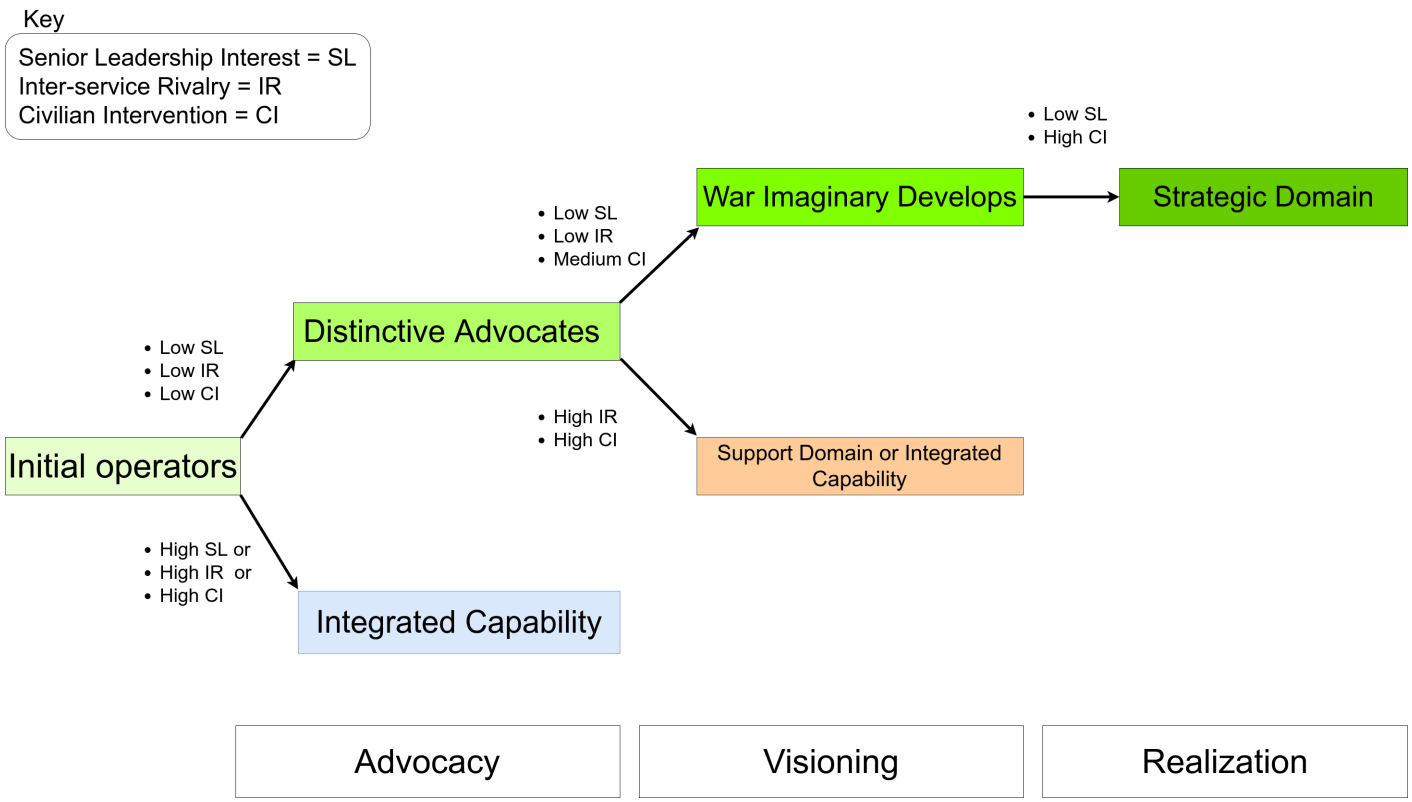

Figure 2.1: Theory of Domain Development

2.4 Research Design

2.4.1 Case Selection

In order to explain the process of how military domains come to develop I will assess the theory of domain development across three empirical cases: air, orbital space, and cyberspace. Therefore, this is a small-N study that engages in comparative case analysis in order to expose how technologically inspired advocacy, mediated by bureaucratic politics, produces or fails to produce new domains of warfare.[48] For each case I assess the degree to which the intervening variables affected the advocacy process within each observable stage and whether they coincide with my theoretical expectations, drawing both inter-case and when possible intra-case comparisons. Each of the cases I selected signify technologies that were widely socially anticipated at the time of their development and are seen as symbolic of the technological progress of their era. Moreover, each of them has been the subject of at least some military prognostication and were acquired by at least one U.S. military service arm. Individually they show the variation in domain development: the development of the air is the baseline case for strategic domains because it unfolds in a theoretically expected manner. The development of orbital space demonstrates both of the potential alternative outcomes: space launch technologies were initially developed as integrated capabilities and orbital space became a support domain. Moreover, orbital space is particularly useful because there were two attempts to challenge its status as a support domain thereby allowing for intra-case comparisons. Finally, cyber, as it lacks a geographical space, demonstrates the constitutive dimension of technologically inspired advocacy. Together these cases expose how the process of domain development is both contingent and driven by technologically inspired advocacy.

I focus on the development of strategic domains in the U.S. Military for three reasons: first, the United States has had a dominant role in defining what characterizes a leading military power operating within these domains. Second, as a matter of policy the United States has maintained substantial capabilities and service arms for all widely accepted domains of conflict

48. Alexander Lawrence George and Andrew Bennett, *Case studies and Theory Development in the Social Sciences* (Cambridge, MA: MIT Press, 2005), Chapter 3; Theda Skocpol and Margaret Somers, "The Uses of Comparative History in Macrosocial Inquiry," *Comparative Studies in History and Society* 22, no. 2 (1980): 176-178; Arend Lijphart, "The Comparable-Cases Strategy in Comparative Research," *Comparative Political Studies* 2, no. 8 (1975): 163-164

whereas many other states maintain a single major service arm. And finally, scholarship, doctrine, and policy debate is much more open and accessible in the United States than many other parts of the world. Each of these cases will be accompanied by a set of short foreign shadow cases to highlight the role of intervening variables in producing the three potential outcomes: strategic domain, support domain, and integrated capability.

Air: The development of the Air domain was the first major technological shift that led the creation of a new strategic domain and will serve as a baseline for successful strategic domain development. This is because I show that the development of the Air domain unfolded in a theoretically expected fashion. The development of the air as a strategic domain took place in furious public and private debates across the first half of the twentieth century, meaning that both the struggles for organizational expansion and the development of a war imaginary are easily observable. This chapter will have three shadow cases: first, the development of U.S. Naval aviation. The U.S. Navy first acquired an aircraft at roughly the same time as the U.S. Army but a body of advocates was never able to coalesce due to high levels of senior leadership interest thereby leading to the integration of aviation into the Navy's overarching conception of war. The second will be the development of the German Luftwaffe in the run-up to World War II. This is because despite an intense interest in strategic bombardment on the part of European military prognosticators and some Luftwaffe officers, the Luftwaffe developed as a support air arm. As with the case of U.S. Naval aviation, this will show senior leadership interest can block the development of distinctive advocacy and doctrine. The last shadow case will be the creation of the Royal Air Force by the United Kingdom during World War I. The creation of the Royal Air Force, I argue, shows how early and intense civilian intervention can accelerate organizational development but not the development of an independent war imaginary. The Royal Air Force's main conception of independent aerial warfare during this time continued to articulate itself within the dominant strategic framework of the ground forces after independence.

Orbital Space: Following World War II and the development of the V-2 rocket, space had the greatest variety of potential domain visions but has existed as a support domain since the early 1960s. Prior to the Sputnik Crisis the Air Force, Army, and Navy all primarily developed space-enabling technologies as integrated capabilities (missiles) as a consequence of inter-service rivalry. What development there was of space systems by the services were largely pro forma bureaucratic maneuvers to maintain or capture a potential orbital space mission. The variety of visions posed for orbital space will be useful in drawing out how the dynamics of inter-service

rivalry and civilian intervention drove a non-military settlement of how to utilize Space in the aftermath of the Sputniks crisis. While the attempts to develop Space into a strategic domain "failed" as it became entrenched as a support domain, there were two major efforts to challenge this status—Aerospace and the SDI. Both of these attempts demonstrate the continuing impact of the intervening variables in entrenching outcomes. Moreover, these efforts and their failures demonstrate how the status of a domain becomes "sticky" over time.

Cyberspace: While theoretically cyber is in the realization phase, it is the newest declared domain as well as the most thoroughly dependent on the relationship between technology and doctrine. The rise of cyberspace will demonstrate the degree to which the success of domain development is contingent on the conceptual work of understanding how a new technology can be employed for a distinct form of warfare. Furthermore, of the set of cases I explore this is the most puzzling because cyberspace doesn't correspond to a commonly accepted geophysical division but is instead a global infrastructure.

2.4.2 Research Method

The course of the development of a strategic domain is deeply historical and contingent. Each of the cases I have selected unfold across multiple decades, drawing attention to the continuity of ideational and organizational processes within military organizations. In order to assess the theory of domain development, I utilize process tracing in order to determine the differential impact of each of the intervening variables across each of the periods of development within the individual cases. Process tracing calls attention to the intentions, argumentative strategies, and actions of historical actors at critical points in time.[49] To explain the patterns of domain development I primarily develop the case histories from third party accounts and original archival research to understand the organizational battles for increased autonomy and the internal ideational development of a unique war imaginary. The records and transcripts of investigating boards, congressional hearings, internal organizational debates are assessed along with (when available) the memos, drafts, notes, service academy course materials, speeches, magazine articles, and published books written by domain advocates. I use these texts to track the degree/impact of intervening variables on struggles for organizational autonomy and the

49. George and Bennett, *Case studies and Theory Development in the Social Sciences*, Chapter 10; Jeffrey T. Checkel, "Process Tracing," in *Qualitative Methods*, ed. Audie Klotz and Deepa Prakash (New York, New York: Palgrave MacMillan, 2008), 114–130

development of a distinct war imaginary by the advocates.

For the purposes of the development of a domain the key struggles for organizational expansion are those that grant greater organizational autonomy. These are: the moment of initial procurement, the creation of the first operational unit, the granting of operational autonomy, and finally strategic autonomy. I assess major drives for expansion that both failed and succeeded as well as the impact of the intervening variables on each period. I determine the degree to which advocates succeed in advancing their vision by the correspondence between the organizational expansion and the arguments they present about the uses of the technology in warfare. That is, whether the expansion grants them the ability to actualize their plans for employment. Additionally, for each case I also briefly assess whether there is evidence for structural dynamics—ideational or material—drive the key outcomes.

I assess evidence for each of the intervening variables in the following way:

Senior Leadership Interest: Senior leadership interest takes various forms across the three stages of domain development. During the advocacy stage, I assess senior leadership interest as high based on three factors: if the senior leadership repeatedly intervenes on staffing initial operators and developers of the technology, assigns a clear mission at the moment of acquisition, and/or subordinates the training and development of the technology. For the visioning stage, I assess senior leadership interest as high if the senior leadership of the parent service consistently argues against all organizational expansion and/or sharply limits the ability of the advocates to promulgate doctrine. Senior leadership interest is low if the advocates are able to modify doctrine to reflect their war imaginary and if the senior leadership actively supports organizational expansions. For the realization phase, I evaluate senior leadership interest based on the degree to which they are adopting or accepting elements of the advocates' arguments or if elements of the senior leadership intervene to protect or advance the interests of the advocates.

Inter-service Rivalry: I evaluate the extent of inter-service rivalry in two ways: first, whether there is a common funding mechanism for the domain enabling technology between the services. Second, whether the senior leadership of the services compete or spar over mission authority for the technology. I consider high levels of rivalry to be present if multiple services repeatedly express competing claims over the technology to civilian politicians and/or the senior leadership of a service acts based on expressed concerns over the activity of another service vis-a-vis the technology.

Civilian Intervention: I evaluate evidence of this as civilian politicians opening hearings or

appointing investigations closely following highly publicized failures of the technology (such as a rocket exploding during launch or a set of aircraft crashes) or large-scale demonstrations of the technology by a competitor (during a war or events such as Sputnik I) I determine whether these events drive the hearings and investigations based on temporal proximity and the stated purpose of the hearings or investigations. Moreover, because this variable presents an endogeneity problem (e.g.: are the hearings created to grant the advocates the desired autonomy) I also examine whether there is evidence that civilians opened these investigations to achieve a predetermined outcome.

Altogether, my assessment of the theory of domain development across these cases involves tracing two subsidiary processes: organizational struggle and ideational development, and determining the extent to which they are mediated by the intervening variables. Depending on the extent of their development, each of the cases are structured according to the process of development elaborated above. For each of the key organizational moments—initial procurement, first operational unit, operational autonomy, and strategic autonomy—I assess the degree and expected influence of each intervening variable on the success of advocates in winning organizational concessions. Within each of the stages I also track advocates' conceptual work to develop new tactical, operational, and strategic roles for the technology that constitute the war imaginary. Finally, at the end of each case I assess whether there is any evidence for structural pressure driving organizational or conceptual changes, by examining whether the arguments deployed by the advocates, senior leadership, or civilians are reactive or emulative of foreign militaries.

Chapter 3

Thinking War in a Third Dimension

3.1 Industrial Age Warfare

During the first session of the 1935 capstone course entitled "Air Force" at the Air Corps Tactical School (ACTS) Major Harold R. George posed the following to the assembled cadets:

> The question for you to consider from today on war, to have constantly before you as you continue your careers, is substantially this:
>
> 'Has the advent of air power brought into existence a method for the prosecution of war which has revolutionized that art and given to air forces a strategical objective of their own independent of either land or naval forces the attainment of which might, in itself, accomplish the purpose of war; or has air power merely added another weapon to the waging of war which makes it in fact only an auxiliary of the traditional military forces?'[1]

Harold R. George's admonition to his students exposes the extent to which the status of aircraft in warfare was still deeply uncertain some fifteen years after their first widespread use in World War I. This stands in sharp contrast to today where the basic role of aircraft in warfare is widely accepted within and across military establishments the world over. This quote highlights the two opposing understandings of what aircraft meant for war during this time period within the American military. First, that the development of aircraft merely provided new means for

1. An Inquiry into the Subject "War", Harold R. George, 1935, Papers of Frank Maxwell Andrews, Box: 11, Folder: Official Papers: Wilcox Bill 1937 (Bill to Create the Air Corps), Library of Congress Manuscript Division

accomplishing the core strategic objective of war-fighting—the destruction of enemy forces in the field or second, that the development of aircraft meant that the basic grammar and objective of war-fighting would have to be radically re-conceptualized. The first perspective attempted to fit the aircraft into existing concepts of the employment of capabilities, for example the bomber was long understood as a form of highly mobile artillery meaning it should be employed as such. The second perspective, which had long been developing in the classrooms of the ACTS, held that the aircraft demanded a revolutionary reinterpretation of the dynamics of warfare, society, and technology.

On the eve of World War II the second perspective would come to dominate with industrial-web theory—a theory of independent aerial warfare—underwriting the development of air warfare plans. This theory of warfare would not only undergird how the Army Air Forces fought in World War II, it continues to underwrite Air Force doctrine to this day.[2] The mobilization of industrial-web theory, which posited that wars could be won at the strategic level with the selective bombing of industrial infrastructure, signaled not just the rise of a new way of war but opening of a "new element" to military activity—the Air—and its attendant consequences meant that war would be conducted in a three-dimensional space as aircraft had "extended the vulnerable area of a country to every acre of its territory."[3]

The rise of the Air as a strategic domain was the consequence of approximately thirty years of advocacy driven forward by the first aviators in the Army Signal Corps. These advocates advanced a vision that aircraft had transformed the geometry and grammar of warfare and encoded these beliefs in organizational forms and doctrine. Thus, this case demonstrates the necessity of distinctive advocacy in the development of a strategic domain. I will begin with an exploration of the early history and social beliefs surrounding the aircraft prior to their acquisition by the United States military. The development of heavier-than-air flight was believed to be yet another dimension of technological modernity for the populations of the Western World. Next, I will discuss the initial acquisition of the aircraft and the development of distinctive advocacy in the Army Signal Corps from 1907 to 1914. This stretches from the issuance of the first acquisition contract for an airplane to the creation of the First Aero Squadron, I theoretically

2. Air Force Doctrine Working Group, *Strategic Attack: Air Force Doctrine Document 3-70*; Conrad C. Crane, *Bombs, Cities, and Civilians: American Airpower Strategy in World War II* (Lawrence, Kansas: University Press of Kansas, 1993), 11; Herman S Wolk, *Toward Independence: The Emergence of the U.S. Air Force* (Washington, District of Columbia: Air Force History / Museum Program, 1996), 13

3. Brig. Gen. James Allen, "Report of the Chief Signal Officer," in *Annual report of the Secretary of War Volume I*, vol. I (Washington, District of Columbia: Government Printing Office, 1910), 651

expect that distinctive advocacy should coalesce during this period as a consequence of organizational neglect and freedom. Indeed, during this period the Army aviators were extended this expected neglect as a consequence of the conservativism of the War Department General Staff, which is contrasted against the involvement of senior Naval officers in Naval Aviation. The next period explored is from 1915-1935, from the creation of the First Aero Squadron until the creation of the General Headquarters-Air Force which was an operationally autonomous command. The increasing organizational strength of the advocates during this period, per my theoretical claims, allowed the advocates to develop a war imaginary. At the Air Service (later Corps) Tactical School the advocates developed and elaborated "industrial-web theory," a set of wagers that the social transformation of industrial society allowed for strategic victory using precision industrial bombing. In the final period from 1936 to 1943, the advocates worked to realize strategic autonomy to make this theory into a reality. This ends with the creation of the strategically autonomous Army Air Forces and the recognition that Airpower is co-equal with Landpower in Army doctrine. In the conclusion I will present two short shadow cases—the RAF and the Luftwaffe—which highlight the need for slow developing advocacy for the development of an independent war imaginary.

3.2 1898-1907: The 'Flying Machine' in the Public and Military Imagination

The key catchword for early aviators in the United States was "air-minded," a term which connoted the degree to which someone was committed to civil and military aviation as more than just a passing curiosity or fad. To be air-minded was not just to have a passion for aviation but to believe that aircraft heralded a new age in the history of Western Civilization that must be encouraged and reckoned with. Air-mindedness denoted a common belief and identity amongst the early aviators, researchers, politicians, and enthusiasts which was juxtaposed against the conservative doubters who believed that mechanical flight would never technologically progress to be more than a curiosity.[4]

The ground out of which these advocates sprung was well-tilled by both the social expectations of technological modernity and the authors of "scientific romances" (later to be

4. *Passim* Charles Chandler and Frank Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914* (New York, New York: The Ronald Press Company, 1943)

known as science fiction.) To the former, the late nineteenth and early twentieth century was a time of rapid technological change. The preceding fifty years had seen the rise and expansion of the railroad, the beginning of electrification and the spread of incandescent lighting, the development of wireless telegraphy, the internal combustion engine, and photography; technologies which were reshaping the lives of the rapidly urbanizing populations in the Western World.[5] Public interest in aeronautics was initially shaped by the increasing sophistication of lighter than air craft, such as zeppelins or hot air balloons. The increased sophistication of ballooning led to the creation of national "Aero Clubs" which organized public spectacles and conducted marketing campaigns to develop public interest in aeronautics. The sporting nature of the public demonstrations of aeronautic vehicles lent early aviators a daredevil mystique.[6]

The "scientific romances" of the late nineteenth and early twentieth centuries predicted to a surprising degree the tactical and strategic uses of aircraft.[7] These romances drew on anxieties of the day and told stories of aircraft being utilized in class struggle or the achievement of racialized imperial dominance.[8] Despite the profusion of these novels, the fantasy of a war in the air was largely a European curiosity, Americans preferred to focus on the technical, economic, or sporting dimensions of aeronautics. This was perhaps a reflection of the psychological security afforded by the two oceans that separated the continental United States from other industrial powers of the period.[9] This difference in societal anxieties is perhaps best highlighted through what some have retrospectively termed the "scareship age" in the United Kingdom. The publication of R.P. Hearne's *Aerial Warfare* in 1908, which argued that the United Kingdom was vulnerable to attacks by German Zeppelins and aircraft, led to a period of mass hysteria as reported sightings of phantom airships spread throughout the country.[10] Despite the fact that these novels were not as popular in the United States as Europe, they were certainly known by some in the military as the first Army pilot became interested in aircraft after reading Jules Verne's

5. Robert Wohl, *A Passion for Wings: Aviation and the Western Imgination 1908-1918* (New Haven: Yale University Press, 1994), 8-14

6. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 53-75

7. Michael Sherry in *The Rise of American Airpower* puts it thusly: "More than any other modern weapon, the bomber was imagined before it was invented. In a century of primitive experiments with balloons and then with dirigibles, nearly every claim later advanced by strategists of air war was already mentioned. See Michael Sherry, *The Rise of American Air Power: The Creation of Armageddon* (Princeton, New Jersey: Yale University Press, 1987), 1

8. Tami Davis Biddle, *Rhetoric and Reality in Air Warfare* (Princeton: Princeton University Press, 2002), 13

9. Sherry, *The Rise of American Air Power: The Creation of Armageddon*, 4

10. Bearing many similarities to modern UFO sightings. David Clarke, "Scareships over Britain: The Airship Wave of 1909," *Fortean Studies* 6 (1999): 39–63

1886 *Clipper of the Clouds* (more commonly known as *Robur the Conqueror*.[11]

Unlike the early air-minded of this period whose beliefs about the potentials of mechanical flight were largely based on boundless speculation, the Army disposition towards flying machines was formed in reaction to an expensive failure. In 1898 the U.S. government was approached by Samuel Langley, the Secretary of the Smithsonian, to provide seed funding for the construction of a prototype aircraft. The Army Board of Ordnance approved a grant of $50,000 for the development of the aircraft, and over the course of two test flights in 1903 the aircraft failed miserably leading to congressional and public outcry at the waste of public funds.[12] Ironically, it was in December of the same year that the Wright Brothers accomplished the first recorded mechanical flight in North Carolina. In a display of patriotism, the Wrights desired to either sign an exclusive production contract with the War Department or transfer their patents so aircraft could be built at Army arsenals. However, the War Department and Congress's experience with the Langley prototype meant that the Wright airplane entered into a context characterized by distrust and suspicion towards potential aircraft and hence the Board refused repeated entreaties by the Wrights to evaluate their aircraft. The strength of this suspicion is borne out in a reflection of two of the earliest Army pilots when they explained that the "traditional conservativism prevented military officials from accepting as true, the reports that actual flights had been made in 1904 and 1905 at Dayton, nor did they even take the trouble to investigate newspaper reports of such flights."[13]

The Wright's failures to capture the interest of the Army's Board of Ordnance was overcome by a chance encounter and the subsequent befriending of the President of the Aero Club of America—Courtlandt Bishop. Bishop, upon reviewing the brother's correspondence with the Board of Ordnance contacted his brother-in-law who was serving as a member of congress at the time. The congressman pledged to help the Wrights and contacted President Theodore Roosevelt who directed the Secretary of the Army to have the Board of Ordnance re-open negotiations with the Wrights.[14] After several more false starts and a reassuring presentation before the Board by Wilbur Wright the board decided in late 1907 to draft and issue specifications for

11. Benjamin Foulois and C.V. Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois* (New York, New York: McGraw-Hill Book Company, 1968), 43

12. Juliette A. Hennessy, *The United States Army Air Arm, April 1861 to April 1917* (Washington, DC: Office of Air Force History, 1985), 20-21

13. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 148

14. Tom D. Crouch, *The Bishop's Boys: A life of Wilbur and Orville Wright*, New York, 2003, 331

a prototype aircraft.[15]

3.3 1907-1914: The Growth of Air-minded Advocacy in the Army Signal Corps

> The pilot of the aeroplane, for whom we all have the highest respect, is the fighting man of the machine. He is the man behind the gun; but from the nature of things he must be a young venturesome officer, generally without the knowledge of administrative and technical matters which can only come with years of experience and study.
> —General James Allen in his 1913 Annual Report[16]

The contract specifications for a prototype aircraft would be developed by the officers of the Army Signal Corps, and it is from these officers that aviation advocacy would spring. Theoretically, for a strategic domain to develop, the period between the initial acquisition and the first formal military unit must see the development of distinctive advocacy following from organizational neglect. One of the key effects of this is that the advocates through experimentation are able to influence doctrine for the first formal military unit. In the case of the Signal Corps advocates, both of these occur. The conservative orientation of the War Department General Staff as well as the non-aviation Signal Corps officers meant the early aviators were granted freedom to experiment with the aircraft and came to believe that they had distinct interests from the Army. Furthermore, a likely consequence of this experimentation is that the 1913 Army Field Service Regulations reflected the reconnaissance techniques developed by the advocates. While this is theoretically expected, what is unexpected is that this neglect led to incompetent leadership and resentment from the aviators towards their senior officers. The conditions for this advocacy to form was also a function of the other two intervening variables—inter-service rivalry and civilian intervention were largely absent. Rivalrous dynamics between the Navy and War Departments was never catalyzed because the Navy Department did not seriously pursue aircraft until after the development of pontoon-equipped seaplanes in 1911 and their aircraft

15. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 142-144
16. Brig. Gen. James Allen, "Report of the Chief Signal Officer," in *Annual Report of the Secretary of War*, vol. I (Washington, District of Columbia: Government Printing Office, 1913), 791

purchases were funded through appropriations given by House Naval Committee.[17] Civilian politicians did relatively little to intervene on the development of aviation until 1913, which resulted in increased funding and organizational stability for the aviators.

This section will proceed by outlining how the neglect and freedom granted to the aviators led to their growing sense of distinctiveness. First, I will explain how the acquisition of the first aircraft set the stage for the development of advocacy. Then, I will show how these conditions generated a sense of distinctive advocacy amongst the aviators. Following that will be a discussion of the First Aero Squadron and the one case of civilian political intervention. Finally, the necessity of organizational neglect for the formation of distinctive advocacy will be exposed by a short discussion of early naval aviation.

3.3.1 Acquiring the First Army Aircraft

The task of developing the first acquisition order was assigned to the newly created Aeronautical Division of the Signal Corps whose remit was to be in "charge of all matters pertaining to military ballooning, air machines, and all kindred subjects."[18] This division was created in August 1907 due to the interest that had been aroused by the surprise victory of American Signal Corps officer Charles DeForest Chandler (acting in a civilian capacity) in the First International Gordon Bennett Balloon Race.[19] The rapid development of free and captive ballooning during this time period alongside the sclerotic and haphazard performance of the Wright Machine led early aeronautical interest in the Signal Corps to tilt towards ballooning, which had the consequence of marginalizing the earliest Army pilots.[20] Despite these crosswinds the Aeronautical

17. Archibald Turnbull and Clifford Lord, *History of United States Naval Aviation* (New Haven, Connecticut: Yale University Press, 1943), 47

18. R. Earl McClendon, *Autonomy of the Air Arm* (Washington, District of Columbia: Air Force History / Museums Program, 1996), Appendix A

19. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 80; Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 47. Of course, this was not the first attempt by the U.S. Army to utilize ballooning for military purposes. The Civil War had seen the use of military balloons for reconnaissance. For a discussion of the ebb and flow of military ballooning in the United States see Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 1-52 or Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 1-19

20. The first Army pilot, Benjamin Foulois was labeled as "dangerous" and was covertly punished by the Signal Corps staff when he stated that he believed that the Army should focus aeronautical development on heavier than air craft. See Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 57 Additionally, the commander of the Signal Corps, General James Allen, preferred investigating rotary aircraft. See Robert T. Finney, *History of the Air Corps Tactical School* (Washington, District of Columbia: Air Force History / Museum Program, 1998), 26

Board of the Signal Corps issued the first call for proposals for a prototype aircraft in December 1907.

The call specified performance characteristics (40 MpH, carrying capacity of 350 lbs, and range of 125 miles) which would seem modest for an aircraft only a few years more advanced.[21] Perhaps remembering the public and congressional outcry over the Langley aircraft, the Signal Corps was roundly criticized in the press for setting seemingly unachievable performance standards. The editor of the *American Magazine of Aeronautics* even went so far as to claim that the specifications guaranteed a failure which would set back the development of aeronautics within the United States.[22] Despite this public reception the Signal Corps received some 40 proposals, of which the Wright's was the only able one to deliver an aircraft by the contract deadline of August 28, 1908.[23] However, the first delivery was marred by the death of Lieutenant Selfridge, a passenger on a test flight; this led to a further delay of another year and in 1909 the Wright Military Flyer was officially accepted by the Signal Corps.[24] With the contract came a stipulation that the Wright's had to train one officer in flight, that officer would be Benjamin Foulois, whose interest in aviation had been spurred by reading Jules Verne's *Clipper of the Clouds*.

Prior to moving onto a discussion of the activities of the first air-minded aviators a few additional points are necessary to understand the situation of the Signal Corps at the time of the acquisition of the Wright Flyer. First, was that the growth of aviation under the Signal Corps would necessarily be limited by the size of the Signal Corps itself. The year in which the Wright aircraft was delivered the Army had 4,116 officers, of which 118 were assigned to the Signal Corps. Even that officer allotment was not considered sufficient for the Signal Corps, as the Chief Signal Officer complained in his 1908 Annual Report of issues with under staffing.[25] The size of the Signal Corps also meant that it had an extremely small budget share. With the consequence that the funds for the first aircraft came from a combination of budgetary shuffling

21. Advertisement and specification for a heavier-than-air flying machine, James Allen, 1907, Papers of Henry Arnold, Box: 3, Folder: 8: 1907 Signal Corp/Wright Bros Agreements, Library of Congress Manuscript Division

22. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 147

23. Form No. 13, Brigadier General James Allen, 1908, Papers of Henry Arnold, Box: 3, Folder: 8: 1907 Signal Corp/Wright Bros Agreements, Library of Congress Manuscript Division; Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 27

24. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 57-58

25. The Secretary of War, *Annual Report of the Secretary of War*, vol. I (Washington, District of Columbia: Government Printing Office, 1908), 5; Brig. Gen. James Allen, "Report of the Chief Signal Officer," in *Annual Report of the Secretary of War*, vol. II (Washington, District of Columbia: Government Printing Office, 1908), 179–215

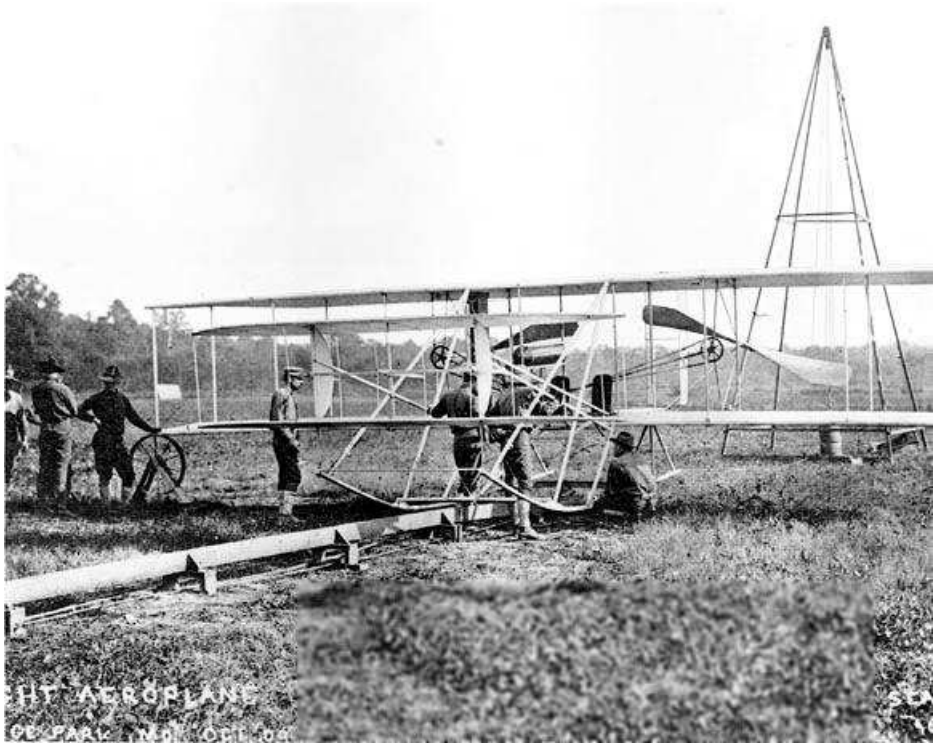

Figure 3.1: The Wright Military Flyer in 1909

and a presidential slush fund left over from the Spanish-American War.[26]

Second, there were several staffing policies that severely limited the ability of the Aeronautical Division to explore and develop the potentials of military aviation. One of the most critical of these was that pilots, due to the dangers of early aircraft, had to be below 30 and unmarried. The next was that the staffing shortages in the Signal Corps meant that pilots were frequently drawn from other branches of the Army. These temporary duty assignments had a maximum time limit of four years, meaning that the accumulation and stabilization of knowledge was limited. Lastly, officers could only serve in the Signal Corps after having served two years in a combat branch with the consequence that the direct recruitment of pilots was prohibited.[27] Altogether these had the consequence that the Aeronautical Division had limited room to grow, would be commanded by senior officers drawn from the regular army, and would become

26. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 148-149

27. Lt. Col. Craig F. Morris, "The Origins of American Strategic Bombing Theory: Transforming Technology into Military Doctrine" (PhD diss., Auburn University, 2015), 15, 21

characterized as an assignment for the young and restless.

The constraints posed by the staffing policies of the War Department and the Signal Corps, and the general disinclination to be interested in non-balloon based aircraft in the Signal Corps leadership meant that the Wright Flyer was accepted into an organizational context defined by disinterest and/or suspicion. Therefore, the acquisition of the Wright Flyer was not an event of particular interest or concern for the General Staff and the novelty of flying meant that the lower level officers outside of the Aviation Division treated the first pilots with mockery and suspicion. Moreover, the lack of General Staff interest is evidenced by the fact that the Wright Flyer was not acquired with a specific or defined mission in mind. This is analytically crucial because it means that the General Staff were not seeking to control and align the development of the aircraft at this stage to fit a preconceived mission. The strength of the conservativism of the General Staff is particularly striking given the cost of the Wright Flyer: $30,000 in 1909 dollars which adjusted for inflation would be worth approximately $800,000 in 2015 dollars. While the funding for the Wright Flyer did not come out of the War Department budget one would assume that the War Department would take interest in such an expensive asset, however this was largely not the case during this time period. This had the consequence that the first Army aviator, Benjamin Foulois, would be left to his own devices in evaluating the aircraft, thus sowing the seeds for the development of a body of advocates.

3.3.2 Army Aviators Develop a Distinct Identity

Due to the factors discussed in the preceding section, the first Army Aviators were largely left to their own devices in evaluating aircraft. This had the theoretically expected consequence that they were free to openly experiment with and develop concepts for how to employ aircraft during combat. The experimentation combined with the mild antagonism directed at them by lower level officers led them to develop a distinct set of prerogatives. When this sense of distinction boosted by the relative youth of the aviators collided with hapless leadership, the early Army aviators were further radicalized in their air-mindedness. These last two conditions—mild antagonism from lower level officers and hapless leadership—are not theoretically expected. They seem to accelerate the development of the distinctive advocacy through exclusion but are neither necessary nor sufficient. Rather, the fact that the aviators felt that they were left on their own with little interference from the War Department General Staff is the primary driver of the formation of advocacy.

The first of the Army Aviators was Benjamin Foulois, who was chosen to be the Army pilot trained by the Wright's because of his graduating thesis for the Signal Corps School entitled *The Tactical and Strategical Value of Digirible Balloons and Dynamical Flying Machines*. Foulois wrote this thesis because he had been following aeronautical developments for some time and was surprised to find that very little had been written within the Army about the potential military applications of these technologies. This interest led to him being regarded as "nutty" by his classmates at the Signal Corps College and presaged the reception he would receive from other members of the Army.[28] While his work was viewed as "nutty" it is fairly cautious and limited in its claims to the modern observer. The thesis was predictive but measured—it correctly identified the strategic and tactical reconnaissance functions that aircraft would quickly assume as well as air battles being the first engagements of a war but demurred on their offensive potential stating that "the value of the dirigible or the dynamical flying machine, as a fighting machine, will only be determined by actual test in time of war."[29]

After a short stint doing further evaluation at a rudimentary airfield in College Park, Maryland the commander of the Signal Corps ordered flight operations to cease because of the impending winter and for Foulois to move to better climes in Texas. Foulois' move to San Antonio, Texas came along with orders which demonstrates the ambivalence of the War Department senior leadership on the role and purpose of aircraft in warfare, they read "You are to evaluate the airplane. Just take plenty of spare parts — and teach yourself to fly."[30] However, due to the poor funding of the Signal Corps those spare parts were soon lacking as the primitive nature of the Wright Flyer meant that crashes frequently occurred. Despite these limitations Foulois was able to do some experimentation with the aircraft, for example, by conveying messages between encampments or practicing reconnaissance techniques. The lack of interest from the General Staff and the Signal Corps staff meant that Foulois was also given authority to define the regulations for the short-lived First Provisional Aero Company in San Antonio. However, his experimentation was cut short when he was remanded back to desk duty in Washington D.C. because of a conflict with a senior officer in San Antonio following the death of a pilot.[31]

---

28. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 43
29. The Tactical and Strategical Value of Dirigible Balloons and Dynamical Flying Machines, Benjamin Foulois, 1907, Papers of Benjamin Foulois, Box: 39, Folder: 2: Personal Speeches and Writings: Writings: Graduating Thesis: Signal Corps School Fort Leavenworth Kansas, Library of Congress Manuscript Division
30. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 2
31. ibid., 80

While Foulois was taken off of active pilot duty, the experimentation that he had begun in San Antonio would be continued in College Park, Maryland by two new pilots who had been recruited in 1911. Both of these pilots would become significant to the organizational development of the U.S. Air Force and the development of a revolutionary war imaginary: Henry Arnold would go on to lead the Army Air Forces in World War II and Thomas DeWitt Milling developed some of the key conceptual distinctions in air warfare doctrine during the 1920s. When Arnold and Milling arrived at College Park in 1911 the only concrete order they received was to train the Commandant of the newly opened Army Aviation School there, otherwise they were left to their own devices. Arnold remarked in his memoir *Global Mission* that:

> In general . . . our purpose had to be a vague one. . . of developing the airplane into a military weapon as best we could, for we certainly received few, if any, suggestions from the War Department. It was a routine of flying a bit higher or a bit farther, or mounting some communications gadget or weapon on our flying machine in an endeavor to give the airplane a military value.[32]

These pilots through their ranging experimentation began to lay the conceptual foundation for how to use the flying machine in military contexts. Among the experiments that were conducted during this period were bomb dropping, marksmanship, machine gun fire, communications systems, and aerial reconnaissance techniques. The ability to experiment was aided by a new funding line in the 1912 War Department appropriation which allowed the Chief Signal Officer to order five more aircraft.[33] The lack of supervision signaled the continuing ambivalence and uncertainty of the rest of the War Department about what aircraft would mean for the future of warfare and in this vacuum the first Army pilots began to form a distinct sense of identity.

The distinct air-minded identity of the aviators was further enhanced by the danger of piloting aircraft in this time period. This was a consequence of the rudimentary construction of the aircraft at the time and the dangerous nature of the pusher-type engine mounting.[34] Charles Chandler and Frank Lahm note that pilot "applicants were presumably attracted by an appreciation of the limitless possibilities of the new military weapon and were endowed with pioneering

32. Henry Harley Arnold, *Global Mission* (New York, New York: Harper & Brothers, 1949), 31

33. Brig. Gen. James Allen, "Report of the Chief Signal Officer," in *Annual report of the Secretary of War*, vol. I (Washington, District of Columbia: Government Printing Office, 1911), 789

34. As opposed to the tractor-type which would come to dominate aircraft design. The rear-mounting of propellers on pusher-type aircraft led to frequent decapitations (see Figure 3.1 for an example of the pusher-type).

characteristics of Americans combined with the adventurous spirit of youth."[35] The institution of hazard pay further increased tensions between the non-flying Army officers and pilots, as the extra pay became a source of resentment towards pilots by the non-flying.[36] The dangerous nature of flying had two consequences that further cultivated the sense of distinctness felt among airmen—it cultivated celebrity and a daredevil mystique. This aura, when combined with the hapless leadership of non-flying or novice commanding officers, led the aviators to feel that their interests were not being considered.[37]

The resentment directed at the aviators went both ways with their chafing under the control of conservative non-flying or novice officers. The disinterest of the War Department General Staff meant that they discounted the views of the first Army pilots when appointing commanders, leading to the early Army pilots being led by officers who had little interest or basic knowledge of the hazards of flying. For example, while in San Antonio Foulois came into conflict with his commanding officer, Paul Beck, after shoddy repair work directed by Beck led to the death of another pilot. Foulois brought the repair issue to the attention of Beck who brushed it off, a lack of caution that Foulois took as a symptom of his novice status as a pilot. Shortly after the repair, a junior pilot was killed flying Beck's aircraft which Foulois immediately blamed on Beck's dismissal of his concerns. This blame carried over into his dissenting opinion from a committee report on the death that had blamed the pilot's death on poor training. Foulois's strident dissent led to his being placed on desk duty managing National Guard units for the Signal Corps.[38] Henry Arnold summarizes this growing resentment well when he writes that "the increasing number of Army flying accidents, too many of them fatal, had set off a feeling of pessimism among the airmen which in part was just low morale, but beyond that was resentful feeling that they should be commanded at the top by men who understood flying." These tensions caused a minor crisis when in late 1912 the Army pilots circulated a letter with a list of demands that included staffing changes and changes in curriculum at the burgeoning aviation schools. While many of these demands were granted they did little to stem the growth of resentment as a fumbled search for missing pilots in 1916 led to a series of courts-martial of Army aviators for their protests.[39]

35. Chandler and Lahm, *How Our Army Grew Wings: Airmen and Aircraft Before 1914*, 196
36. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 104-105
37. Arnold, *Global Mission*, 31-32
38. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 93-94
39. Arnold, *Global Mission*, 42-46

What is significant in this series of accidents was that the disinterest of the General Staff had the effect that the Army aviators were generally led by officers who had little experience in aviation. This had the consequence that the pilots believed that their interests were not being taken seriously. Therefore, one of the theoretically unexpected effects of the lack of senior leadership interest in this case is the generation of resentment amongst the advocates, and in turn that resentment leading the advocates to believe that their interests are not being represented.

Altogether, the grounds for a distinct body of advocates to form during this period was driven by the open experimentation that the early aviators enjoyed. This openness and the disinterest of the senior staff meant that the Army pilots believed that they were on their own in conceptualizing the role of aircraft in warfare. This sense of distinction was further deepened by two other factors: the mild antagonism of peer and lower level officers towards the pilots and the hapless leadership of their commanding officers. The latter factor flowed from the lack of senior leadership interest, their disinterest in aviation matters meant that the pilots were commanded by officers with little aviation experience. Altogether this led the first pilots to strenuously advocate for a greater say in defining their own place within the Army, though this advocacy was limited in its aims likely owing to the sclerotic development of aircraft and tight funding.

3.3.3 Statutory Expansion and the First Aero Squadron

The early air advocates won both organizational and doctrinal victories during 1914. The organizational victory was the creation of the Aviation Section within the Signal Corps, which granted the advocates permanent funding, a formal staff element, and a personnel increase. While not resolving all the complaints of the early pilots, it gave them a stable foothold and an increased ability to control the development of aviation. Critically, this led to the creation of the First Aero Squadron, which was commanded by a seasoned pilot: Benjamin Foulois. Moreover, the experimentation of the advocates paid off when in 1913 the main Army doctrinal manual was updated to reflect the missions demonstrated by the early pilots. This exposes the extent to which the early aviators were able to influence how aircraft would be received in the War Department.

In March 1913, a bill was introduced to the House of Representatives which would create an Air Corps on the line of the Army and thus liberate the Aeronautical Division from the tutelage of the Signal Corps. Civilians decided to intervene on aviation matters at this

time because of the rising number of accidents: 1913 by that point had seen seven accidents whereas there were only six from 1908-1912.[40] Called to testify were several of these early air-minded including Foulois, Milling, Mitchell, and Arnold. In their testimony before the House Committee on Military Affairs all of them strenuously opposed separation for the time being. The through line of all of their arguments was that military aviation in the United States had barely developed and separation from the Signal Corps would only seed confusion and delay.[41] The sole dissenting aviator was Paul Beck, who argued that an Air Corps should be created because aviation is not relevant to the statutory function of the Signal Corps—the development of signaling apparatuses—which constrained the ability for aviation to develop.[42]

Due to the strength of the opposition to the bill from the pilots, the House Committee went back the drawing board. The new bill was prepared and introduced in 1914 where, after little debate, it was passed by both the House and the Senate with the full support of the Signal Corps and War Department General Staff. The most significant feature of the bill was that it gave a statutory basis to the Aeronautical Division under the Signal Corps, something that had been lacking in the ad hoc Aviation Section (and thus resolving Beck's main argument for separation.) Critically, this statutory definition brought permanent funding allocations, a formal staff element within the Signal Corps to manage aviation, and an increase in the number of officers and enlisted personnel who would work on aviation.[43] As a result of this newfound support, the commanding officer of the Signal Corps decided that it was time for the first formal operational unit to be created and on August 5, 1914 the First Aero Squadron was created with Foulois at its head.[44]

The organizational victories of 1913-1914 were paired with doctrinal victories. While the early aviators had spent the last five years largely concerned with learning how to fly, modifying aircraft, and testing new devices they also began to develop ideas about what the military value of aircraft could be. The most fertile moments were the participation of aircraft in field

40. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 107

41. United States House of Representatives, *Aeronautics in the Army. Hearings before the Committee on Military Affairs, House of Representatives, Sixty-third Congress, first session, in connection with H. R. 5304, May 16, 1913, entitled "An act to increase the efficiency of the aviation service of the army, and for other purposes." August 12, 14, 15, and 16, 1913.* (Washington, District of Columbia: Government Printing Office, 1918), See pp. 51-53 for Foulois, 82-83 for Mitchell, 88-89 for Arnold, and 94 for Milling

42. ibid., 38-39

43. Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 117

44. George Scriven, "Report of the Chief Signal Officer," in *Annual report of the Secretary of War*, vol. I (Washington, District of Columbia: Government Printing Office, 1913), 522

maneuvers. For example, reflecting on the 1912 Connecticut Maneuvers, Foulois remarked that "we proved that airplanes could replace the calvary and could prevent surprise mass attacks by providing information on enemy troop buildups and movements much faster than ever before." The maneuvers were critical because they demonstrated the utility of aircraft in actual practice, rather than abstract speculation or feat of sport.[45] As if a reflection of Foulois's proof, the 1913 edition of the main Army Doctrinal Statement—the Field Service Regulations—included a lengthy discussion of how to utilize aircraft for strategic and tactical reconnaissance whereas the prior edition merely stated that the "flying machine is used as the commander directs."[46] It is not clear if Foulois and the other pilots played any direct role in the formulation of the 1913 Field Service Regulations, but it is known that several of the General Staff witnessed the performance of aircraft in the field maneuvers.[47]

Thus, the theoretically expected development of distinctive advocacy began to occur during this period. This was the consequence of the effects of low senior leadership interest, which had several theoretically expected and unexpected effects. Chief among those that are expected, was that it granted the aviators the freedom to experiment and develop amongst themselves a sense that aviation was in some sense fundamentally different. Unexpected, is that this low interest manifested in poorly trained commanding officers, which further drove this sense of distinction between the aviators. This vacuum allowed them to play a role in defining early Army doctrine on the usage of aircraft and gave them the beginnings of the organization they desired.

3.3.4 Early Naval Aviation

The lack of interest from the senior leadership of the Army stands in stark contrast to the experience of early Naval aviation.[48] Whereas the General Staff of the War Department was

45. Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 101-102

46. War Department Office of the Chief of Staff, *Field Service Regulations: United States Army* (Washington, DC: Government Printing Office, 1910), 54; War Department Office of the Chief of Staff, *Field Service Regulations: United States Army* (Washington, DC: Government Printing Office, 1913), 58

47. Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 110

48. The factors involved in early Naval aviation here largely follows those provided in Turnbull and Lord, *History of United States Naval Aviation*, the best granular account of the rise of early Naval Aviation. For an account that contextualizes the rise of Naval Aviation in the development of Sea Power Strategy see: Lester Brune, *The Origins of American National Security Policy — Sea Power, Air Power, and Foreign Policy* (Manhattan, Kansas: MA/AH Publishing, 1981). For an account that also covers Naval lighter than air aeronautics see R.D. Layman, *To Ascend from a Floating Base: Shipboard Aeronautics and Aviation, 1783-1914* (Rutherford, New Jersey: Fairleigh Dickinson University Press, 1979)

largely ambivalent towards the development of aircraft during this time period, the Naval senior leadership exhibited a great deal of prospective interest in the development of Naval aviation. However, this interest was only sporadically acted upon. Despite the sporadic activity, the theoretically expected effect of high senior leadership interest—distinctive advocacy fails to form—occurred. This is because the senior leadership immediately began to assimilate aircraft into seapower and their constant intervention interrupted the development of advocacy.

The Naval senior leadership was sporadically involved in Naval aviation during this time period. For example, the first effort to integrate aviation into the Navy, the creation of the Aviation Office, was spurred by the highest ranking naval officer—the Admiral of the Navy.[49] However, the Aviation Office was largely powerless and the sole service member assigned to it was an engineer who largely focused on following developments in aeronautical science. This stands in sharp contrast to the Aviation Section of the Signal Corps which was commanded by a line officer who was also a champion balloonist. The Navy did eventually have a pilot trained by an early pioneer in seaplanes—Glen Curtis—but the training was not followed up by any concrete movement towards acquiring an aircraft until 1912 when an Air station was created at Guantanamo Bay, Cuba.[50] The station at Guantanamo was eventually replaced by an air station in Pensacola, Florida in 1914, that led to a brief flourishing of experimentation amongst Naval aviators. However, this was cut short by the volunteer pilots being sent abroad in the run-up to World War I while those that remained were arbitrarily denied pay.[51]

Meanwhile, from 1910-1916 the General Board of the Navy, the main advisory committee to the Secretary of the Navy, issued repeated studies that described a variety of desired types and roles for aircraft to extend sea power.[52] As the General Board was issuing reports, articles began appearing in Navy journals written by flag officers that described how aircraft could be used to extend Mahan's concept of sea power which further aligned the development of aircraft within the overall rubric of existing practices of Naval warfare.[53] These spurts of interest were rarely followed up by actual funding, and Naval aviation was characterized by faltering development during this period.

Even when the Navy did provide funding for the aeronautics program, it was hampered

49. Turnbull and Lord, *History of United States Naval Aviation*, 8
50. ibid., 12
51. ibid., 38-44
52. ibid., 13, 33, 65
53. Brune, *The Origins of American National Security Policy — Sea Power, Air Power, and Foreign Policy*, 23

by the split nature of aeronautical development within the department. Unlike the Army which centralized development of aviation under the Signal Corps, the Navy divided aeronautical development (and funding) functionally between different bureaus which spent the funds without the supervision of the officer appointed to the Aviation Office. This meant that the use of funds was subject to the whims of the Bureau heads and in some cases were never spent.[54] The bureau system also came to limit the range of experimentation that was permissible by the Naval aviators, as after 1916 any modifications to aircraft made by pilots had to be approved by the relevant bureau.[55] Therefore, the experimental activities undertaken by Foulois, Arnold, and Milling such as using homemade bomb sights or modifying control systems would not have been possible by Naval aviators.

Taken together, the sporadic interventions and organizational fumbling of the Naval leadership when handling the adoption of aircraft meant that an aviation constituency with a rudimentary shared identity was unable to form. By the time that Naval Aviation had gotten off of the ground, on the eve of World War I, it had already been articulated as serving the core mission of the Navy. The core effect of this interest is theoretically expected, the deep intervention of Naval senior leadership articulated the aircraft as part of seapower and prevented the formation of advocacy. Unexpected is that the split responsibility of aviation development, distributed between the various bureaus of the Navy, blocked the creation of a shared institutional site for advocacy to form. This dynamic is likely the consequence of the reliance of the Navy on complex technological systems for basic operation. Hence, it was much easier to conceive of the influence of a new technological platform on the dynamics of Naval warfare and aircraft were slotted into the existing bureaucratic structure for technological development and maintenance. The experience of the Navy adoption of aviation stands in stark contrast with early Army aviation, which while at times was deadly in its ambivalence, granted the early pilots enough space to both experiment and begin realize a distinct set of prerogatives.

The development of Naval Aviation also has bearing on one of the intervening variables—inter-service rivalry. Rivalrous dynamics never developed between the Army and Navy over aviation for two reason: first, Army and Naval appropriations for aviation were generally conducted through their respective House committees meaning that they never had to compete for the same funding line.[56] And second, the Army and Navy created a joint board

54. Turnbull and Lord, *History of United States Naval Aviation*, 44
55. ibid., 65
56. ibid., 47

to coordinate on aeronautical development following the creation of the Aviation Section. This board facilitated high level coordination between the Army and Navy on both technical issues involving aircraft and the development of missions for their aviation units thereby largely preventing inter-service rivalry until defense unification following World War II.[57]

3.4 1915-1935: Envisioning Strategic Air Warfare

> Due to the youth of the Air Service, no definition of the principles of the air strategy exist; its tactical principles, on the other hand, while basically established may be considered "in the making," due to the constant improvement in air weapons. Without waiting for the next war to force upon us the fact that the Air Force is a true arm, capable of independent action, is it not better to analyze the principles underlying employment of other arms, such as the Army and Navy, and then, considering the present efficiency of air weapons, estimate the value of the Air Force?
> —Major T. D. Milling in a November 1923 lecture at the Army War College.[58]

The conditions under which the first Army aviators labored—defined by low senior leadership interest—led to the beginnings of distinctive advocacy. However, doctrinal development and ideas for how to employ aircraft during this time period was rudimentary at best: chronic under-funding, the frailty of early aircraft, and staffing shortages all meant that the air advocates had little time to devote to serious consideration of the role of aircraft in warfare. This conceptual drought was present even on the eve of the American entry to World War I: Henry Arnold reflected that "we had no theories of aerial combat, or of any air operations except armed reconnaissance. Despite Billy Mitchell's eagerness to blow up Germany, we had a single bomber. Such things as formation flying, a new German development appearing on the Western Front that spring, were unknown to us."[59] While the Army aviators had an inkling at this point that

57. Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 143; Huntington, *The Common Defense: Strategic Programs in National Politics*, 403-407

58. Tactics of the Air Forces in War, T.D. Milling, 1923. IRIS 00159992, Call: 248.211-65N, Air Force Historical Research Agency, pp.5

59. Arnold, *Global Mission*, 52. For example, in a 1917 interview the Signal Corps Chief indicates that the primary role of aircraft is in relation to artillery: "The modern type of land war is dependent on two things above all others: aviation and artillery. They are cooperative elements in a fighting army, and against an enemy, a flying machine is a terror and a menace to big guns. That airplanes are positively essential for directing artillery fire is an axiom among military men who have seen action in the sort of battles being fought on the western front." n.a., "Plan to use U.S. for Air Training Base," *Sun*, June 16, 1917, 3

the aircraft would fundamentally alter the nature of war, they were still largely unsure how.

Theoretically, I expect that the period from the creation of the first formal unit to the creation of an operationally autonomous organization should be characterized by the development of a coherent war imaginary—a new theory of victory founded on a series of wagers about how technology is changing conflict. From 1915-1935 the Army aviators would come to develop a distinct war imaginary called industrial-web theory, by first drawing on their experiences in World War I[60] and then through conceptual refinement in the classrooms of the Air Service Tactical School (later Air Corps Tactical School.) While World War I was important for doctrinal developments in the 1920s, "industrial-web theory" would grow out of the theoretical freedom granted to the instructors of the Tactical School in the early 1930s.

The growth of industrial-web theory followed on from the sense of distinctiveness that characterized the early aviators, as they sought to prove that aircraft could play a fully independent role in warfare. The development of this war imaginary was a consequence of the development of an organizational infrastructure by the aviators—in particular the Air Service Tactical School officer academy—enabled by overall low levels of senior leadership interest, inter-service rivalry, and infrequent civilian intervention. During World War I the relationship between the senior leadership and the air advocates was mixed: the senior leadership became antagonistic when air officers didn't properly genuflect to military custom but otherwise gave the advocates limited room to explore the use of aviation on the battlefield. Immediately after the war there was immense tension between air officers and the Army General Staff due largely to the incendiary lobbying of Billy Mitchell for full air autonomy. After Mitchell was sidelined, the relationship between the General Staff and the advocates became much more cooperative as they moved to an incrementalist approach to expansion. Inter-service rivalry continued to be largely resolved through the Joint Army-Navy Board on Aeronautics. As to the last variable, civilians intervened in on the organization of the military three times during this period. The first was immediately after World War I, which led to the creation of the Aviation Section on the line of the Army. Second, in response to a series of hearings in the mid-1920s, which produced largely cosmetic changes for the newly renamed Air Corps. Finally, in response to the "Air-Mail

60. For analytical reasons this section does not include any substantive discussion of the actual combat and operations of the Air Service in World War I, but rather focuses on the key doctrinal innovations that were elaborated during the war. For a good overview of World War I aerial combat and operations see John Howard Morrow, *The Great War in the Air: Military Aviation from 1909-1921* (Washington, District of Columbia: Smithsonian Institution Press, 1993)

Crisis", in which numerous Army aviators died, leading to the creation of the operationally autonomous General Headquarters-Air Force (GHQ-AF). Only the first and third interventions led to meaningful changes in autonomy for the aviators, while the second did not. This is because the second intervention was largely driven by a process internal to the War Department and Army aviation.

In order to explain how these conditions enabled the development of industrial-web theory, I will first explain how World War I impacted the development of aviation doctrine. The development of doctrine during World War I set the stage for post-war doctrinal development, and demonstrates how early aviators initially drew on the strategic framework of the Army. Next, I outline the civilian intervention into Army aviation following World War I which resulted in the creation of the Air Service and the creation of the Air Service Tactical School. Following this, I will explain how doctrine began to be refined at the Air Service Tactical School. Then, I demonstrate how civilian intervention that is not driven by technological failure or adversary demonstrations does not result in dis-junctural change by examining a series of investigations in the mid-1920s. Following this, I will show how industrial-web theory was formed at the Air Corps Tactical School. Finally, I expose how domestic technological failure—in the form of the Air-Mail Crisis—was able to create the opening for the aviators achieving operational autonomy with the creation of the GHQ-AF.

3.4.1 Doctrinal Developments in World War I

On the eve of World War I, the Aviation Section was still fairly rudimentary as the years since its creation had only seen halting growth. Further development and expansion was constrained by policies that limited the amount of time a pilot could serve, prevented direct officer commissions, and put a restrictive ceiling on officer advancement. This combined with an unfounded optimism over the production capacity of the American aviation industry meant that the initial entry of American Aviation into World War I would be a haphazard affair. By the time that the United States declared war on Germany the Aviation Section had 293 aircraft on order with less than 100 on hand. The task of planning the massive expansion to meet the demands of the coming conflict fell to Benjamin Foulois. One of the core problems that Foulois faced was that American aviation substantially lagged European aviation in both its technological development and sophistication of concepts for employment. While the Europeans had developed a variety of more powerful role specific aircraft (observer, pursuit, night bombing, day bombing) the

United States only had unarmed, low power observer aircraft. During the buildup to the American entry, the Joint Army-Navy Board settled on a 3:5:1 ratio of observer:pursuit:bombers with a numerical production target of 4,500 aircraft.[61] With production targets set and funds made available, the Army aviation officers next had to turn to how exactly they were going to employ the aircraft in combat.

The core struggle for the newly created Air Service-AEF (American Expeditionary Forces) during World War I was to prove that the Air Service was not just a technical section but also a combatant branch of the American Expeditionary Forces. Among the regular personnel of the Army there was a substantial amount of confusion about the precise role of the Air Service leading the officers of the Air Service to repeatedly reinforce the fact that it was a combatant branch. For example, in November 1918 the Chief of Staff of the Air Service distributed a memo to all sections of the AEF clarifying the combatant status of the Air Service stating "the Air Service, although highly technical and specialized in character, is organized, equipped, and trained for the sole purpose of taking its place on the fighting line with other combatant services."[62] Efforts to clarify this role even continued after the war with Edgar Gorrell's preparation of "Notes of the Characteristics, Limitations, and Employment of the Air Service" in 1919. This short paper was a response to complaints from infantry and artillery officers over the operation and function of the Air Service while reinforcing its combat status.[63]

For doctrine, the two key figures in World War I were Edgar Gorrell and Billy Mitchell. Both of them, through their contacts with European aviators would develop distinct concepts and plans for the employment of aircraft by the newly created Air Service-AEF. The one common thread between them was an overarching focus on the manipulation of the morale of enemy forces. This focus on morale was a consequence of the dominating influence of Clausewitz on strategic thought at this time: the overall strategic purpose of ground forces (and their aviation units) was to achieve victory by supporting infantry operations to break the morale of the enemy army, thereby winning the war.[64] This would constitute the basic framework for the development of doctrine by Mitchell and Gorrell.

---

61. Arnold, *Global Mission*, 52-55; Foulois and Glines, *From the Wright Brothers to the Astronauts: The Memoirs of Benjamin D. Foulois*, 140-158

62. Office Memorandum No. 82., H.C. Whitehead, RG 120, Gorrell's History of the American Expeditionary Forces Air Service 1917-1919, Series A, Volume 9, National Archives at College Park, 201.

63. Edgar Gorrell, "54. Notes of the Characteristics, Limitations, and Employment of the Air Service 1919," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 303

64. Biddle, *Rhetoric and Reality in Air Warfare*, 14

Edgar Gorrell began the process of defining a combat function for aircraft prior to the American entry, and in so doing would be highly influential on early Air Service doctrine. By the eve of World War I Edgar Gorrell was widely known as an aeronautical savant whose qualifications led to his selection for the Bolling Mission, a group of officers and civilians who were sent to Europe in the summer of 1917 to study European aviation and provide guidance on training and production. It was during this time that Gorrell came into contact with British and Italian aviators who would prove influential on his conception of strategic bombing.[65]

The main Italian influence on Gorrell and the Bolling Mission was Count Caproni, an Italian industrialist who had developed the first heavy bomber aircraft. Caproni, perhaps due to pecuniary interest, was a strident advocate of strategic bombing in the war with Germany as a solution to the stalemate produced by trench warfare. In addition to personally advocating to the mission for U.S. development of bomber aircraft, Caproni also gave Gorrell and other members of the Bolling Mission a copy of a pamphlet entitled *Let us Kill the War! Let us Aim at the Heart of the Enemy!* by Nino Salvaneschi which is likely a distillation of Caproni's own thoughts on bombing.[66] In this pamphlet, which was only published in english to target American audiences, Salvaneschi develops a theory of strategic bombardment based on the nature of industrial society. He argues "all the inventions, discoveries and perfected products have combined to give it the impression of a gigantic watch making factory. Each country is disciplined in a precise rhythm of mechanised life. Every man, every factor has become part of the great war machine."[67] The machinic nature of industrial society leads Salvaneschi to argue that the only way to win the war is through the destruction of critical war industries and logistics lines through bombing.[68] The Salvaneschi pamphlet foreshadows the broad contours of the air war imaginary that would later develop at the Air Corps Tactical School in the early

65. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 20-21; George K Williams, "' The Shank of the Drill ': Americans and Strategical Aviation in the Great War," *Journal of Strategic Studies* 19, no. 3 (1996): 383-385

66. Dr. J.L. Boone Atkinson, "Italian Influece on the Origins of the American Concept of Strategic Bombardment," *Airpower Historian* IV, no. 3 (1957): 145-146. Giulio Douhet, acclaimed theorist of aerial warfare, was also a close confidant of Caproni and likely influenced his thinking. Douhet, Caproni, and Salvaneschi were all significant figures at the intersection of Italian Futurism and Fascism. This is because the airplane was a particularly significant technology for all varieties of European fascism, and during the 1920s the primary advocates of aerial warfare in Europe, except Winston Churchill, were fascist politicians. See *passim* Azar Gat, *Fascist and Liberal Visions of War: Fuller, Liddell Hart, Douhet, and Other Modernists* (Oxford, UK: Clarendon Press, 1998)

67. Nino Salvaneschi, *Let us Kill the War: Let us Aim at the Heart of the Enemy!*, Art Edition (Milan: Bianco e Nero, 1917), 31

68. ibid., 38-44

1930s. However, whether Italian writings on strategic bombing had any direct influence on the formation of "industrial web theory" is under contention.[69] While the influence of the Italians on later aviators is unclear, their influence on Gorrell will be seen shortly.

From the British, in particular Hugh Trenchard of the Royal Flying Corps, Gorrell gained an appreciation for the potentially deleterious effects on military and civilian morale that bombing could induce.[70] Unlike the Italians, the British in their bombing plans tended to focus not on the value of the actual destruction of war infrastructure but rather on the fear and demoralization that bombing would sow. For example, in a 1916 note by Hugh Trenchard that was in circulation among the Air Service staff describes how the three-dimensional nature of air warfare makes defense near impossible. This meant that a strong offensive barrage can rapidly sow fear and discontent among soldiers on the front lines through the use of concentrated assaults.[71]

Both of these threads came together in Gorrell's November 1917 proposal for strategic bombing by the Air Service entitled "Strategical Bombardment." In "Strategical Bombardment" Gorrell introduces his plan by arguing that "three and a half years of War finds in us a position in which movement either by land or by sea is rendered vastly difficult and expensive... if the conduct of the War is to be seriously affected in the near future, a new policy of attacking the enemy must be adopted."[72] The new policy that Gorrell proposes is the strategic bombing of munitions plants and commercial centers in order to overcome the stalemate on land and sea. Gorrell explains how this bombardment will achieve victory through an extended metaphor:

> An army may be compared to a drill. The point of the drill must stand up and bear the brunt of the much harder work with which it comes into contact; but unless the shank of the drill is strong and continually reinforcing the point, the drill will break. So with the nation in a war of these days, the army is like the point of the drill and must bear the brunt of constant conflict with foreign obstacles; but unless

69. The ACTS instructor who is credited with the key work in developing the theory harshly rebuked the Atkinson article (n. 65) for insinuating direct influence. See: Donald Wilson, "Origin of a Theory for Air Strategy," *Aerospace Historian* 18, no. 3 (1971): 19–25

70. Biddle, *Rhetoric and Reality in Air Warfare*, 54; Williams, "' The Shank of the Drill ': Americans and Strategical Aviation in the Great War"

71. "Future Policy in the Air", Hugh Trenchard, RG 120, Gorrell's History of the American Expeditionary Forces Air Service 1917-1919, Series A, Volume 23, National Archives at College Park, 166-168.

72. Edgar Gorrell, "29. Gorrell: Strategical Bombardment 28 November 1917," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 141

> the nation—which represents the shank of the drill—constantly stands behind and supplies the necessary aid to the point, the drill will break and the nation will fail. The object of strategical bombing is to drop aerial bombs upon commercial centers and lines of communications in such quantities will wreck the points aimed at and cut off the necessary supplies without which the armies in the field cannot exist.[73]

The influence of Salvaneschi here is clear in the relationship posited between the military and society. However, the effects of bombing industry also draws on the "morale effect" from Trenchard.[74]

While this plan was initially approved by Foulois, who then led Air Service-AEF, the plan would never be carried out for three reasons: first, it would require joint command with the British of U.S. Forces, something which the War Department General Staff blanched at. This tension was exacerbated by Gorrell's inexperience in the bureaucratic protocol of the War Department. Second, aircraft production in the United States was faltering, and production ratios favored pursuit and observation aircraft so very few bombers were available.[75] Finally, the Secretary of War strongly opposed the bombing of civilian populations and in November 1918 he sent to the Air Service a memorandum that prohibited any action "that has as its objective, promiscuous bombing upon industry, commerce, or population in enemy countries disassociated from obvious military needs to be served by such action."[76] Despite the failure for Gorrell to realize his specific vision of bombing, he would go on to be influential in the refinement of doctrine immediately after the war. This episode among others demonstrates the extent to which the grandiose claims and in artful maneuvering characteristic of the relatively youthful aviation officers could quickly turn the senior leadership against them. The prohibition of Secretary Baker and the frustration of the senior leadership at Gorrell meant that the Air Service-AEF was never able to field an independent bombing force.

The limited traction that Gorrell's plan for independent air warfare had with the General

---

73. ibid., 143

74. ibid., 144. It should be noted that this is a point where I differ from Biddle 2002 (55) who argues that the British had a greater effect on the thought of Edgar Gorrell. However, I think that the drill metaphor that Gorrell uses points more strongly to the influence of Salvaneschi's thought, what was clear was that for Gorrell the primary point of bombing was to play upon the relationship between the military and civilian populations, sowing fear and chaos.

75. "Early History of the Strategical Section", Edgar Gorrell, RG 120, Gorrell's History of the American Expeditionary Forces Air Service 1917-1919, Series B, Volume 6, National Archives at College Park, 371-401.

76. Quoted in: Alfred Hurley, *Billy Mitchell: Crusader for Air Power* (Indianapolis, Indiana: Indiana University Press, 1975), 37

Staff was offset by Billy Mitchell's successful demonstrations of the need for concentration of aircraft to achieve air supremacy during the Battle for the St–Mihiel Salient. Mitchell was able to marshal and command a force of over 1,500 aircraft due to his ability to work with the General Staff (an ability that would rapidly degrade after the war) and the maintenance of American control over combat units. Mitchell's plans for employment were developed through his experience as an Air Attaché prior to the war, having met with Hugh Trenchard and other British aviators, he gleaned the need for aerial attacks to defined by unified command, lightning speed, and a concentration of force.[77] Despite this success, there are few representative writings of Mitchell's doctrinal thought that were composed during the war, on several occasions he even purloined the work of others when issuing doctrinal memoranda.[78]

Due to this, it is more useful to turn to his immediate post-war assessment of developments in combat aviation doctrine. After the war Mitchell was placed as the head of the Air Service Training and Operations Group and prepared a memorandum in which he summarizes the work that he and his staff did in codifying doctrinal lessons from the war. He identifies six key conclusions about the nature of aerial warfare in this memorandum:

- The only defense against an air force is another air force;
- That, when control of the air is established, air-planes can fly unhindered over hostile territory to the limit of their gas capacity.
- That no means of defense against aircraft from the ground or water is efficient in itself. . .
- Aviation can sink any class of surface vessel, including armored ships of all classes.. . .
- That an enemy concentration point, ten by ten miles square, can be covered with gas which will last eight days and whose effect will be such that nothing can live in that area without either being destroyed or greatly inconvenienced, according to the kind of gas used.[79]

77. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 21

78. See commentary: Frank Parker, "22. Parker: The Role of Aviation," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 119

79. It should be noted that during this time gas munition were treated with both horror and hope. The sense of horror will be familiar as a reaction to contemporary readers but the sense of hope was driven by a belief that the area denial characteristics of gas munitions would lead to a more humane warfare. See Basil Liddell-Hart, *Paris, Or:*

- That troop concentrations, moving troops, railroad trains, motor transport, tanks, or any object exposed to attack can be destroyed or scattered by aircraft.

These observations led Mitchell to conclude that "an air force can act either over the land or the water, and if adequately organized, trained, and equipped, can defend the United States from aerial attack and from naval attack. An air force... can assist an army in destroying the hostile armed force." Thus, was unique about aircraft for Mitchell (and Gorrell) was that the extension of the sphere of military activity into the air posed a fundamentally new way of waging war. Activity in the air was not tied to geographic space in the same way as an Army or Navy: aircraft moved in the third dimension.[80]

The ability for aircraft to act over the water and the rise of submarine warfare led Mitchell to the conclusion that navies were rapidly becoming obsolete. This view is best expressed in a passage from his 1925 work of public advocacy entitled *Winged Defense*, in which he argues "the day has passed when armies on the ground or navies on the sea can be the arbiter of a nation's destiny in war. The main power of defense and the power of initiative against an enemy has passed to the air... air power has not only come to stay but is, and will be, a dominating factor in the world's development."[81] However, as his public advocacy grew, his power within the War Department diminished as he successively burned bridges with sympathetic elements of the War Department and civilian politicians. The case of Mitchell is instructive in how grandiose claims catalyzed War Department interventions into the operations of post-war Army Aviation. Mitchell's confrontational tenor led the General Staff to appoint General Mason

The Future of War (London, United Kingdom: Dutton, 1925) for a representative polemic in favor of strategic gas warfare the 1920s. See Mark Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945* (Lincoln, Nebraska: University of Nebraska Press, 2011) for a discussion of the relationship between strategic bombing, gas warfare, and the progressive era.

80. Memo for C/AS Subject: Principles underlying the use of an air force by the United States, William Mitchell, November 30 1920, Papers of Billy Mitchell, Box: 31, Folder: Aeronautics — Separate Department Recommendations, Library of Congress Manuscript Division. Mitchell also composed the "Provisional Manual of Operations" while commanding the Air Service for the Third Army occupying Germany. However, it the manual has little interesting to add beyond what is covered in this memorandum. See: William Mitchell, "53. Mitchell: Provisional Manual of Operations 23 December 1918," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 267–301; See also: William Mitchell, "17. Mitchell: Air Policy, 13 June 1917," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 107–110; William Mitchell, "18. Mitchell: Aeronautical Organization, 13 June 1917," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 111–112

81. Billy Mitchell, *Winged Defense: The Development and Possibilities of Air Power—Economic and Military* (Tuscaloosa, Albama: University of Alabama Press, 2010), 3

Patrick in 1919 to tame Mitchell. The appointment of Patrick signaled the end of the influence of Mitchell on the internal operations of Army Aviation.[82]

While the radical nature of Mitchell's conclusions and his strident advocacy would eventually lead him to become sidelined in the post-war Air Service, his real legacy was in the staff that he assembled in the Training and Operations Group. Frequently referred to as a "cabal," their strident advocacy led to their having to choose to either take loyalty oaths to the War Department General Staff or resign. These officers would go on to be deeply influential in the development of doctrine inside the Air Service during the 1920s; amongst his staff were Henry Arnold, William Sherman, and Thomas Milling.[83]

The work of Gorrell and Mitchell were synthesized in one of the first comprehensive attempts to develop doctrine for Army Aviation by William Sherman. Sherman worked both with Mitchell as part of the Training and Operations Groups as well as with Gorrell in compiling a post-war report on the actions of the Air Service-AEF.[84] The 1919 "Tentative Manual for the Employment of Air Service" published in the *Air Service Information Circular* was conservative in orientation, stating that "the role of the Air Service...[is] to aid the chief combatant, the infantry", however the way in which it draws the reader to understand that role is illuminating.[85] The manual identifies three keys to victory in battle and draws the reader to see how the Air Service is critical to achieving each of these tasks. First is the destruction of morale of enemy forces in the field through the swift and thorough destruction of an element of the opposing forces. To explain how this can defeat an entire army Sherman relies on a corporate metaphor, arguing that an army is akin to a human body and like the human body the destruction of a part can engender the death of the whole. Second, the clear knowledge of the disposition of enemy forces through aerial reconnaissance. Third, the harassment of a retreating enemy force with fast-moving attack aircraft.[86] Throughout the specific recommendations in the manual Sherman articulates how aircraft contribute to each of these goals. To the first, Sherman draws upon the British claim that the aircraft is particularly effective at inducing terror and helplessness

82. Biddle, *Rhetoric and Reality in Air Warfare*, 138; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 35-38; Rondall R. Rice, *The Politics of Air Power: From Confrontation to Cooperation in Army Aviation Civil-Military Relations* (Lincoln, Nebraska: University of Nebraska Press, 2004), 25

83. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 31-32

84. ibid., 29

85. William Sherman, "55. Sherman: Tentative Manual for the Employment of Air Service 1919," in *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, ed. Maurer Maurer, vol. II (Washington, District of Columbia: U.S. Government Printing Office, 1978), 313

86. ibid., 314

in soldiers in the field because of the difficulty in defending against them and an inability to rapidly retreat from their attacks. Sherman claims that this "morale effect" has a 20:1 ratio versus the physical destruction wrought. On the second, Sherman argues that aircraft are able to provide dispassionate reconnaissance because they are not affected by the turbulence of the battlefield. And to the third, he argues that aircraft are uniquely effective at harassing soldiers because of their speed and range. After establishing these basic features of aircraft in warfare, Sherman goes on to conclude that air supremacy is critical for overall operational success, a goal that can only be obtained through the independent operation of aviation.[87] The overall goal of Sherman's manual was to show how and why the Air Service could function as an independent combatant arm within the predominating strategic framework.

While the Army aviators entered World War I with few aircraft and even fewer concepts for how to use them, the experiences of rudimentary aerial warfare and contact with European aviators laid the foundations for post-war doctrinal development. Moreover, the contrast of Gorrell and Mitchell's experiences in enacting this doctrine demonstrates the degree to which senior leadership interest can stem the operationalization of more expansive war plans by early advocates. The most significant development of this period was proving that aircraft had a *role* in combat beyond being an instrument for artillery spotting or reconnaissance. The British and Italian inflected doctrine that the aviators developed influenced their arguments during the post-war defense re-organization. While the aviators would have to continue to explain their combat role to lower level line officers and enlisted after the war, the senior leadership of the War Department had come to accept that aircraft had a combat role. The nature and extent of this role would be publicly debated by the War Department and the aviators during the creation of the Aviation Service following World War I.

3.4.2 The Creation of the Aviation Service

The deep civilian intervention into aviation after the war brought into public the differences between the War Department and the Air Service-AEF veterans as they debated what place aircraft should have in the wars of the future. Civilian political interest in the defense structure was driven by a cohort of Republicans who entered office in 1919. After gaining office, they launched a legislative effort to scrutinize the handling of the war by the Democratic Wilson

87. *passim* ibid., 315-384

Administration.[88] Interest in Army aviation in particular was spurred by the election of veteran aviators to the House of Representatives. The limited platform given by House Representatives such as Fiorello La Guardia was not enough for a massive expansion of autonomy due to the opposition of the General Staff and Secretary of War. However, the place of aviation in the Army was expanded with the creation of the Air Service, receiving a much larger share of funding and personnel than it had prior to the war. All in all this post-war expansion was in line with the view espoused by the General Staff and Secretary of War: that aviation was another combatant branch of the Army that supported the infantry. The limited gains of the aviators during this period is theoretically expected: the advocates were still relatively new and lacked the organizational legitimacy to advance a new theory of warfare. Moreover, the rudimentary nature of the doctrine discussed in the previous section meant that they had yet to develop a distinct war imaginary or theory of strategic warfare through the Air.

The War Department position on the status of aviation can be seen in Secretary of War Newton Baker's 1919 Annual Report, where he dedicates an entire section to the issue. In the report Baker acknowledges that the development of aircraft "carried the war into the third dimension and raised new questions about the relationship of aircraft to the prewar military and naval establishments."[89] But, Baker argued that there were three limitations to the seemingly revolutionary nature of aircraft—first, effective air defense tactics and weapons had developed thereby limiting the utility of bombing and attack aviation. Second, bombing was ineffective: the total infantry casualties as a consequence of bombing in the entire AEF numbered 141 and the bombing of civilian populations only seemed to strengthen resolve instead of triggering mass panic. And finally, outside of artillery spotting and observation the activities of aircraft were clearly extensions of existing Army capabilities. Comparing bombers to artillery he argued that "nobody would think of suggesting that artillery should be a separate service," therefore maintaining aviation subordination was necessary to ensure the unity of command in operations.[90] Moreover, Baker was concerned that the potentials for combined arms operations would be stemmed by the development of rivalry between the War Department and a potential

88. Rice, *The Politics of Air Power: From Confrontation to Cooperation in Army Aviation Civil-Military Relations*, 14

89. The Secretary of War, *Annual Report of the Secretary of War* (Washington, District of Columbia: Government Printing Office, 1919), 68

90. Baker's conceptual move to identity aircraft with artillery could be seen as a movement towards rendering aircraft an integrated capability. However, as will be seen throughout the rest of this section, the War Department did little to intervene or impose this view on the aviators. ibid., 71

aviation department as they battled one another for appropriations.[91] Internally, the General Staff also conducted an investigation into the possibilities of air independence, in a set of contemporaneous notes that Billy Mitchell took of the investigation he expressed the suspicion that the General Staff had started the investigation with a conclusion in mind—that the air service should remain subordinate.[92]

Sensing the opportunity opened by the election of political allies, the Army aviators were forceful in their arguments for full autonomy. La Guardia served as the acting Chairman of the House Military Affairs committee and convened a hearing in 1919 to give the Army aviators a forum to air their views. During the hearings many aviation officers testified and the testimony of Mitchell, Sherman, and Foulois are analyzed here for their significance. The common point that they all agreed upon was that the support activities of the Air Service for friendly ground forces comprised an increasingly small percentage of what aviation could actually accomplish in battle. They outlined that the only direct infantry support role of aviation encompassed artillery spotting and observation. For example, Sherman testified that:

> In the beginning observation aviation constituted about 100 percent of aviation. At the end of the war it hardly exceeded 25 percent. This was a change in its role, and this change was not appreciated, I believe by most Army officers.. . .
> I believe that in the future this tendency in so far as numbers are concerned, pursuit and bombardment will increase in importance whereas observation will not greatly increase in numbers. [93]

The growing capacity of bombers, attack, and pursuit aircraft to act independently, they argued, necessitated separation so that pilots could be properly trained, led, and prosecute missions independent of the infantry. Though, there was disagreement on the degree to which aircraft could accomplish a fully independent strategic mission: Mitchell continued to press his claim that the entirety of warfare had been revolutionized. Sherman presented a slightly more expansive argument than in “Tentative Manual”: that aviation contributes to victory by the infantry, but that

91. ibid., 69-72

92. Notes on Air Service Independence Meeting, William Mitchell, 1919, Papers of Billy Mitchell, Box: 32, Folder: Subject File: Air Service War Department Committee Report 1925, Library of Congress Manuscript Division

93. United States House of Representatives, *Hearings before the Committee on Military Affairs, House of Representatives, Sixty-sixth Congress, second session, United Air Service: General Discussion* (Washington, District of Columbia: Government Printing Office, 1919), 44, 81, 119

this contribution was more like the Navy than the artillery or independent cavalry.[94] Foulois took a slightly different gloss on the necessity of full separation: he argued that a national aeronautical department would help spur the development of the domestic aviation industry leading to a turn-key air force composed of civilian aircraft in times of war.[95]

The core differences between the War Department position and the Army aviators are twofold.[96] First, whether aircraft have an independent operational mission. The key conceptual wedge between the two sides is whether bombing and attack aviation are sufficiently distinct from an artillery barrage so as to merit their detachment from infantry combat units. To this the aviators general response was that the destruction of the enemy air force constituted the independent mission, which could only be accomplished through aerial engagements. This then led to the second key point of contention between them—which was command and training. If Army aviation has an independent mission then it implies that they need a distinct training and command structure. Otherwise, if Army aviation is merely complementing the roles of extant capabilities, albeit in an enhanced capacity, then they must stay subservient to the General Staff and Army training structure.

The independence bills proposed during this period would ultimately falter based primarily on the opposition of the War Department and the cost for the creation of an entirely new service arm. That being said, the 1920 National Defense Act did grant the aviators some concessions: the pre-war Aviation Section under the Signal Corps was transmuted into the Aviation Service on the line of the Army. This organizational move granted recognition that aviation was no mere technical aspect of combat operations, but had a role in combined arms warfare.[97] This reflected the predominating view of the War Department senior leadership which was doctrinally codified in the 1923 Field Service Regulations which expanded the use of aircraft beyond observation, to include offensive battlefield operations in coordination with other combatant arms of the Army.[98] The organizational expansion also came with two benefits: it mandated a

94. ibid., 81

95. ibid., 118

96. The Secretary of War, who represented the War Department view, repeated the same claims as those he made in the 1919 Annual Report. See: ibid., 393-394, 395, 402

97. Biddle, *Rhetoric and Reality in Air Warfare*, 135-138; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 35 Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 25

98. War Department Office of the Chief of Staff, *Field Service Regulations: United States Army 1923* (Washington, DC: Government Printing Office, 1923), 21-25

statutory strength of 1,514 officers and 16,000 enlisted, prior to the war the officers of the Aviation Section numbered in the dozens and enlisted personnel in the hundreds. The second was that it eliminated the promotion obstacles that had dogged the Aviation Section and mandated that experienced pilots command aviation units.[99] The National Defense Act was a partial fulfillment of the aviators' wishes—they gained recognition for their combat role and the ability to cultivate their own officer corps, but remained subservient to the War Department in all matters.

Overall, what would become the most consequential aspect of this expansion was the creation of the Air Service Tactical School (ASTS). The initial mission of the ASTS was to train officers but this would be expanded in the following year when the War Department delegated the task of developing of aviation doctrine to the instructors. Prior to the creation of the ASTS aviation doctrine had been developed in an ad hoc manner, without an institutional environment where officers could debate and take time away from their other duties to consider how to use aircraft in warfare.[100]

The immediate post-war political environment generated an opening for the Aviation advocates to advance their case for a new type of warfare and a new service branch. While the aviators gained many concessions in the National Defense Act of 1920, their overall effort failed. This is theoretically expected for three reasons, first is that the grandiose advocacy of Mitchell and other aviators questioned the basic utility of the War Department, causing the General Staff and Secretary of War to have an antagonistic disposition towards them. Second, the Air Service-AEF, owing to the youth of its officer corps, was run haphazardly during World War I. And finally, the nascent war imaginary of the aviators was not able to articulate itself in the context of the overarching post-war isolationist defense posture. However, the act did lay the groundwork for doctrinal and conceptual developments that would eventually culminate in the development of the "industrial-web theory" war imaginary.

3.4.3 Extending Doctrine after the War

Despite the increased recognition of the combat utility of aircraft granted to the Army aviators, formal doctrinal development was relatively staid for the first half of the 1920s. The instructors refined the distinctions elaborated in 1919/1920 hearings between an Air *Service* that aided

99. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 35
100. ibid., 3; Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 16

ground forces and an Air *Force* that would conduct independent operations. Despite the devolution of doctrinal development to the ASTS, the General Staff continued to be a key veto point for the formal promulgation of doctrine which limited the claims the aviators could make. The one manual submitted for approval after the war was Sherman's "Tentative Manual for the Employment of Air Service," which waited in limbo for approval by the General Staff. However, this did not restrict the advocates within the Air Service from wondering aloud to what end aircraft might be put.

A lecture by Thomas Milling at the Army War College in 1923 is representative of the state of conceptual development at the ASTS during this period.[101] The instructors continued to put pressure on the distinction introduced by the advocates in the hearings over the independence bills between an Air *Service* and an Air *Force* through prognostication.[102] Milling used the aircraft categories of pursuit, bombardment, and attack to logically separate the offensive and defensive uses of aircraft arguing "air warfare might be roughly divided into two distinct classes: first, reconnaissance and cooperation with land and sea forces performed by the Air Service; second, command of the air secured by the destruction of enemy aircraft in the air or at their bases and by independent air operations against cities and industrial centers of the enemy country".[103] The primary strategic goal for an Air Force in 1923 was the destruction of enemy aircraft with pursuit, a class of aviation that Milling likened to infantry in its primary importance. Bombardment serves a secondary strategic function through the bombing of enemy aerodromes first and after those have been exhausted industrial centers would be targeted. Attack aviation would serve as tactical support for infantry units by harassing enemy infantry. Mindful of his audience, Milling acknowledges issues of morality in bombing industry, but discards it in favor of the potential contribution to victory.[104] The missions assigned to the varieties of aircraft are indicative of the continued dominance of Clausewitzian strategic theory in shaping doctrine. Rather than see the bombing of industrial centers as the primary strategic aim of independent aviation, Milling focuses on the destruction of (aerial) forces in the field.[105]

---

101. Unfortunately little survives of ASTS course material for this period. Milling was a critical early instructor at the school so this lecture serves as a snapshot of the thinking of this period.

102. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 40; Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 16

103. Tactics of the Air Forces in War, T.D. Milling, 1923. IRIS 00159992, Call: 248.211-65N, Air Force Historical Research Agency, 4-5

104. ibid., 10-12

105. Cf. Future of Air Service, General Mason Patrick, 1925, IRIS 00159951, Call: 248.211-61X, Air Force Historical Research Agency

While Sherman's manual was waiting in limbo pending approval by the General Staff, the Army War College developed a doctrinal text that defined the official Army position on the Air Service for the middle part of the decade. The text states that "the mission of the Air Service is to assist the ground forces to gain strategical and tactical successes by destroying enemy aviation, attacking ground forces and other enemy objectives on land or sea, and, in conjunction with other agencies, to protect ground forces."[106] The War College committee that drafted this text elided the distinction introduced by Milling and others between Service and Force and collapses them when they argue that "aviation is essentially an offensive arm."[107] In discussing the different classes of aviation the War College drafters saw pursuit as the most critical type of aviation, similar to Milling, but grants a substantially diminished role to bombardment as another form of artillery.[108] Comparing the War College text to Milling's lecture shows the continued perception that aircraft are best employed in combined arms warfare and that air supremacy is only a priority insofar as it aids the infantry. After five years the official Army position on the utility of aircraft, while incorporating some newer elements of Air Service thinking, was still largely the same.

By 1926, the General Staff finally approved the tentative manual written in 1919 by Sherman; the commandant of the Command and General Staff College Hugh Drum is reported to have described it as "the most advanced thought in the world today on aviation."[109] However, the Sherman manual (discussed in the preceding section) was fairly conservative in its orientation, focusing on how aircraft support infantry operations.[110] The core strategic function of air supremacy articulated by Milling was merely a factor contributing to the victory of the infantry in Sherman's manual. However, the fact that the manual identifies a strong offensive role for aviation combined with the War College text indicates that the General Staff was beginning to more fully appreciate the combat function of aircraft.

The development of doctrine during this period focused on further advancing how aircraft could aid the overall Army in achieving victory. While instructors such as Milling mused about the potentials for strategic activity by aircraft, the courses at the ASTS tended to focus

106. Fundamental Principles for the Employment of the Air Service, Army War College, 1925-1926, IRIS: 00159985, Call: 248.211-65F, Air Force Historical Research Agency, pp. 1
107. ibid.
108. ibid., 5, 15
109. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 46
110. For the promulgated edition see: Fundamental Principles for the Employment of the Air Service TR 440-15, Chief of Air Service, 1926, IRIS 00159985, Call: 248.211-65A, Air Force Historical Research Association.

almost exclusively on analyzing World War I. This was partly a consequence of the proximity of the ASTS to the War Department: its location in College Park, Maryland meant that classes were conducted under the shadow of the General Staff located in nearby Washington, DC.[111] What conceptual innovations occurred during this period were driven by instructors such as Milling engaging in public prognostication. However, these musings continued to operate within the existing dominant strategic framework: air warfare was imagined to observe the same strategic principles as land warfare.

3.4.4 Air Service to Air Corps

During the middle of the 1920s another set of independence debates centered around three successive board investigations of the status of the Air Service. This string of debates was catalyzed by a study commissioned by the General Staff from the Chief of the Air Service Mason Patrick. The purpose of Patrick's study was to assess whether the further development of aviation since 1920 justified a re-organization of the Air Service.[112] Following Patrick's study three successive military and civilian investigative boards met to assess the development of military aviation.

The most notable witness called to testify before the investigations was Mason Patrick, the head of the Air Service. Patrick argued that any future war would likely open with a battle for air supremacy between opposing nations, preceding any other type of engagement. This image of war necessitated the momentary readiness of pursuit aviation units leading Patrick to present a slightly more expansive set of recommendations than those in the original report. He argued that to have this readiness it was necessary to create an Assistant Secretary of War whose sole remit was aviation and establish a semi-autonomous Air Corps akin to the Marines.[113] While Patrick saw the need for an expanded role for aircraft, the Army concluded that for the time being there was little possibility of attack against the continental United States by aircraft due to the Atlantic and Pacific Oceans and that any attack involving aircraft carriers could be

111. Finney, *History of the Air Corps Tactical School*, 28

112. Lassiter Board Report, Lassiter Board, 1923, IRIS 00119244, Call: 145.93-102A, Air Force Historical Research Association, 1-2

113. At this time there was only one Assistant Secretary of War who mainly oversaw procurement.United States House of Representatives, *Inquiry into the Operations of the United States Air Service, Select Committee of Inquiry into Operations of the United States Air Service, House of Representatives, Sixty-Eighth Congress, On Matters Relating to the Operations of the United States Air Service, PT II* (Washington, District of Columbia: Government Printing Office, 1925), 519-530

thwarted by the Navy. Moreover, they argued that air power had not in fact proven its utility and that any attempt at separation would violate the principle of unity of command.[114]

The recommendations of the boards were enacted in the Air Corps Act of 1926 which changed the name of the Air Service to the Air Corps and added an Assistant Secretary of War for the Air. The direct effects of the Air Corps Act were largely cosmetic: the name change formalized the unofficial position of the senior leadership vis-a-vis the offensive utility of aircraft and the new Assistant Secretary of War, while giving a civilian voice to aviation issues, tended to increase the control of the Army General Staff over the internal workings of the Air Corps.[115] These cosmetic changes reflect the fact that this set of political interventions were driven by processes internal to the Army, as opposed to failures or demonstrations of the technology. Thus, these hearings did not provide the opening for dis-junctural change necessary for large-scale organizational expansions.

3.4.5 Air Corps Tactical School: Crucible of the Air War Imaginary

Following the creation of the Air Corps, the most influential event for the creation of new theory of victory through the air was a shift in the institutional purpose of the newly renamed Air Corps Tactical School (ACTS) which allowed for the theoretical exploration of aerial warfare. Distinct spaces for officers to debate and test theories of warfare, I argue, are critical to the development of a war imaginary. A rapid succession of institutional changes in following years led the ACTS to become a space for the development of a new strategic framework.[116] Official ACTS historian Robert Finney describes these changes as having the effect of turning the school into a "cerebral testing ground for ideas, where innovative young officers could envision air power without the restraints of reality."[117] Instead of focusing on defeating forces in the field, the ACTS war imaginary proposed an end run solution to the stalemate of trench warfare in the form of "industrial-web theory": the fragility of industrial economies meant that the destruction of key industries could disable a nation's war effort leading to a rapid and relatively humane

114. Morrow Board, *Report of the President's Aircraft Board* (Washington, District of Columbia: Government Printing Office, 1925), 10-11, 16-19

115. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 51-52

116. One of the key changes was initiated by the John Culver, who became Commandant of the school in 1928. Culver desired to re-orient the curriculum from analysis of World War I to theoretical exploration. As part of this, he created a capstone course entitled "The Air Force," which focused on the theoretical exposition of independent aerial warfare. ACTS Commandant's Annual Report, John Culver, 1929, IRIS 00155806, Call 245-111, Air Force Historical Research Agency.

117. Finney, *History of the Air Corps Tactical School*, 28

victory.

There were two events that would lead "industrial-web theory" to be developed at the Air Corps Tactical School. The first was the participation of ACTS instructors as umpires at the V Corps area maneuvers in 1929 where bomber formations were able to effectively blunt an infantry advance and avoid engagements with pursuit aircraft.[118] This was interpreted by a core of ACTS instructors to indicate that "a well organized, well planned, and well flown air force attack will constitute an offensive that cannot be stopped."[119] The second event was the Great Depression, which would inspire ACTS instructor Donald Wilson to begin investigating how to disrupt industrial economies through bombardment. Wilson interpreted the Great Depression as exposing the ways in which modern industrialized economies depended on highly fragile logistics and communications networks that were prone to compounding disruptions.[120]

To refine this idea Wilson began studying the industrial structure of the Northeastern United States, an area which at this time was considered to be key to the economic vitality of the entire country. Wilson requested maps showing the industrial reach of metal industries from the War Department under the guise of trying to work out a defense of this region but hinted in his request at the true purpose: "if we are to dictate the terms of peace we must defeat the enemy nations, and to do this we must carry the attack to his key points."[121] In a subsequent request to a more sympathetic officer, Wilson exclaimed that "this sort of information puts a new angle on the air force operations, and may be the guiding star in our future military intelligence efforts. It seems to hold the promise of solving all problems of destruction in the most efficient way—like hitting a power dam rather than cutting the six or eight transmission lines that radiate therefrom."[122] These studies led Wilson to derive a new strategic framework for air warfare—industrial-web theory—by identifying key economic nodes in a society and

118. Biddle, *Rhetoric and Reality in Air Warfare*, 64; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 142

119. Pre-World War II Evaluation of the Air Weapon, Haywood Hansell, 1953, IRIS 00483446, Call K239.716253-36, Air Force Historical Research Association. This view is represented in the 1931 "Air Force" course text. See: The Air Force, 1931, IRIS 00157154, Call 248.101-1, Air Force Historical Research Association

120. It is unclear what the exact impetus for Wilson's interpretation was: in his memoir he claimed that the idea came to him in a dream. Elsewhere, he claimed that his experiences working on the railroad in his youth impressed upon him this fragility as the railroad would frequently shut down for want of a specific lubricant. See: Biddle, *Rhetoric and Reality in Air Warfare*, 160; Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 58

121. Memo to Major William H. Crom A.C. Office of the Assistant Secretary of War, Donald Wilson, 1933, IRIS 00157330, Call 248.126, Air Force Historical Research Association

122. Memo to 1st Lt. John S. Gullet Industrial War Plans Division, Donald Wilson, 1933, IRIS 00157330, Call 248.126, Air Force Historical Research Association

utilizing inviolable bomber formations to destroy them, air warfare could accomplish victory in a war without reference to the ground.

These studies culminated in the 1933-1934 "Air Force" course taught by Donald Wilson. In one of the first lectures, Wilson signals the key shift from the dominant strategic framework of the 1920s which gave pride of place to pursuit aircraft in attaining air supremacy. Rather, he argues, the bomber has come to supplant pursuit as the key air capability: "it is apparent that the physical means of waging war, as well as morale, can be destroyed by aerial bombing... Since bombardment aviation is the principal bomb-delivering agency, we have the reason that bombardment is the basic arm of the air force, and hence the basis upon which an air force is built."[123] This priority extended to the core tactical objective identified in the 1920s—the destruction of the enemy Air Force, in this new conception of what an "Air Force" *is* pursuit was demoted to tactical defense of airdromes and other vital installations.[124]

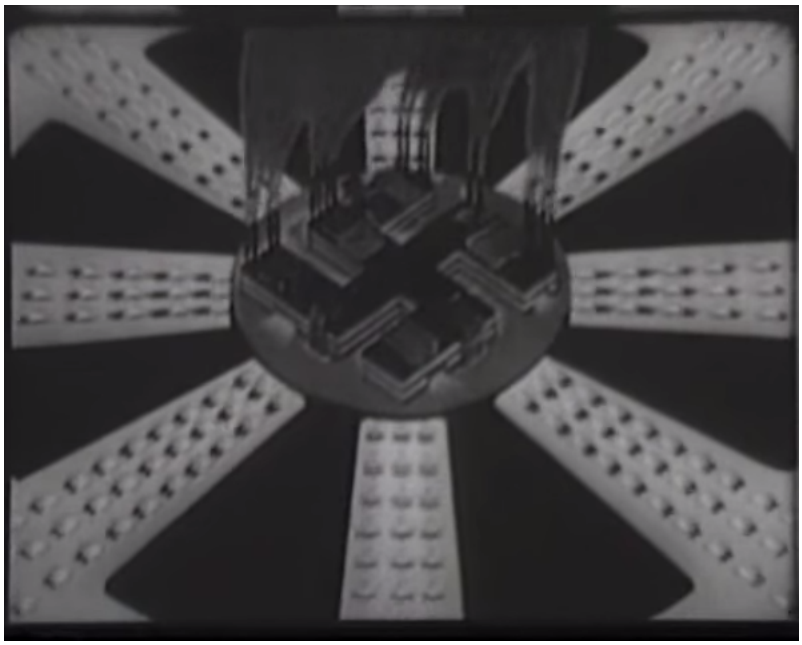

Figure 3.2: A visual representation of "Industrial Web Theory" from the 1942 Disney Film "Victory through Air Power"

The new emphasis on the bomber as the backbone of an Air Force was paired with his

123. Lecture: "Air Force Principles" in Air Force Lectures 1933-1934, Donald Wilson, 1933, IRIS 000157164, Call 248.101-2, Air Force Historical Research Agency, pp 3
124. ibid.

studies into the nature of modern industrial society to articulate a new way of strategic warfare based on industrial-web theory. These two currents crystallize in third lecture of this course when he argues:

> . . . modern industrial nations are susceptible to defeat by interruptions of this [industrial] web, which is built to permit the dependence of one section upon many or all other sections, and further this interruption is the primary objective for an air force. . . . To continue a war which is hopeless is worse than an undesirable peace because the latter comes soon or late [sic] anyway, but to continue a modern war without machinery is impossible.[125]

This strategic framework based on the bomber came to be the dominant position of much of the ACTS faculty.[126] The faculty inculcated these theories within their students, many of whom from this period went on to serve as generals in the Army Air Forces during World War II.[127] Versions of industrial-web theory continued to be taught in the Air Force Capstone course.[128] The fragility of modern economies gave a pathway for an Air Force to achieve a strategic victory without resorting to any ground engagements. Therefore, the air war imaginary of the ACTS faculty hinged on a specific interpretation of the nature of modern societies and the inviolability of bombers. Together, these moved aviation thought beyond the Clausewitzian framework that earlier theorists of air warfare labored under, thus conceptually liberating the aircraft from tactical support of infantry.

3.4.6 The General Headquarters-Air Force

As the officers and the students of the ACTS developed a theory of strategic air warfare, the Air Corps leadership began to push for the realization of an operationally autonomous General Headquarters-Air Force (GHQ-AF). This push coincided with the "Air Mail Crisis" which

125. Lecture: "Principles of War Applied to Air Force Action" in Air Force Lectures 1933-1934, Donald Wilson, 1933, IRIS 000157164, Call 248.101-2, Air Force Historical Research Agency, pp 3

126. Biddle, *Rhetoric and Reality in Air Warfare*, 160-163; Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 57-58

127. Stephen Mcfarland, *America's Pursuit of Precision Bombing* (Washington, District of Columbia: Smithsonian Institute Press, 1995), 91; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 106. Henry Arnold remarked in 1944 that the ACTS had developed the "strategic and tactical doctrines that would later guide our air campaigns in World War II." Quoted in ibid., 127

128. Cf. Air Force, n.a., 1934-1935, IRIS 000157157, Call 248.101-1, Air Force Historical Research Agency; Air Force Part One: Air Warfare, n.a., 1936, IRIS 000157158, Call 248.101, Air Force Historical Research Agency; Air Force—Air Warfare, n.a., 1938, IRIS 000157160, Call 248.101, Air Force Historical Research Agency

the Air Corps exploited to create support for a GHQ-AF. The crisis was triggered by a number of Air Corps pilot deaths which drove civilian intervention and catalyzed the conditions for disjunctural change. Foulois and the other advocates' success in creating the GHQ-AF is theoretically expected, by this point in the visioning stage the advocates' had cultivated organizational legitimacy and power as a function of age and relative size. This is perhaps reflected in the fact that the GHQ-AF had been approved in theory during the board investigations of mid-1920s, but the aviators were not able to secure statutory action on it until nine years later.

The push for the GHQ-AF was driven by Benjamin Foulois's appointment to be Chief of the Air Corps. During his time as an air-attaché in Berlin during the late 1920s Foulois became convinced that Germany was going to use aircraft to conquer Europe. He believed that "the first phase of the next war is going to be the conquest of Europe, and the second phase is going to be the conquest of the United States. They're going to use short-range aircraft to do the conquest of Europe job, but they'll need long range stuff to lick us."[129] This coincided with a War Department push to re-organize the Army to meet the needs of the newly crafted RAINBOW war plans for defending the continental United States. The Air Corps under the leadership of Foulois was tasked with developing their role in the RAINBOW plans with the implicit understanding that the Air Corps would support the infantry.

However, the plan submitted by the Air Corps articulated a defensive plan that relied upon an operationally autonomous GHQ-AF. The GHQ-AF would conduct independent air interdiction and interception operations against both air and ground targets. Despite the fact that the Air Corps presented a plan that went against the wishes of the General Staff, Chief of Staff Douglas MacArthur gave cautious approval in 1933.[130] However, much like what followed after the idea was originally endorsed by the Lassiter Committee, there was little concrete action to formally create the GHQ-AF.[131]

The spring of the following year would bring a crisis and an opportunity for the advocates to press their case. In late 1933 Roosevelt initiated a series of investigations into the handling of air mail contracts by the previous administration. By February 1934 Roosevelt had decided that there was enough evidence of fraud and collusion in the issuing of contracts to

129. Quoted in Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 66
130. Memo for D/CS Subject: Report of the Special Committee on Employment of Army Air Corps Under Certain Strategic Plans. Attachment: Plans for the Employment of Units of the Army Air Corps under certain strategic plans, Benjamin Foulois, 1933, Papers of Benjamin Foulois, Box: 17, Folder: 4, Library of Congress Manuscript Division
131. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 67-68

justify their cancellation and ordered the Air Corps to carry mail until new contracts could be negotiated. Foulois overestimated the ability of the Air Corps to safely carry mail and over the next eight weeks ten Air Corps pilots died while carrying mail. The carriage of mail was halted in late March with the deaths having spawned a period of public uproar and political recriminations.[132]

The public outcry over the poor state of the Air Corps aircraft inventory caused Roosevelt to appoint a board to investigate Air Corps reform. In front of this board, which called few witnesses, Foulois argued that it was necessary for the Chief of the Air Corps to have greater authority in order to carry out the Air Corps part of the RAINBOW war plans (i.e.: creating the GHQ-AF) coupled with an aggressive modernization program to replace the rapidly aging aircraft inventory.[133] Representing the General Staff, Brigadier General Kilbourne, countered with two arguments against any further expansion: first, that the potential utility of the Air Corps in case of invasion would be severely limited based on the experience of the first World War. Second, that in a time of budgetary constriction the "Army had been sacrificed for the Air Corps" and whatever complaints the Air officers had were a product of being indoctrinated into believing that they were facing unfair treatment.[134] It is interesting that Kilbourne argued against Air Corps expansion on the grounds of past efficacy and organizational culture, this is likely because the GHQ-AF had already been approved in theory multiple times by War Department staff. Perhaps due to the weakness of the General Staff protests the board concluded that the Air Corps deserved greater financial assistance, expanded representation on the General Staff, and the full activation of a GHQ-Air Force which would be operationally independent.[135] The report was then forwarded to President Roosevelt who enthusiastically approved its recommendations in whole.[136]

---

132. ibid., 70; Rice, *The Politics of Air Power: From Confrontation to Cooperation in Army Aviation Civil-Military Relations*, 116-117

133. Statement and Recommendations by Major General B.D. Foulois , Benjamin Foulois, 1934, Papers of Benjamin Foulois, Box: 25, Folder: 8: Baker Board: War Dept. Special Committee on Air corps 1934-1935: Statements and Recommendations by Foulois, Library of Congress Manuscript Division

134. Remarks of General Kilbourne Before Board Investigating Air Matters, Benjamin Kilbourne, 1934, Papers of Benjamin Foulois, Box: 25, Folder: 8: Baker Board: War Dept. Special Committee on Air corps 1934-1935: Statements and Recommendations by Foulois, Library of Congress Manuscript Division

135. Final Report of the War Department Special Committee on Army Air Corps, War Department Special Committee, 1934, IRIS 119235, Call 145.93-94A, Air Force Historical Research Association, pp. 61-67

136. Letter to Secretary of War from President Franklin Roosevelt August 31, 1934, Roosevelt, Franklin, 1934, Papers of Benjamin Foulois, Box: 25, Folder: 7: Baker Board: War Dept. Special Committee on Air Corps Miscellany 1934, Library of Congress Manuscript Division

Later that fall the long awaited GHQ-AF would finally be activated with Roosevelt's imprimatur. The significance of the GHQ-AF for the Air Corps cannot be overstated, an officer reflecting on its importance said: "basically, the trouble was that we had to talk about air power in terms of promise and prophecy instead of in terms of demonstration and experience. When the GHQ Air Force was organized and actually began to receive modern aircraft, the Air Corps was able to begin basing its doctrine on a lengthening record of demonstrations and experience."[137] The success of the Air advocates in gaining the long-awaited GHQ-AF was the consequence of a series of events that generated the civilian political will to intervene into the workings of the Air Corps. This victory is particularly palpable because of Newton Baker's blessing: in 1919 he had argued against greater aviation autonomy based on the limited capabilities of aircraft. Therefore, by 1935 the Air Corps had developed a theory of strategic air warfare and gained operational autonomy.

The developments of this period are theoretically expected, the core process for the second stage of the development of a strategic domain is the formation of a distinct war imaginary. In the case of the aviators, they developed a theory of independent strategic air warfare that exceeded the existing strategic framework of the Army. As I showed, this was the outcome of conceptual development over time as the aviators built on their sense of distinctiveness to argue first that aircraft had a tactical combat role, then a strategic role in aiding the infantry, and then finally a fully independent strategic function. Despite the fact that at times the War Department portrayed aircraft as an extension of artillery, they did little to control or intervene on the work of the aviators.[138] Senior leadership interest was only piqued when figures, such as Billy Mitchell, advanced strongly combative claims. Moreover, the lack of senior leadership intervention and inter-service rivalry allowed the aviators to accrue organizational legitimacy. This growth in legitimacy is demonstrated by the fact that the aviators were able to win far greater concessions—funding and autonomy—in 1935 than they had in 1919. Finally, the failure of the board hearings in the mid-1920s to produce substantive change in aviation demonstrates that civilian intervention only opens the possibility for disjunctural change in the face of technological failure (Air Mail Crisis) or strong demonstrations by adversaries (World War I.)

137. Quoted in Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 75

138. For example, they could have placed bombing aviation training and development under the control of Artillery officers.

3.5 1936-1943: Realizing Strategic Air Warfare

To realize the strategic air warfare imaginary developed by Donald Wilson and the other ACTS instructors would need more than the GHQ-AF: they needed long-range heavy bombers and the ability to act with strategic autonomy. The key process of the final stage of the development of a strategic domain is advocacy for a strategically autonomous organization. The Army Aviators capitalized on a rapid series of events in the run-up to World War II that allowed them to achieve strategic autonomy during and after World War II. Per the theory of domain development, for advocates to achieve a strategic mission requires both support from senior leadership and heightened civilian intervention. This is because strategic autonomy requires both a high degree of political will to alter the extant defense structure and the willingness of the senior leadership to lose control over a growing segment of their service. The run-up to World War II would see both, Roosevelt would be catalyzed by the Munich Crisis into believing that a major air-build up was necessary and turnover in the General Staff would bring a new generation of officers who were more open to the potentials of aircraft.

3.5.1 Aviator Lobbying

Perhaps the most important dimension of General Staff turnover was the appointment of George C. Marshall as Chief of Staff in 1939. Marshall's military career began with the Mexican Punitive Expedition (1917) which featured the first use of aircraft by the United States in a military operation and his career had been spent adjacent to many aviation developments. Sensing an opportunity when he was first appointed to be head of the War Plans Division of the General Staff in 1937, the Air Corps Chief took him on an extended tour of aircraft production facilities and air bases to build rapport.[139] The cultivation of Marshall by the Air Corps as an ally would pay dividends after the Munich crisis and his ascension to Chief of Staff. Marshall's rise in the ranks of the General Staff was representative of the wave of new officers in the General Staff who had also spent much of their careers with aircraft and were more open to its possibilities.[140]

During this same period, Roosevelt had become attuned to the military and political

139. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 93; Jeffrey S. Underwood, *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration 1933-1941* (College Station, Texas: Texas A&M University Press, 1991), 121. For a discussion of the Punitive Expedition see: Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 167

140. Underwood, *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration 1933-1941*, 152-153

symbology of the aircraft. While he was an enthusiastic Naval Aviation advocate during his time as Assistant Secretary of the Navy, his early time in office had not shown any particular concern with developing military aviation.[141] This began to change when the Italian Regia Aeronautica effectively deterred a British response to the Italian invasion of Ethiopia in 1935. Roosevelt perceived this as a symbolic victory for aircraft, and his appreciation of this symbolic dimension was deepened by growing fears of fascist subversion in South America. Mussolini's government was sponsoring newspapers, radio stations, and the touring of an aerial acrobatics squadron across the continent. The latter activity is important to note because the aircraft was a key part of Italian fascist symbology.[142] The Air Corps arranged several non-stop "good-will" flights from North America to points in South America to demonstrate to domestic and foreign audiences the rapidity with which they could deploy to the region. These flights were part of a conscious strategy to demonstrate the necessity of large fleets of heavy bombers to Roosevelt and the War Department.[143] The overall goal of this advocacy was to demonstrate that heavy bomber fleets could be a potent (symbolic) deterrent tool for enforcing the Monroe Doctrine against fascist subversion in South America.[144]

In July 1938, shortly after the partition of Czechoslovakia, the American Ambassador to Germany Hug hWilson argued to Roosevelt that the significance of the growing Luftwaffe was "war or political blackmail."[145] Further confirmation of this would come several months later when the French and British would warn Roosevelt that Hitler's power was underwritten by the size and strength of the Luftwaffe. These warnings led Roosevelt to become "convinced for the first time that American airplane production should be greatly stimulated with all possible speed."[146] This series of events led to what has been described as the "magna carta" for the

141. This was despite a public friendship with Billy Mitchell, a friendship that he likely entertained due to Mitchell's aid in securing his nomination by the Democratic Party. ibid., 57

142. See n.66

143. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 90; Underwood, *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration 1933-1941*, 75, 103-122

144. Report of the Air Corps Board: Air Corps Mission Under the Monroe Doctrine, Air Corps Board, 1938, IRIS 00121165, Call 167.5-44, Air Force Historical Research Agency

145. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 90; Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 103. On the relationship between the Luftwaffe and Munich see: George Fielding Elliot, "Aerial Blackmail at Munich," in *The Impact of Air Power: National Security and World Politics*, ed. Eugene M. Emme (Princeton, New Jersey: D. Van Norstand Company Inc., 1959), 64–67; H. J. A. Wilson, "The Luftwaffe as a Political Instrument," in *The Impact of Air Power: National Security and World Politics*, ed. Eugene M. Emme (Princeton, New Jersey: D. Van Norstand Company Inc., 1959), 58–63

146. Mark Skinner Watson, *Chief of Staff: Prewar Plans and Preparations* (Washington, Disctrict of Columbia: Department of the Army Historical Division, 1950), 131-132

Air Force as Roosevelt became increasingly assertive in arguing for an expansion of domestic military aircraft production. The expansion reflected Roosevelt's belief that aircraft and air power would be the key to securing the Western Hemisphere against attack. However, the General Staff of the War Department continued to be recalcitrant in their opposition to any sort of Air Corps expansion demanding that the rest of the Army also receive greater funding, to which Roosevelt famously responded "America could not influence Hitler with barracks, runways, and schools."[147] The following spring Roosevelt went to Congress and asked for appropriations totaling $300,000,000 to purchase 3,251 aircraft for Air Corps, a large fraction of which would be heavy bombers. Roosevelt justified this on the grounds of force modernization and the need to be prepared to fend off strategic attack.[148] Roosevelt's ultimate interest in air expansion was deterrence of the Luftwaffe, but the nature of this air expansion—a build-up of long-range strategic bombers—was a consequence of the aviator's advocacy.[149]

As the prospect of war grew closer in 1941 there was a string of high level talks between the Canadian, British, and Americans called the American-British Conference. Those gathered at the conference agreed that the Royal Air Force and the Army Air Corps would conduct strategic bombing operations against Germany. The task of developing plans for this campaign fell to the newly created Air War Plans Division of the Army Air Corps. The Air War Plans Division was staffed by a group of instructors from the ACTS known as the "bomber mafia" who along with Donald Wilson had developed and refined industrial-web theory and precision strategic bombing.[150]

The resultant war plan—AWPD/1: Munitions requirements of the Army Air Forces for the defeat of our potential enemies—contained a detailed exposition of how to wage strategic air warfare against Germany. It contained three planks: first, the strategic bombing of "systems...vulnerable to air attack and to the continuance of war effort of Germany" which included transportation, oil infrastructure, and the capitol Berlin. Second, the attainment of air superiority by bombing Luftwaffe installations and the domestic aviation industry. And third, close

147. Quoted in: Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 90

148. Franklin D. Roosevelt, *The Public Papers and Addresses of Franklin D. Roosevelt: 1939* (New York, New York: MacMillan, 1941), 70-74

149. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 100

150. Donald Miller, *Masters of the Air: America's Bomber Boys Who Fought the Air War Against Nazi Germany* (New York, NY: Simon / Schuster, 2006), 52; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 108-109

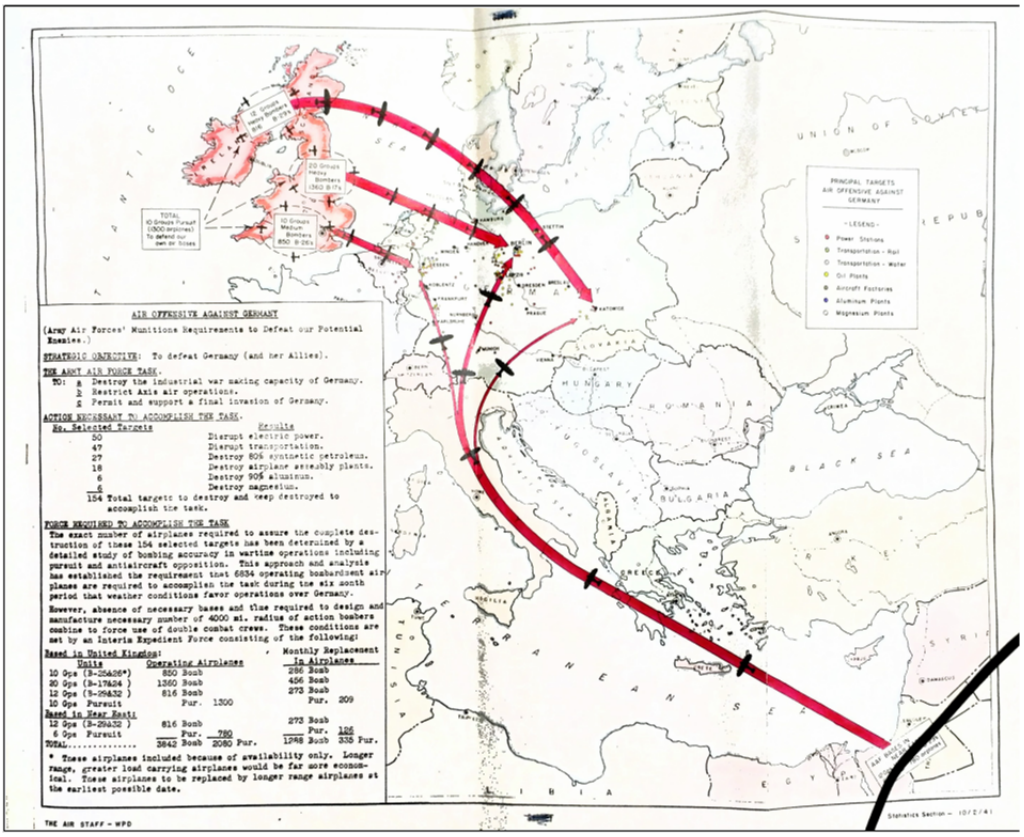

Figure 3.3: Visual Brief of AWPD/1

air support for the final ground invasion.[151] The dominance of the bomber in this new thinking comes through in the production ratios of 10:8:2, bombers:pursuit:observation, an inversion of the first production schedule developed during World War I. Thus, the bomber had come to have the primary strategic offensive role, whereas pursuit aircraft were primarily granted a defensive one.[152] The plan and production schedule was approved by both the General Staff and the Secretary of War, paving the way for operationalizing strategic air warfare.[153]

Coinciding with the creation of the AWPD/1 were several organizational changes in 1941-1942 to prepare for the increased role that aircraft would play in the coming war. This re-organization was spurred by Chief of Staff George Marshall and Henry Arnold, the latter had

151. Memo for C/S Subject: Munitions Requirements of the Army Air Forces for the defeat of our potential enemies, Air War Plans Division, 1941, IRIS 00118163, Call 145.82, Air Force Historical Research Agency, 1
152. ibid., 2
153. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 111

commanded the immediate pre-war Air Corps and would serve as the commander of the Army Air Forces during the entirety of the coming war. Critically, Arnold's drive for the creation of the Army Air Forces was favorably received by Marshall and the General Staff, who gave it their full endorsement. The consequence was the Air Corps and GHQ-AF were merged into the Army Air Forces which granted a massive expansion of autonomy and resources in three ways. First, by consolidating the control of air fields and support personnel under one command which was accomplished by merging the GHQ-AF and the Air Corps into each other. Previously, the former had been responsible for the employment of air capabilities and the latter for staffing and procurement. Second, granting full independence in the development of doctrine to the Army Air Forces officers. And third, further expanding the number of officers and aircraft. This was accompanied by the full recognition of the Army Air Forces as co-equal with the Army Ground Forces and Army Service Forces.[154]

Full strategic autonomy was gained with the appointment of General Arnold to the newly formed Joint Chiefs of Staff in March 1942. The Joint Chiefs were created to serve as a venue for high level strategic coordination between the various armed services of the United States and the symbolic nature of Arnold's appointment was intentional.[155] Roosevelt wrote of it "My recognition of the growing importance of air power is made obvious by the fact that the Commanding General of the Army Air Forces is a member of both the Joint and Combined Chiefs of Staff. The Air Forces, both in the Army and in the Navy, have a strong voice in shaping and implementing our national military policy."[156] While the Army Air Forces still worked in coordination with the Army Ground Forces, the appointment to the Joint Chiefs also led to the creation of two dedicated strategic air warfare units: the 20th Air Force and the US Strategic Air Forces in Europe operated independently of theater commands thereby finally giving the aviators what they had so long desired.[157] The final victory of recognition would come in 1943, as the newly issued overarching Army doctrinal manual stated explicitly that "LAND POWER AND AIR POWER ARE CO-EQUAL AND INTERDEPENDENT FORCES; NEITHER IS THE ADJUNCT OF THE OTHER" (emphasis in the original).[158]

154. McClendon, *Autonomy of the Air Arm*, 95; Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 103-104
155. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 129
156. Quoted in: McClendon, *Autonomy of the Air Arm*, 98
157. Wolk, *Toward Independence: The Emergence of the U.S. Air Force*, 6
158. War Department General Staff, *Field Manual 100-20*, (Washington, District of Columbia: Government Printing Office, 1943), 1

The realization of the possibility for independent strategic air warfare through the operationalization of industrial-web theory in AWPD/1 shows the necessity of civilian intervention in creating the conditions for disjunctural change. Air Corps lobbying efforts helped to shape Roosevelt's belief in the utility of aircraft, granting them the organizational capital to shape production ratios and war plans in the run-up to World War II. This legitimacy meant that Roosevelt turned to them, rather than the War Department General Staff in preparing the response to the Luftwaffe. The trust that Roosevelt had in the aviators led him to overrule the General Staff on multiple occasions, a vote of support that the aviators had never before received.[159] On the other hand, the good graces of the General Staff was also necessary. The greater openness of the War Department was a product of alliance-building between Air Corps officers and Chief of Staff George Marshall and generational turn-over. The General Staff, while concerned about funding, went on to grant the Army Air Forces ever greater recognition for their role in warfare. This culminated in the 1943 FM 100-20 which admitted the co-equal status of air power, an act that would have made earlier generations of General Staff either blanch or laugh. Overall then, the realization of the Air as a strategic domain was not the function of technological determinism but rather a 30-year process of advocacy and conceptual development.

3.6 Epilogue

In 1947 the dream of the aviators would be realized in the creation of the Air Force as part of a unified Department of Defense. At various points in the development of the air domain in the United States military, aviators had argued for this very arrangement. On each occasion, it was opposed by the War and Navy Departments on the basis of unity of command. It is ironic then, that the push to create a unified Department of Defense was the product of concerns over command and coordination in combined arms warfare. The needs for greater coordination were apparent by 1943 when Admiral Henry Yarnell and the Special Planning Division of the General Staff independently argued that a lack of unity of command in air-sea-land operations was hampering combat effectiveness.[160] While each service would maintain distinct strategic missions, the rise of the air as a strategic domain also reshaped the relationship of various types of warfare. The shift in the overall conception of warfare that drove this push is best captured

159. For example, the Secretary of War and General Staff had preferred to build medium-range bombers. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 85, 100
160. McClendon, *Autonomy of the Air Arm*, 100-101

by the 1944 testimony of the Assistant Secretary of War for Air Robert Lovett when he argued that future wars would be "a series of combined operations in each of which Ground, Sea, and Air Forces must be employed together and coordinated under one directing staff and over-all command.[161] The fact that the unification debate was defined by arguments over operational coordination is a result of the fact that a separate aviation service arm was considered a fait accompli by civilian politicians, War Department, and Army Air Forces leadership after the war.[162] These provocations and investigations would culminate in the 1947 National Security Act which created a unified Department of Defense with co-equal Navy, Army and Air Force sub-departments.[163]

3.7 Alternative Explanations

The effect of the Munich Crisis in opening the pathway for disjunctural change may suggest that pressure from the security environment could have driven the articulation of the independent role of aircraft in World War II. While the rise of the German Luftwaffe altered Roosevelt's assessment of the pre-war security environment, the path that he chose was paved by the conceptual labor and advocacy of the Army aviators. That is, Munich may have given the push for organizational development but the overall conception of air warfare mobilized had already been in existence for several years. Furthermore, this does not explain why the Air Mail crisis—a domestic technological failure—drove both operational autonomy and aviation expansion which laid the foundations for increasingly assertive aviation advocacy.

Evidence that changes in the security environment drove earlier developments, such as the creation of the Aeronautical Division in 1913, is also sparse. Unlike the United States which was slow to even believe the claims of the Wrights, European officers and politicians were eager to begin integrating aircraft into their militaries. German military aviation in 1913, for example, received a budget of $8,000,000 dollars while aviation in the United States was appropriated a meager $125,000.[164] Reviewing the annual reports of the War Department indicates some concern by the Chief Signal Officer and the Secretary of War over the development of European and Japanese aviation. These "first class powers" are cited as rapidly developing their aviation

161. Quoted in ibid., 102, Henry Arnold expressed a similar sentiment in hearings see: Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 191
162. ibid., 190
163. ibid., 194
164. Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 108

capabilities alongside descriptions of the strength and types of aircraft used. The 1911 Annual Report of the Chief Signal Officer included a thorough description of the organization that the French Army had constructed for the purposes of military aviation.[165] However, the Secretary of War tended towards recommending a "wait and see" approach regarding developments in European aviation.[166] While the U.S. military watched European developments with a wary eye there was little sense of urgency in the military establishment over these developments.

As to the political establishment, they were certainly keeping abreast of foreign developments. In 1912 the House of Representatives directed the Secretary of War to prepare a report on the progress of aviation abroad compared with the Aeronautical Division.[167] Though, there is no evidence that had any real political impact. Moreover, during the hearings for the 1913 independence bill, the House Committee on military affairs considered over a hundred pages of detailed reports on European and Japanese civil and military aviation and yet they did not seek any competitive expansion.[168]

The impact of the Luftwaffe and the experience of the Air Service in World War I is potentially suggestive of normative emulation: that the air warfare doctrine was shaped by foreign influences. It is certainly true that the aviators borrowed heavily from the Europeans during World War I, however by World War II they had developed a fully distinct theory of air warfare.[169] Moreover, the most commonly imputed foreign influence on the American conception of air warfare—Giulio Douhet—was only available to the ACTS instructors in a vulgarized form.[170] Despite the impact of the Luftwaffe on Roosevelt's views of aviation, they had largely organized for combined arms air warfare and contemporaneous Army aviation accounts actively

165. Allen, "Report of the Chief Signal Officer," 741-742

166. The Secretary of War, *Annual Report of the Secretary of War*, vol. I (Washington, District of Columbia: Government Printing Office, 1913), 26, ISBN: 3210105073

167. Hennessy, *The United States Army Air Arm, April 1861 to April 1917*, 108

168. United States House of Representatives, *Aeronautics in the Army. Hearings before the Committee on Military Affairs, House of Representatives, Sixty-third Congress, first session, in connection with H. R. 5304, May 16, 1913, entitled "An act to increase the efficiency of the aviation service of the army, and for other purposes." August 12, 14, 15, and 16, 1913.*, 549-660

169. Industrial-web theory bears many similarities to Gorrell's "Strategical Bombardment" plan, however based on archival research it seems like this not available to the ACTS instructors. Lawrence Kuter, an ACTS instructor, seems to indicate it was re-discovered after industrial-web theory was developed. Air Power—The American Concept. Lawrence Kuter. 1943. IRIS 00121306, Call: 167.6-50, Air Force Historical Research Agency. See also: Wilson, "Origin of a Theory for Air Strategy"

170. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 30; Wilson, "Origin of a Theory for Air Strategy." Even then, the ACTS instructor Ira Eaker stated that they viewed Douhet as too extreme and conceptually loose to be useful. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*, 50-51

criticized their doctrine.[171] Furthermore, reports from the German invasion of Poland, Spanish Civil War, and Sino-Japanese War all seemed to indicate that bombing had limited efficacy—something that the Army aviators argued was a function of poor doctrine and training. When they gave praise it was articulated as a confirmation of their existing theories and concepts of employment, i.e.: that foreign Air Forces were vindicating their theories.[172] The relative isolation and disregard of the Army aviators during their core period of conceptual development seems to indicate that foreign normative influence was limited at best.

3.8 Conclusion

The development of the air domain of warfare in the United States military was the consequence of two intertwined processes driven forward by the advocates. On the one hand was the slow and steady development of an organization capable of carrying out strategic air warfare; on the other was the development of an independent air war imaginary. Bomber wings and pursuit squadrons are useless without the doctrine and theories of combat that under-gird the training of their pilots and guide them to their targets. This outcome was not fated, but was the direct consequence of a thirty-year campaign of advocacy by Army pilots.

This effort only succeeded because of the specific organizational environments faced in each successive stage of development. The possibilities of air-advocacy were only to be found because of a largely indifferent senior leadership during the early years of aviation development which drove distinctive advocacy. This for both better and ill led the aviators to believe that the War Department did not represent their interests, a sense that was further catalyzed by the experiences of World War I. For the advocates, aviation had a role in warfare, but this role was still largely limited by their inheritance of the Clausewitzian strategic framework of the War Department. While the advocates opposed the minimization of this role by War Department

171. What is Blitzkrieg?, NA., 1940, Papers of Henry Arnold, Box: 5, Folder: 1, Library of Congress Manuscripts Division

172. Lecture: American Air Power–School Theories vs World War Facts, L. S. Kuter, 1937-1938, IRIS: 157529, Call: 248.11-2, Air Force Historical Research Agency; Study: Unity of Command as Exercised by the Belligerents in the Present European War, R. C. Candee, 1940, Papers of Henry Arnold, Box: 5, Folder: 1, Library of Congress Manuscript Division; Analysis of Initial German Air Force Operations in Poland, Thomas White, 1939, IRIS: 159584, Call: 248.211-15A; The Lessons of the Air War in Poland, NA., 1939, Papers of Henry Arnold, Box: 4, Folder: 10, Library of Congress Manuscripts Division; Air Operations in the European War, NA., 1939, Papers of Henry Arnold, Box: 4, Folder: 10, Library of Congress Manuscripts Division; Biddle, *Rhetoric and Reality in Air Warfare*, 171

following the war, they were able to successfully grow by changing their strategy by both more closely aligning their arguments with the overall conceptual framework of the War Department. Successive organizational successes gave the advocates the space to develop an air war imaginary, and the venues provided when civilians were spurred to act gave them a place to publicly advance their claims. The culmination of these organizational battles and the development of thought was in the drafting of AWPD/1, when aviators had achieved such a degree of legitimacy in their claims that they were able to mobilize an entirely new conception of warfare. This had the consequence of fundamentally altering the defense structure of the United States with two consequences: first, the early Cold War security architecture was focused on strategic nuclear bombing and second, the socialization effects of the development of the Air Force identity means that strategic bombing continues to be a core mission of the Air Force today.[173]

A useful comparison that demonstrates the necessity of slow building distinctive advocacy is the development of the Luftwaffe by Nazi Germany during the 1930s. After the collapse of the Versailles Treaty system in the early 1930s, Hitler directed a process of re-armament and in so doing attempted to create an air arm out of whole clothe over three years. The development of the Luftwaffe draws into contrast two features of my argument: first, the effect of an interventionist senior leadership; and second, the necessity of a body of distinctive advocates.

The initial officer corps of the Luftwaffe was drawn from air officers previously attached to the inter-war Reichswehr which carried the legacy of World War I German aviation. Previous incarnations of German military aviation had left a doctrinal legacy that posed the main function of aircraft as being tactical support of ground forces. The consequence was that the Reichswehr officers were inclined towards ground-support functions for aircraft.[174] This issue became magnified with build out of the Luftwaffe Officer Corps, most of the senior staff were taken from the land forces of the Reichswehr and veteran civil servants. For lower level officers, the Luftwaffe recruited from eleven different organizations in the German military and civil society.[175] The rapid increase in size and organizationally diverse officer corps meant that

173. For early Cold War planning see: Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 214-219. For the endurance of strategic bombing see: Builder, *The Masks of War: American Military Styles in Strategy and Analysis* , 129-133; Crane, *Bombs, Cities, and Civilians: American Airpower Strategy in World War II*, 11; Wolk, *Toward Independence: The Emergence of the U.S. Air Force*, 13. Cf. Air Force Doctrine Working Group, *Strategic Attack: Air Force Doctrine Document 3-70*

174. James S. Corum, *The Luftwaffe: Creating the Operational Air War 1918-1940* (Lawrence, Kansas: University of Kansas Press, 1991), 129; Overy, "From 'uralbomber' to 'amerikabomber': The Luftwaffe and Strategic Bombing," 159

175. Corum, *The Luftwaffe: Creating the Operational Air War 1918-1940*, 159-160

there were frequent "culture clashes" due to the wide variety of prior organizational allegiances. The constitution of Luftwaffe officer corps in this fashion had two effects—first, it meant that the Luftwaffe had a variety of entrenched perspectives on how to use aircraft in warfare; and second, that there was difficulty in developing continuity of doctrinal thought. For example, the first Chief of Staff of the Luftwaffe, Walter Wever, developed a theory of strategic air warfare that was broadly similar in its emphasis on strategic bombing as the American aviators.[176] This led him to pursue the development of large strategic bombers to operationalize this theory of warfare. However, by time the prototypes were ready for assessment he had died and was replaced by the Wehrmacht General Staff with a loyalist—Albert Kesselring. Kesselring opposed independent air warfare, preferring to maintain the doctrinal tenets of close tactical support and canceled Wever's bomber program in favor of light and medium bombers. Wever's staff had been drawn from the Wehrmacht and shared a similar disposition to Kesselring, meaning that his strategic concepts had no defenders among the Luftwaffe senior staff.[177] The effect of these entrenched loyalties is that the Luftwaffe never pursued a theory of independent strategic air warfare in the run up to World War II, instead focusing on ground support for the Blitzkrieg doctrine.[178]

This short discussion of the creation of the Luftwaffe is meant to highlight two features of the domain development process: first, is the necessity of distinctive advocacy. Whereas the advocacy of the Army aviators was formed out of singular institutional site staffed by young officers, the Luftwaffe was an aviation service arm that was created whole-cloth with an experienced officer corps who had cross-cutting loyalties. The youth and shared institutional site of the Army aviators meant that they were able to form a distinctive corporate identity without the weight of prior allegiances. Moreover, the eclectic mix of Luftwaffe officers meant that they were not able to create a shared organizational and cultural focus on the independent role of aircraft. This suggests that the socialization of young officers during the formation of advocacy is crucial to the development of a distinct war imaginary. Further, while the Luftwaffe was

176. ibid., 135

177. Kesselring resigned after a year in office, but the effect of his cancellation of bomber programs and reorientation of doctrine would be continued. Corum, *The Luftwaffe: Creating the Operational Air War 1918-1940*, 145; Overy, "From 'uralbomber' to 'amerikabomber': The Luftwaffe and Strategic Bombing," 155

178. What is Blitzkrieg?, NA., 1940, Papers of Henry Arnold, Box: 4, Folder: 1, Library of Congress Manuscripts Division. That being said, the Luftwaffe did have plans for terror bombing of civilian and military targets, but they never seriously prepared to enact them. By, for example, developing heavy bomber airframes. Corum, *The Luftwaffe: Creating the Operational Air War 1918-1940*, 230-231; R.J. Overy, *The Air War 1939-1945* (New York, New York: Stein / Day, 1980), 8-15

nominally independent, the control of the Wehrmacht staff on doctrinal development is clear. The General Staff of the Luftwaffe served as a conduit for the Wehrmacht to control the development of aviation doctrine, a dynamic that is exposed by the choice of Kesselring for Chief of Staff. The long-run consequence of this was that Germany was unable to effectively field an independent offensive Air Force during World War II.[179]

A comparison that draws out the necessity of distinctive advocacy but highlights how accelerated development will lead to an impoverished war imaginary is the development of the Royal Air Force. That the Royal Air Force as a distinct organization developed rapidly can be explained by one main factor: the close proximity of other aviation powers. The early rise of British aviation follows a similar course to that of the United States in the beginning: much like the Signal Corps the War Office converted a ballooning unit into an ad-hoc airplane unit in 1911. While the unit accepted pilots from both the Navy and Army, there were few because they had to pay for their own pilot training due to skepticism from Army and Navy senior leadership.[180] Though, after some pilots had been trained the Army began to express an interest in developing close support reconnaissance units.[181] As aviation progressed into 1912, the Royal Flying Corps (roughly equivalent to the 1913 Aeronautical Division) was formed in response to fears over German aviation, it had a Military (Army) and Naval Wing. The interest of the Army leadership in reconnaissance missions led the Military wing to focus almost exclusively on developing tactics and aircraft for observation.[182] Whereas, due to the work of the First Lord of the Admiralty Winston Churchill, the Naval wing began to take on an offensive orientation. This was due to Churchill's encouragement of the exploration of the offensive potentials of aircraft, leading to a great deal of experimentation amongst the Naval aviators. However, this offensive orientation articulated by the Naval pilots was not directed towards fulfilling an existing concept of sea power but rather Zeppelin interdiction.[183] These dispositions only grew more pronounced by the time that Britain entered the war in 1914 when the aviation units were activated. The effects of senior leadership interest are apparent at this stage: the British Army focus on a specific mission tended to guide the early British Army

179. ibid., 78-81
180. Neville Jones, *The Origins of Strategic Bombing* (London, United Kingdom: William Kimber, 1973), 35
181. ibid., 37-38
182. ibid., 40. It should be noted that as with U.S. Army and Naval aviation, the British had established a joint committee that prevented rivalry between the two wings. Smuts Committee, ""Magna Carta" of British Air Power," in *The Impact of Air Power: National Security and World Politics*, ed. Eugene M. Emme (Princeton, New Jersey: D. Van Norstand Company Inc., 1959), 34
183. Jones, *The Origins of Strategic Bombing*, 44

aviators to become solely focused on the problems of observation. In contrast, the relative openness of Churchill to experimentation by the Naval aviators led to widespread experiments with mounted machine guns and bombs among the Navy aviators. This experience confirms the influence that the senior leadership can have: the direction of a new technology towards an existing mission can and will stifle innovation and experimentation. For example, Churchill's interventions into Naval aviation was far more open than early American Naval aviation and therefore gave greater room for experimentation.

After the entry into the war, much of the doctrine was developed on the fly. The Royal Flying Corps had a few key innovators such as Hugh Trenchard and Lord Tiverton who through their battlefield experiences began to focus on the offensive use of aircraft against forces in the field. Military aviation lagged Naval aviation in this respect owing to the different orientations of the units prior to the war. The entry into the war saw the Admiralty force the separation of the Naval aviation division into the Royal Naval Air Service, and their prior offensive orientation meant that they began developing offensive doctrines much more readily than the now exclusively Army Royal Flying Corps. The Royal Flying Corps focused on ground support operations (hence the focus on infantry morale in World War I by Mitchell) while the Royal Naval Air Service focused on long-range bombing operations.[184] However, their separation would not last through the war as bombing raids on London would force deep civilian intervention into the operation of military aviation.

The civilian intervention was triggered by the sudden raids of German bombers on London and other parts of the United Kingdom. Prior to 1917 the Germans had only occasionally conducted bombing raids with Zeppelins against the British interior. The switch to aircraft was motivated by the weakness of Zeppelins to pursuit aircraft and the development of longer-range bombers. The first of the raids in the summer led to an immediate increase in the size of both aviation units. However, the government sensing that this was not sufficient to effectively defend the island put together a total review of air defense on July 11, 1917.[185] The outcome of this review—the Smuts Report—would lead to the creation of the Royal Air Force.

184. Biddle, *Rhetoric and Reality in Air Warfare*, 25-26; Jones, *The Origins of Strategic Bombing*, 94-120. The Army focus was also partly a functional view of aircraft as being like artillery—similar to the United States.Smuts Committee, ""Magna Carta" of British Air Power," 35. See also:"Future Policy in the Air", Hugh Trenchard, RG 120, Gorrell's History of the American Expeditionary Forces Air Service 1917-1919, Series A, Volume 23, National Archives at College Park, 166-168

185. Biddle, *Rhetoric and Reality in Air Warfare*, 29-31, 33; Jones, *The Origins of Strategic Bombing*, 135

The report contained within it, a rudimentary air war imaginary that posited an independent role for aircraft. Smuts begins his report by noting that aircraft shouldn't be thought as similar in function to artillery, but rather as independent capability. Smuts argues that:

> Under the present constitution... essentially the Air Service[186] is as subordinated to military and naval direction and conceptions of policy as the artillery is... the position of an Air Service, is quite different from that of the artillery arm... artillery could never be used in war except as a weapon in military or naval or air operations. It is a weapon, an instrument ancillary to a service, but could not be an independent service itself. Air service, on the contrary, can be used as an independent means of war operations.[187]

Not only was aviation functionally different from artillery, Smuts also saw aviation as potentially defining the future of warfare: "the day may not be far off, when aerial operations with their devastation of enemy lands and destruction of industrial and populous centres on a vast scale may become the principal operation of war".[188] In order to exploit this possibility, Smuts argued that aviation needed to be liberated from its tutelage, leading to the fusion of the Naval and Army aviation branches into the Royal Air Force. Surprisingly, There was little opposition from the British Naval aviators but the British Army aviators such as Hugh Trenchard vigorously opposed the RAF on the grounds that independent aerial warfare was unlikely to succeed. Over the objections of Trenchard and others of the War Office / Army, the Royal Air Force was formally created in the April 1918.[189]

From the British case it is clear that the experience of war accelerated the development of military aviation which led to several deviations from the American case. First, the drive to develop the Royal Air Force was not the product of sustained advocacy from an aviation branch. General J.C. Smuts was a member of the War Cabinet, and unfortunately there is a dearth of documentary evidence with which to assess how he formed his beliefs on aviation. That being said, as explained in section 3.2 literature on air warfare was fairly widespread at this point and particularly popular in Europe. This suggests that the experience of wartime can drive rapid increases in organizational autonomy through deep civilian intervention. This outcome is

186. The organization responsible for administration of the Royal Flying Corp and Royal Naval Air service.
187. Smuts Committee, ""Magna Carta" of British Air Power," 35
188. Quoted in Jones, *The Origins of Strategic Bombing*, 136
189. Biddle, *Rhetoric and Reality in Air Warfare*, 33-34

not completely theoretically unexpected, I argue that a strong civilian intervention before the achievement of operational autonomy can lead to an alternative vision for the domain enabling technology. In this case it turned out to be one that promoted full separation. Second, the crucial difference was the much longer experience of aircraft in war which seemed to drive both the civilians and Churchill to view aircraft through a far more offensive lens. However, this did not mean that they had developed a distinct war imaginary, rather independent air operations by the Royal Air Force were founded on the "morale effect" as an extension of the existing Clausewitzian framework which sought victory by breaking the morale of enemy forces. Thus, the British independent air operations were to a large extent ad hoc in nature.[190] The case of the Royal Air Force, therefore, demonstrates that autonomy can be achieved without a war imaginary. However, without the slow build of distinctive advocacy, a fully independent theory of warfare cannot develop.

Altogether, the evolution of the air domain took multiple paths in the years prior to World War II. The experience of American Naval Aviation, the German Luftwaffe, and the British Army Royal Flying Corps demonstrate that the senior leadership of a service can effect the ability for advocacy to form during the early stages of the formation of advocacy. In each of these cases the action of the senior leadership aligned aircraft within existing missions or conceptions of war, thereby stemming a sense of distinctiveness. While the British case is potentially suggestive of structural pressure driving organizational outcomes, it does not demonstrate that it drives innovative strategic doctrine. Moreover, the fact that the United States during this same period did not meaningfully accelerate their aviation development suggests that structural pressures do not drive all domain outcomes. The experiences of World War II would cement the American conception of air warfare as the dominant one. These large-scale aerial campaigns would contribute to a belief that technological innovation would be a crucial aspect of the future of warfare. This belief about technology and warfare would come to influence how the United States military would approach the technologies that enabled orbital space.

190. ibid., 14, 35, 45

Chapter 4

What's a Heaven for?

> Mrs. John: "I explained to the man who answered the phone call all about our interplanetary plans. When I had finished, I asked him, 'Now isn't that interesting?' The man didn't say anything at all for a couple of minutes. Then finally he said 'No'"
>
> Narrator: "That's the trouble with most of us all right, Mrs John. Not enough vision..."[1]

4.1 Warfare under the condition of High Technology

In a 1946 memo entitled "Scientific and Technological Resources as Military Assets" Dwight Eisenhower, who was then Chief of Staff of the Army, articulated what he saw as a core lesson of World War II: that science and technology had become critical national assets in modern warfare. Whereas the generation of senior Army officers emerging from World War I looked at the still new aircraft with suspicion or disinterest; the senior officers of the second World War emerged with a deep conviction that science and technology had transformed warfare. The atomic bomb, V-2 rocket, RADAR, Higgins boat, and jet-powered aircraft transformed the dynamics of the battlefield. When combined with the memory of the surprise attack on Pearl Harbor, these new technologies cultivated a newfound sense of vulnerability. The image of society that the Army Air Corps officers had labored under when developing their doctrine—the

1. A Trip to the Moon, Edson, Arthur, 1953, Papers of Werhner von Braun, Box: 1, Folder: General Correspondence 1953 "I-R", Library of Congress Manuscript Division

industrial age—was sublimated into the technological age. World War II with its technological wonders had transformed an industrial way of war premised on quantitative dominance into technological war premised on qualitative innovation in weaponry.[2]

The rise of "technological warfare" as a key catchword amongst service leaders following World War II meant that the conservatism of the past gave way to a desire to actively pursue new technologies. Thus, senior leaders of the Army, Navy and Air Force were interested in the development of space technologies and missions after World War II. This led to an intense period of inter-service rivalry characterized by false starts, bloated funding requests, and organizational sparring. Consequently, a body of distinctive advocates never formed within any of these services as space enabling technologies were aligned within existing service conceptions of war. Furthermore, this rivalry delegitimized the services' space development programs on the eve of the Sputnik Crisis. This had the effect that military services were granted only a limited role in space following the deep civilian intervention triggered by the Sputnik Crisis.

Due to the effect of the intervening variables this case demonstrates multiple outcomes. First, the development of launch technologies were directed towards the creation of medium and long range guided missiles, an example of an integrated capability. These missiles were developed in order to buttress or extend existing service conceptions of war and mission authority. Second, the development of space into a support domain. Due to a dearth of legitimate service advocacy for weaponizing space, a civilian-surveillance vision of space came to dominate. This focus meant that the only military space programs pursued were those that provided tactical and strategic support in other domains—primarily through photo-reconnaissance and other remote sensing activities.

The way in which the United States navigated the political and military challenges posed by the opening of orbital space would be initially influenced by the Air Force think tank Project Rand. The legacy of Rand is reflected in the policy framework—"space for peaceful purposes"—and its interpretation that has been long maintained by the United States. Orbital space would be both a place of civilian scientific feats and a platform for the strategic surveillance of adversaries. While the overall outcome—space as a support domain—is theoretically

2. Scientific and Technological Resources as Military Assets, Eisenhower, Dwight, 1946, Papers of Henry Arnold, Box: 6, Folder: 1: Correspondence Chronological 1946-1947, Library of Congress Manuscript Division. See also: Henry H. Arnold, *Third Report of the Commanding General Army Air Forces to the Secretary of War* (Baltimore, Maryland: Schneidereith & Sons, 1945), Passim; Consideration of Guided Missiles in Future Long Range Strategic Planning, Holloman, George, 1945, Papers of Henry Arnold, Box: 5, Folder: 9: Correspondence Chronological 1945, Library of Congress Manuscript Division

expected, the influence of the civilian Rand advocates is unexpected. However, Rand advocacy, despite its civilian nature, exhibits several theoretically expected characteristics that will be explored later in this chapter.

This case also demonstrates two theoretically expected failures of advocacy as the status of "space for peaceful purposes" was strenuously contested twice after Sputnik. First, was the failure of the Air Force to promote the Aerospace Domain. Following Sputnik the Air Force began promoting an idea that air/orbital space were indivisible (Aerospace) and therefore they needed to develop space capabilities. However, this failed because it was an attempted top-down imposition of revolutionary change, rather than bottom-up distinctive advocacy. Second, was the promotion of the Strategic Defense Initiative in the 1980s. The Strategic Defense Initiative failed to launch because it was the product of multiple independent visioning centers and failed to develop any real military constituencies.

This case begins with a brief discussion of the early history of rocketry and associated space technologies. Next, I will discuss developments from 1945-1960, which is the period between the initial acquisition of space technologies to the launch of the CORONA strategic surveillance satellite. While during this period there was no clear body of advocates that formed within the military services, I argue that Project Rand came to be an external visioning center with some theoretically expected features. The third section covers the two attempts to revise the post-Sputniks settlement of U.S. space policy: first, the attempt by the United States Air Force to operationalize the Aerospace Domain from 1960-1968. Second, is the Strategic Defense Initiative that was initiated during the 1980s.

4.2 Early Views on Space and the V-2

♫

Gather round while I sing you of Wehrner von Braun,
A man whose allegiance
Is ruled by expedience.
Call him a Nazi, he won't even frown.
"ha, Nazi sch-mazi," says Wehrner von Braun.
Don't say that he's hypocritical,
Say rather that he's apolitical

–Tom Lehrer[3]

While rockets have been in military use for the last thousand years it took the development of a suite of technologies to make transit to orbital space possible.[4] Primary among them was the development of tracking and telemetry systems as well as the development of liquid propellant rocket motors. The latter, in particular, was critical because of the limitations in thrust generated by early solid propellants. As a suite of technologies these entered the U.S. Military alongside captured V-2 rockets and German scientists following World War II. However, the scientific basis and imagination of spaceflight long predated the creation of the V-2 by German scientists at the Peënemunde complex.

Much as with aircraft, the issue of space travel had been well-trodden in literature prior to the theoretical, let alone, material development of the basis of spaceflight. Some more important works of speculative fiction were Jules Verne's *De la terre á la lune* (1865) and *Autour de la Lune* (1870) which describe the voyage of three men from the post-Civil War American south to the Moon and back. While Verne covered with astonishing accuracy some of the issues with building a space-faring vessel, H.G. Wells' the *The War of the Worlds* (1898) and *First Men on the Moon* (1901) accurately (for the time) anticipated the need for an enclosed craft to traverse space. H.G. Wells books in particular had a great impact on the public imagination: stories that touched upon the possibility of contact with extra-terrestrials were amongst the most popular of early space literature. For example, C.S. Lewis, otherwise known for works of high fantasy, in the late 1930s wrote a trilogy that focused on transformative contact with extra-terrestrial life. Despite the dark undertone of works like *War of the Worlds* the dominant themes of spaceflight literature were those of exploration and wonder.[5]

The most fateful of those inspired by Verne would be Hermann Oberth who became obsessed with the cannon used to launch the protagonists of Verne's book into space. After puzzling over and realizing the limits of this propulsion system Oberth turned to investigating liquid fueled rockets. Oberth used these studies for his dissertation which was about accessing, using, and exploring orbital space. However, this was viewed as too extreme a topic in 1922 and

3. Tom Lehrer, "Wehrner von Braun" in *That Was The Year That Was*, (New York, New York: Warner Bros. Records, 1965).

4. Michael Gruntman, *Blazing The Trail: The Early History Of Spacecraft And Rocketry* (Reston, Virginia: American Institute of Aeronautics / Astronautics, 2004), 3

5. Roger D. Launius, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," chap. Prelude to the Space Age, ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1995), 4-5

the University of Heidelberg refused to approve his dissertation. Frustrated, Oberth borrowed money and personally published his dissertation, titled *Die Rakete zu den Planetenräumen*, which went on to be widely studied by astronautics enthusiasts. The influence of Oberth's dissertation is so significant that science fiction author Arthur C. Clark reflected that it "may one day be classed among the few that changed the history of mankind."[6]

Critically, Oberth's book inspired the creation in 1927 of the German astronautic enthusiast group "Verein Für Raumschiffahrt." Shortly after its founding Wehrner von Braun joined and quickly became one of the most important figures in the budding German spaceflight movement.[7] By 1931, the activities of these enthusiasts came to the attention of the German Wehrmacht who had been seeking to develop long-range rocketry to circumvent the Treaty of Versailles. In 1932 the Wehrmacht Ordnance division began recruiting rocket engineers (including von Braun) to work at the Kummersdorf Proving Grounds.[8] As German rearmament progressed, the rocketry program so expanded until the Peëmunde development complex was established in 1937, which would become the birthplace of the V-2 rocket and other early guided missiles.[9]

While von Braun worked on guided missiles for the Wehrmacht it is likely that he was instrumentalizing this development program in service of his own dreams of space exploration. At Peënemunde von Braun convinced the commander, Walter Dornberger, of his dreams of space exploration. This was a dream that came to be shared by many of the scientists working the complex as Dornberger reflects "our dream from the beginning was to reach infinite space."[10] Braun's interests in the exploratory potential of space travel became so widely known that he and several other researchers were arrested by the SS in 1944 for insufficient adherence to Hitler's war plans. He and the others were eventually freed after Dornberger intervened on their behalf.[11] While von Braun was not able to pursue space exploration directly, the technologies developed in service of creating the V-2—large liquid propellant motors, guidance and

6. William Sims Bainbridge, *The Spaceflight / Revolution* (New York, New York: Wiley Interscience, 1976), 29-30

7. ibid., 30

8. J.D. Hunley, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," chap. A Question of Antecedents: Peenemunde, JPL, and the Launching of U.S. Rocketry, ed. Roger D. Launius (San Diego, California: American Astronautical Society, 1995), 4

9. David N. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership* (Peterson Air Force Base, Colorado: Air Force Space Command, 2011), 5

10. Quoted in Robert L. Perry, *Origins of the USAF Space Program 1945-1961*, technical report (Air Force Systems Command, 1961), 4

11. See Chapter 3 in Bainbridge, *The Spaceflight / Revolution*

ground based telemetry systems—were critical to the development of all later space enabling technologies.[12]

Following the surrender of Germany in World War II, the United States initiated Operation Paperclip, which capitalized on the scientific community that Nazi Germany had cultivated.[13] Wehrner von Braun and other German scientists and a large quantity of captured V-1 and V-2 rockets were transferred to U.S. Army Ordnance. In the words of Space Historian Robert Launius: "the influx into the United States of captured German technicians and V-2 rocket components... merged with the native U.S. rocketry capabilities... to create a potentiality for spaceflight that was for the first time in the human record realizable."[14]

4.3 1945-1960: Orbital Space and Technological War

> Military space capabilities will eventually be the choice made by our political process.
> - General Curtis Lemay[15]

This section examines the period from the transfer of the V-2 Rocket and German astronautical scientists to the launch of the CORONA Satellite in 1960. I analytically mark the post-World War II transfer of rocket motor, guidance, and ground telemetry systems alongside the German scientists as the "initial acquisition" of space enabling technologies. This is because these

12. Hunley, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," 2. The careful reader might notice that there is no discussion of either Robert Goddard or the work done at GALCIT/ORDCIT by Robert Malina, Frank Parsons, Edward Forman, Theodore von Kármán, and Hsue-shen Tsien. To the former, Goddard was a pioneer of liquid propelled rockets having launched the world's first in 1926. However, he styled himself a lone inventor and jealously guarded the results of his research meaning that by the time of his death in 1945 he had left little to no impression on the development of rocketry. As to the latter, these figures did engage in a lot of pioneering work at ORDCIT but the U.S. Army guided their work towards short range rockets, barrage rockets, jet-assisted take off rockets, and the creation of guided bombs. It wasn't until 1944 that they began working in earnest on longer-range rockets that required similar technologies to the V-2. See: Bainbridge, *The Spaceflight / Revolution*, 26-29; Dwayne Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships*, ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1996), 235; Roger D. Launius, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," chap. Early U.S. Civil Space Policy, NASA, and the Aspiration of Space Exploration, ed. Roger D. Launius (San Diego, California: American Astronautical Society, 1995), 66; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 7

13. Launius, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," 13

14. Launius, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," 67

15. Curtis Lemay, "The Hour of Decision," *The Airman*, October 1962, 7

technologies formed the basis for early military space programs and triggered some of the first military satellite studies. The basic technological systems underpinning artificial satellites had been developed by 1945 and the only constraint was the desire to build and launch one.[16] I mark the end of this period with the launch of the CORONA satellite for two reasons. First, Project Orbiter—the first American satellite—was thoroughly civilian-scientific. Second, it was the first launch of an explicitly *military satellite* and with it the creation of an operational space unit.

Orbital space does not become an independent strategic domain because a body of distinctive advocates within a military organization does not form, due to inter-service rivalry and overriding senior leadership interest. During this stage the theoretically expected development of a distinctive body of advocates for space warfare never occurs for two theoretically expected reasons. First, the decade following World War II was characterized by intense inter-service rivalry over mission and budget authority for any major technology with military applications. The development and use of the ultimate strategic weapon—nuclear bombs—during World War II meant that the services were interested in controlling and/or developing any exotic new technologies. Perceived threats to existing missions and the desire to develop new ones led services to spar over space enabling technologies and lead competing development programs. This squabbling had the long-term effect of delegitimizing the military services' claims to authority over orbital space. This meant that when Eisenhower reacted to the Sputnik crisis he initially wanted to create a distinct agency for military space operations, the extant services having undermined their own legitimacy in operating the technologies.

Intertwined with inter-service rivalry was the second reason, a high level of senior leadership interest. Not only did rivalry over exotic technologies drive service interest claims to authority they also led senior officers to weave other uses of space enabling technologies into their existing conception of war. The Army pursued long-range guided missiles as a natural extension of artillery while the Air Force initially sought to hamstring the development of missiles and satellites fearing that they would usurp the primacy of the bomber. After the Air Force received expanded authority to develop guided missiles, they focused on the development of Intercontinental Ballistic Missiles (ICBM) in order to maintain their strategic nuclear delivery mission. While the development of the ICBM was justified as a precursor to the development of space enabling technologies by Air Force leadership, their core interest was integrating long-range

16. Perry, *Origins of the USAF Space Program 1945-1961*, X

guided missiles into their existing mission. This had the effect that space enabling technologies were initially developed as integrated capabilities.

One theoretically unexpected reason is that much of the early exploration of these technologies was conducted by civilian scientists and contractors that were hired by the services. This meant, for example, that the work done by the Navy and Army on rocketry during the immediate post-World War II period was dominated by civilian exo-atmospheric research.[17] However, the Air Force civilian contractors, working at Project Rand, would come to define American space policy up to the present. The Project Rand studies would become highly influential because they provided a coherent rationale for entering space: civilian technological prestige and strategic surveillance. The success of the Rand researchers and the failure of the services meant that space developed into a support domain. While the success of a non-uniformed visioning center is theoretically unexpected, the experience of the Rand researchers exhibits several theoretically expected characteristics.

This period of the development of Space is highly complex and therefore each of these threads will be separated for the sake of clarity. First, I will discuss the roots of inter-service rivalry in satellite and missile development. Second, I will discuss the vision advanced by Rand in how to use space. Third, I will turn to the influence of Project Rand on the development of early space policy in the Eisenhower Administration. Finally, I will discuss the reactions to and consequences of the Sputnik crisis.

4.3.1 Technology and Rivalry Between the Services

There were two ways in which space enabling technologies led to rivalrous dynamics between the various services in the aftermath of World War II. First, was the threat and potential represented by artificial satellites. The second was the development of medium and long range guided missiles. Both of these fonts of competition involved a service beginning a development program and then the Air Force seeking to counter and co-opt it. The Air Force interest in these technologies was born out of the perception that these technologies were either rightfully the bailiwick of the aviators (satellites) or posed a fundamental threat to their core mission (missiles.) This had the consequence that much of the Air Force's interest in these technologies was

17. For a focused discussion of the relationship between space sciences and the military see: David H. DeVorkin, *Science with a Vengeance: How the U.S. Military Created the US Space Sciences after World War II* (New York, New York: Springer-Verlag, 1992)

cursory and expressed through statements of interest or demands for mission recognition rather than the creation of stable development programs where advocacy could form.[18]

Early Satellites: Navy against the Air Force

The first site of contention—the creation of satellites—was spurred by Naval interest in orbiting a minimal scientific satellite to study the Earth's atmosphere. This interest was catalyzed by the debriefing materials of von Braun becoming available to the Navy's Bureau of Aeronautics (BuAer). Harvey Hall, a scientist, was intrigued by von Braun's discussion of the potentials for an artificial satellite and initiated a study in 1945.[19] The Naval senior leadership lent support to this study because of a belief in the significance of exotic technologies drove them to investigate any potential new missions. By the end of 1945 Navy BuAer had put together a study that argued that a minimal scientific satellite was feasible based on current technology and lobbied to have the Joint Army-Navy Aeronautical Board's Research and Development Committee[20] consider the proposal in 1946.[21]

However, the high cost of the program and its scientific bent meant that it was not fiscally justifiable for the Navy to pursue alone. Therefore, they turned to the Army Air Forces in early 1946 for a potential partnership. The issue passed to General Curtis Lemay and eventually the Office of the Commanding General of the Army Air Forces. The "office decided that the position of the air forces in any interservice conference would be compromised unless its representatives could produce a paper demonstrating equal competence with the Navy—and equal interest—in space research."[22] This position led Lemay to reject any potential cooperation, and he directed the newly formed Project Rand to develop a counter-proposal in an attempt to capture a potential scientific satellite mission because "satellites represented an extension of strategic air power." In under a month the Project Rand team wrote the *Preliminary Design of an Experimental World-Circling Spaceship* which the Army Air Forces presented as a counter

18. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 13

19. Hall and BuAer were likely inspired by this paper which was circulated amongst the services in 1945. See: Wehrner von Braun, "Survey of Development of Liquid Rockets in Germany and their Future Prospects," *Journal of the British Interplanetary Society* 10, no. 2 (1951): 75–80

20. The primary purposes of this inter-departmental committee was to resolve mission and technological development conflicts between the Army and Navy.

21. Perry, *Origins of the USAF Space Program 1945-1961*, 9; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 9

22. Perry, *Origins of the USAF Space Program 1945-1961*, 11

proposal at the Research and Development committee meeting.[23]

Seeing disagreement between the two services, the Research and Development committee demurred on assigning responsibility for a satellite and forwarded a summary to the full Aeronautical Board which itself decided to await determination of the space mission from civilian leadership. No determination would be forthcoming over the following year which frustrated the officers and scientists of Navy BuAer, which led them to attempt to force the issue in early 1947.[24] These struggles culminated in a 1948 determination when the DoD Committee on Guided Missiles stated that "neither the Navy nor the USAF has as yet established either a military or scientific utility commensurate with the presently expected cost of a satellite vehicle" and directed that the studies should be consolidated and continued at Project Rand.[25]

The consequence of this determination was that the Navy's satellite program died on the vine while the newly created Air Force turned to focus on building out its fleet of nuclear capable strategic bombers. However, the squabbles over satellite studies did not end without a parting shot as in late 1948 as the Air Force Chief of Staff, Hoyt Vandenberg, issued a declaration that "The USAF, as the service dealing primarily with air weapons—especially strategic—has logical responsibility for the Satellite."[26] Despite this strong statement of interest, the upper echelons of the Air Force leadership remained uncommitted to pursuing a satellite until 1954.

The main driver of the Air Force's actions during this period was a desire to deny any other service a satellite system. This situation can be theoretically described as the odd occurrence of high inter-service rivalry but low senior leadership interest. The rivalrous dynamic

---

23. R. Cargill Hall, "Early U.S. Satellite Proposals," *Technology and Culture* 4, no. 4 (1963): 413-414; Benjamin Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space* (Santa Monica, California: RAND Corporation, 2003), 11; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 13

24. It is not clear from available historical documentation who or which office was tasked with determining the space mission. However, one of the key figures in the post-WWII drive to develop technology by the Federal Government was Vannevar Bush. Bush served as science adviser to Presidents Roosevelt and Truman and was deeply skeptical of ballistic missiles and satellites. This skepticism went so far that Bush openly mocked starry eyed officers in print: "Some eminent military men, exhilarated by a short immersion in matters scientific, have publicly asserted that we are [interested in ballistic missiles]...We have been regaled by scary articles [and] even have the exposition of missiles fired so fast they leave the earth and proceed around it indefinitely as satellites, like the moon, for some vaguely specific military purposes." Quoted in McDougall, *...the Heavens and the Earth*, 101

25. Hall, "Early U.S. Satellite Proposals," 425

26. Hoyt S. Vandenberg, "I-1: Major General S. Craigie, Director of Research and Development Office, Deputy Chief of Staff, Materiel, to Brigadier General Alden R. Crawford, Air Materiel Command, Wright Field, Dayton, Ohio, "Satellite Vehicles", 16 January 1948, with attached: Memorandum for the Vice Chief of Staff, "Earth Satellite Vehicles," 12 January 1948, and General Hoyt S. Vandenberg, Vice Chief of Staff, United States Air Force, "Statement of Policy for a Satellite Vehicle"," in *Orbital Futures: Selected Documents in Air Force Space History*, ed. David N. Spires, vol. II (Peterson Air Force Base, Colorado: Air Force Space Command, 2004)

then, was driven both by a desire of Air Force officers to maintain a potential mission and the fear that the technology threatened their core mission. The Air Force position during this period reflects the then un-thematized Aerospace Domain concept: that space is an extension of the Air and therefore military operations in space are a natural extension of the Air Force mission. It would be another decade before this understanding was given a name in "Aerospace." The reactive dynamic of the Air Force approach to space technologies would continue until the Sputnik Crisis.

Guided Missiles: Army against the Air Force

Unlike the German pursuit of the V-2, the American military did not pursue long or medium range guided missiles until 1944, despite the repeated entreaties of civilian researchers. The Army would turn to developing long-range missiles following reports of German V-2 attacks on the United Kingdom, and initiated a research program at a collaborative Army Ordnance / CalTech laboratory called ORDCIT.[27] Army Ordnance had a particular interest in long and medium range guided missiles because they were viewed as a natural extension of artillery and therefore were rightly the province of the Army Ground Forces. This caused consternation in the staff of the Army Air Forces who viewed it as an attempt to usurp their strategic bombing mission. These tensions led the War Department to divide development responsibilities between Army Ordnance and the Air Forces on the basis of flight characteristics. Ordnance would develop missiles that relied on their velocity for motion (like an artillery shell) and the Air Forces would develop missiles that relied on aerodynamics (like an airplane).[28] Therefore, the initial interpretive schema for space enabling technologies was founded upon the functional extension of existing military arrangements.

This division of labor was fragile and became an object of increasing concern for Air Forces by 1946 for two reasons: first, Army Ordnance had integrated von Braun and other German scientists into their missile research program and were beginning preparations to launch captured V-2 rockets. The integration of the German scientists and technology meant that Army Ordnance possessed the most advanced missile program at the time. Second, the successful use of the Atomic Bomb led the Army Air Forces staff to believe that missiles with nuclear payloads

27. Hunley, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," 18-19

28. McDougall, *...the Heavens and the Earth*, 87; Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space*, 11

threatened their core strategic mission by usurping the role of the bomber.[29]

The fear of the Army Air Forces was multifaceted: a September 1946 memo from General Curtis Lemay to Army Air Forces Chief of Staff Carl Spaatz discusses how the development of guided missiles by Ordnance could lead to a loss of autonomy for the fledgling Air Force. Lemay admits that "the long-range future of the AAF [Army Air Forces] lies in the field of guided missiles." The successful development of precise guided missiles by Ordnance could, Lemay added, lead the Army leadership to re-assert control over the newly independent strategic air forces. However, while the development of guided missiles by the Army caused concern Lemay did not express any urgency for Air Force development programs.[30] Air Force Space Historian David Spires argues that overall: "the Air Force demonstrated more interest in gaining and preserving its prerogatives than moving ahead with a strong missile research and development program."[31] This development focus was partly the consequence of internal Army Air Force analysis that predicted that bombers would be dominant for another fifteen years, leading the Army Air Forces to prioritize short range missiles that would support a strategic bomber offensive.[32] Therefore, the Air Force pursued missiles during this period as a bureaucratic strategy to fend off potential challenges from the Army to their core mission.

These tensions led the Assistant Secretary of War for Air to intervene in late 1946, granting all research and development responsibilities to the Army Air Forces but demurring on operational responsibility. This issue was again re-opened following the creation of a unified Department of Defense in 1947, where the newly created Air Force gave Army Ordnance research and development responsibilities in exchange for operational authority over strategic missiles (Army retained control over tactical missiles). The new missile programs, however, would soon founder during a DoD budget contraction in 1947-1948, meaning that the development of nuclear capable strategic missiles would languish until the early 1950s.[33]

Therefore, much as with the early satellite proposals, long-range guided missiles became a football that was passed between services. Ironically, the board system of the DoD and the pre-unification Army-Navy Aeronautical Board were created in order to resolve interservice rivalry but in the age of technological war only served to enhance it. Outside of making

29. Memorandum for General Eaker Subject: Guided Missiles, Colonel T. A. Sims, 1946, IRIS 11819, Call: 145.86-19, Air Force Historical Research Association.
30. Quoted in Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 18
31. ibid., 19
32. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 482
33. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 19, 44-45

the development of artificial satellites and guided missiles a faltering affair in the services, the confusion created by the various boards lent a "flavor of subtle irresponsibility" to the missile and space programs that would continue to dog them until well after the Sputnik crisis.[34] The nominal commitments expressed by the Air Force, the shelving of the Naval space program, and the Army's interest in a strategic missile all combined to prevent the formation of advocacy. Where there was a minimally stable military institutional environment, such as the missile research programs of the Navy and Army, they tended to be dominated by civilian scientists which meant that discussions inclined towards basic research or space exploration.[35] While the space and missile programs constituted a football that was being passed between the services, the intellectual groundwork for the American conception of space as a support domain was being laid by Project Rand.

4.3.2 Project Rand and Strategic Reconnaissance

The creation of Project Rand by the Army Air Force in March 1946 was part of broader project of the Commanding General of the Army Air Forces, Henry Arnold. Arnold, being one of the first Army aviators, had a keen interest in the development and effects of technology on warfare. For example, one of the first known American military discussions of satellites occurs in his third report to the Secretary of War in 1944. In a section entitled "New Concepts" he discusses how the nuclear revolution was bringing into existence the potential for vessels to enter orbital space. Arnold saw the potential for a "true space ship" as providing an exotic method for delivering nuclear weapons.[36] Much of the language of his report also echoes themes in Eisenhower's memorandum on the critical function of science and technology in the future of warfare.[37] Bernard Schriever, a close friend of Arnold's, recalls that Arnold argued that World War I was won with brawn, World War II with logistics, and that World War III would be won

34. Perry, *Origins of the USAF Space Program 1945-1961*, 20

35. See, for example, von Braun's discussion of life at the White Sands Proving Grounds in "Las Cruces 10 January 50" , von Braun, Wehrner, 1950, Papers of Wehrner von Braun, Box: 46, Folder: Speeches and Writing File 1949-1950, Library of Congress Manuscript Division

36. Arnold, *Third Report of the Commanding General Army Air Forces to the Secretary of War*, 67-68

37. He also spent time evangelizing the necessity of progressive technological thinking. For example, during his retirement address he told the assembled senior officers of the Air Force that "if they don't quit operating and get to thinking, they would find themselves in the Service Forces where they belonged." He recommended that the Air Force "employ all the scientific brains they could find, and make their own careers out of thinking up ways of turning the weird and wondrous facts the scientists unearthed into useful channels." Apparently these remarks were not taken well by the staff. See: Perry, *Origins of the USAF Space Program 1945-1961*, 11 It was not only the aviation officers who didn't take Arnold's wild imagination seriously, the chief science liaison in the Truman

with "brainpower."[38]

In order to meet the need for brainpower Arnold cultivated relationships with the civilian scientific community. One of the outgrowths of this effort would be the creation of Project Rand in a partnership with the Douglas Aircraft company.[39] The dominating shift that would come out of Project Rand was the use of exotic technologies to provision strategic surveillance as a good in itself and as a political/psychological weapon. Project Rand during this period displays some familiar dynamics of military advocacy: the researchers possessed a sense of distinctiveness that drove extensive lobbying for recognition of their ideas. However, I posit that unlike a military body of advocates, the civilian quality of Rand meant that their thinking would not incline towards a new theory of independent strategic warfare. This is because military officers are socialized into thinking about the work of warfare—fighting and winning—and justifying their claims on this basis. The relative freedom of the Rand researchers and their lack of military socialization meant that their thinking was not canalized in the same ways.[40] For example, the early Army aviators needed to conceptualize the aircraft in the grammar of the dominant strategic orientation of the Army whereas the Rand visionaries were unbound by these demands.

Project Rand was tasked with developing the initial Air Force study on satellites, and served until the 1960s as the primary site for Air Force space technology research. This section will track the development of a technological warfare imaginary at Rand through 1955 when NSC 5520 was issued by the Eisenhower Administration. NSC 5520 was the first official statement of space policy and it was likely influenced by Rand advocacy. This policy statement is critical because it formed the core of the Eisenhower Administration response to Sputnik and its main themes went on to dominate official United States space policy in the following decades.

Army aviation had long depended on private contractors to do much of the development work for new aircraft and therefore rejected the arsenal system employed by the Army.[41]

---

administration—Vannevar Bush—singled Arnold out for ridicule in congressional testimony. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 11

38. Bernard Schriever, "The U.S. Air Force in Space: 1945 to the 21st Century," chap. Military Space Activites Recollections and Observations, ed. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History / Museums Program, 1998), 12

39. ibid., 13

40. William Burrows in *This New Ocean* provides a similar assessment—arguing that the Air Force hostility to space reconnaissance drove the RAND researchers to be more creative in their prognostication. See: Burrows, *This New Ocean: The Story of the First Space Age*, 174-175

41. One of the consequences of this preference was that the Air Force didn't retain a cluster of German scientists like Army Ordnance. The captured scientists assigned to the Air Force had largely left to work in private industry

Consequently, when Curtis Lemay was confronted with the early Navy study on satellites in the spring of 1946 he turned to Project Rand. Project Rand's mission was to engage in long-term planning on technology and aircraft/missile roles for the Air Force. This long term orientation meant that the research staff at Project Rand were extended freedom to follow their own lines of inquiry. This creative freedom was intentionally fostered by Curtis Lemay who managed the Air Force Relationship with Project Rand. One way in which Lemay accomplished this was through a commitment "to give RAND at least five years of benign neglect, allowing it to structure its staff and research agenda."[42] This freedom sheltered the Rand researchers from the intervention and shifting priorities that characterized the formal military space development programs.

The beginnings of the Project Rand vision for space technologies was a consequence of Lemay's request for a "crash program" to demonstrate both interest and competence in Earth satellite research on the part of the Air Force. The resultant paper, *SM-11827 Preliminary Design of an Experimental World-Circling Spaceship*, spanned some 250 pages and elaborated the scientific and technical basis for the development of a rudimentary satellite. In the abstract, the study authors concluded that a satellite was feasible within five years time at a cost of $150,000,000 (a little under $2 billion dollars in 2016).[43] As to *why* a satellite should be built the authors largely focused on the scientific merits as this was meant to be a feasibility study. However, they do provide some suggestions of the potential effects and applications of satellite vehicles.

One of the dominant themes that would emerge at Rand is the psychological impact that a successful satellite launch would have. A contributing author notes this very early in the introduction when he argues: "the achievement of a satellite craft by the United States would inflame the imagination of the mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb."[44] In the second section, written

---

by the end of the 1940s. This is likely another reason why the Air Force never really developed an "in-house" body of advocates. Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*, 479 That being said, some space historians argue that there was a body of space advocates within the Air Force during this period. However, they do not provide observable evidence of who these advocates might be (outside of Henry Arnold). See: Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 233

42. Meron E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology* (Santa Monica, California: Rand Corporation, 1988), 3

43. "SM-11827 Preliminary Design of an Experimental World-Circling Spaceship," chap. Abstract (Santa Monica, California: Project Rand, 1946), vi-viii

44. D. Griggs, "SM-11827 Preliminary Design of an Experimental World-Circling Spaceship," chap. Introduction (Santa Monica, California: Project Rand, 1946), 2

by Louis Ridenour, potential military applications of a satellite are discussed. Ridenour argues that it is unlikely that a satellite would ever be used as a direct offensive weapon but rather could be used to improve guidance of ballistic missiles. He also goes on to briefly mention the potentials for the satellite as a near invincible reconnaissance craft but does not elaborate. The limited place given to reconnaissance in this investigation is likely a function of the poor quality of television and film cameras during this period.[45]

The next Project Rand report that has bearing on the question of the *why* of space technology outside of basic research is the February 1947 *Reference Papers Relating to a Satellite Study*. James Lipp's "The Time Factor in the Satellite Program" claims that a satellite launch would impact the struggle for dominance between the United States and Soviet Union. Lipp argues that the position of technological superiority of the United States is founded on both its navy and air force, thus any potential competitor would likely pursue advanced rocketry "as being the quickest shortcut for challenging" the United States. This technological end run is not a matter of *if* but *when* for Lipp. He goes on to mention many of the same military applications already discussed by previous papers but also concludes that photo-reconnaissance is increasingly feasible.[46] However, his central claim is that satellites constitute a *political* weapon. It is worth quoting Lipp's argument at length:

> Since mastery of the elements is a reliable index of material progress, the nation which first makes significant achievements in space travel will be acknowledged as the world leader in both military and scientific techniques. To visualize the impact on the world one can imagine the consternation and admiration that would be felt here if the United States were to discover suddenly that some other nation had already put up a successful sa tellite!
>
> The psychological effect of a satellite will in less drastic fashion supplement that of the atom bomb. It will make possible an unspoken threat to every other nation that we can send a guided missile to any spot on earth. Combined with our present monopoly of the atom bomb such a threat in being will give pause to any nation which contemplates aggressive war against the United States...
>
> As an aid to maintaining the present prestige and diplomatic bargaining power of

45. Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 10

46. James E. Lipp, "RA-15032 Reference Papers Relating to a Satellite Study," chap. The Time Factor in the Satellite Program, ed. James E. Lipp (Santa Monica, California: Project Rand, 1947), 41, 45-46

> the United States, it would be well to give the world the impression of an ever-widening gap between our technology and any other possible rivals since other nations are obviously hoping to play for time in an effort to overcome the existing lead of this country.[47]

In this passage from Lipp the satellite as a *political* weapon operates with two distinct logics. The first is that the satellite would grant automatic prestige and legitimacy as a world-leader. The second is deterrent: that the technological demonstration is not only a symbol of technological preeminence but also of an ability to strike any nation at any time. While the military largely viewed the satellite as a means to a bureaucratic end, Lipp argued that the satellite was the means to a global-political end: the fulfillment of American technological and military domination. Lipp concludes by recommending that the United States immediately embark on a satellite development program.

In 1948, a year after the publication of *Reference Papers*, Project Rand was transitioned by Douglas Aircraft and the Air Force into a distinct non-profit corporation with a broader charter. The newly independent RAND Corporation expanded its scope of investigation: it had previously focused on technical feasibility studies but now it began exploring the sociopolitical dimensions of a satellite launch.[48] I argue the "benign neglect" extended by Curtis Lemay contributed to RAND becoming an alternative advocacy center both for its freedom to experiment in *thinking* about the satellite and the fact that the RAND researchers would have to turn to strenuous advocacy to have their reports considered. This is because through the early 1950s the Air Force leadership was largely uninterested in the uses of satellite technology, preferring to focus on the development of strategic nuclear bombers. As an independent center of visioning, the RAND researchers were less constrained in how they could advocate. A body of uniformed advocates is beholden to the prerogatives of their more senior officers, and seeking external alliances carries risk that they will upset those officers who hold power over their existence. By comparison, the RAND researchers were unbound in their selection of audiences and carefully built alliances.

RAND's new focus led to the publication of *The Satellite Rocket Vehicle: Political and Psychological Problems* by Paul Kecskemeti. This report has subsequently been described as

47. Lipp, "RA-15032 Reference Papers Relating to a Satellite Study," 48

48. Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 17

"the birth certificate of American space policy" because of its likely role in the formulation of NSC 5520.[49] The core claim of Kecskemeti's report on the satellite is that "it is of prime importance what we *say* about it, in addition to what we *do* with it." This is because the satellite constitutes a new and unconventional capability that would necessarily be seen as an alteration of the "balance of strength," therefore it is a "political problem as soon as it becomes known to the outside world."[50] Outside of the basic spectacle of orbiting an artificial satellite, the novelty of the satellite for Kecskemeti hinges on the unique strategic reconnaissance that it can provide.[51]

Kecskemeti spends a substantial amount of time puzzling through the ways in which the *saying* could be conducted in order to minimize the potential for escalation while maintaining the aura of technological domination. To do this, Kecskemeti divides and assesses the audiences of a satellite launch—allied nations, neutral nations, and the Soviet Bloc. To the former two, he argues that they would likely initially interpret the satellite launch as an attempt at world domination, however over time the alarm would become a heightened assessment of the prestige of the United States. As to the Soviet Union, he argues that they will likely interpret and proclaim that it is an example of the United States' megalomaniacal intentions. Therefore, Kecskemeti argues that it is crucial to stem speculation over the military uses of the satellite by cloaking it in a veneer of civilian scientific research. To effect this, he recommends that a satellite launch program be announced ahead of time with the public relations handled by the scientific community.[52]

As part of this, he also highlights the ways in which the satellite becomes a political problem. At this time there was no commonly accepted distinction between the atmosphere and space thereby leaving unresolved the vertical limits of territorial sovereignty. He notes that if satellite overflight were interpreted as a violation of sovereignty then it could lead to a violent escalation. If the satellite were launched on an equatorial orbit without passing over the USSR, then the Soviets would likely respond legally rather than militarily. Therefore, he recommends that a satellite be launched on this orbit in order to minimize possible Soviet reaction and test whether states would object to satellite overflight in order to establish what would later be called

49. McDougall, *...the Heavens and the Earth*, 108

50. Emphasis in the original. Paul Kecskemeti, *RM-567 The Satellite Rocket Vehicle: Political and Psychological Problems* (Santa Monica, California: RAND Corporation, 1950), 5

51. It should be noted that during this time the only reconnaissance available outside of human intelligence was that which could be gleaned by Strategic Air Command flights around the periphery of the Soviet Union.

52. Kecskemeti, *RM-567 The Satellite Rocket Vehicle: Political and Psychological Problems*, 7-9

the "principle of freedom of space."[53]

After making an argument about what to say about it and where to launch it, he turns to how the satellite could be used a *political weapon*. Kecskemeti notes that the value of strategic intelligence of the Soviet Union is manifold: first, knowledge of the Soviet military complex and technological development would be strategically useful in itself. Second, he argues that Soviet Union bases their own perception of their strength on their ability to maintain secrecy and ambiguity. The opening of the Soviet Union through satellite reconnaissance would have a deterrent effect and undermine their own self-confidence. Third, the United States could use a covert satellite reconnaissance system in order to undermine the Soviet's assessment of their own regime security thereby sowing distrust amongst the leadership (e.g.: by leaking to the Soviets selected results of the reconnaissance). Lastly, the opening of the Soviet Union through surveillance can have the effect of making them realize that privacy was no longer tenable, thereby making them more amenable to an international arms inspection regime. Taken together, Kecskemeti concludes "that a successful intelligence operation using a satellite would yield an important political payoff, possibly culminating greater Soviet readiness to refrain from attack or even yield to pressure."[54]

This RAND report represents the culmination of the investigation of the sociopolitical effects of a satellite launch by the RAND researchers. For Kecskemeti, the satellite not only garnered immense prestige but also through reconnaissance could become a tool of psychological/political warfare on the Soviet elite. In this argument, Kecskemeti is turning strategic intelligence from an element of war-planning to both an end in itself and a *political weapon*. Strategic intelligence as an end in itself had three functions in his argument: first, as a way of keeping abreast of Soviet military and technological developments; second, as a tool of psychological warfare; and third, as a way of fundamentally altering Soviet military policy through a spectacular loss of privacy. The necessity of strategic intelligence as a peacetime good would be further deepened by subsequent RAND studies in the next few years.[55]

In an era in which dominance, competition, prestige, and technology were all intertwined, the launching of a satellite was the perfect weapon for the ideological struggle of the early Cold War. While not explicitly thematized, the notion of technological war is shot through

53. Kecskemeti, *RM-567 The Satellite Rocket Vehicle: Political and Psychological Problems*, 13-15, 22
54. ibid., 17-20
55. See: Burrows, *This New Ocean: The Story of the First Space Age*, 156; Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 33-45

these selected Rand studies. The RAND researchers implicitly argued that the publics of the world were keenly aware of the state of technological development and that spectacular demonstrations would necessarily affect their assessment of the dueling superpowers.

RAND finds an audience

Despite the many engineering, feasibility, and sociopolitical studies produced by the RAND Corporation, their work largely languished in the offices of the DoD and Air Force leadership during the late 1940s to early 1950s. A RAND analyst from this period recalls that "the RAND scientists were now beginning to become impatient and frustrated. First they demonstrated feasibility, then utility; still there was not enough support…to start development."[56] While they had proven it could be done and argued strenuously that it should be done there was little government support for actually developing a scientific or reconnaissance satellite. This led the researchers to start strenuously lobbying the DoD and Air Force Staff, a critical example is the work of Merton Davies in convincing RAND liaison and Air Force Colonel Richard Leghorn to take the RAND satellite reconnaissance studies seriously.[57]

During 1951-1953 Leghorn was a key figure in the development of reconnaissance systems and reconnaissance planning in the United States Air Force. In this role, he became the key figure through which the RAND researchers made their research on satellite reconnaissance known in the Department of Defense and the Air Force. For example, Leghorn composed a memo that described a counter-force strategic bombing strategy that was premised on pre-attack reconnaissance. Davies convinced Leghorn to include in this memo a section on the feasibility of satellites in provisioning this reconnaissance. Leghorn's memo went on to be read by the senior leadership of the Air Force, leading them to adopt a requirement for pre-hostilities strategic reconnaissance.[58] This requirement would eventually lead to the initiation of the WS-117L reconnaissance satellite program in 1953-1954 by the Air Force.[59]

The work of the RAND researchers in many ways parallels the development of a technologically inspired body of advocates. For example, they were granted "benign neglect" and freedom to puzzle through uses of the technology. Additionally, due to a lack of interest from

56. Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 40

57. ibid., 35

58. ibid., 33-35

59. Burrows, *This New Ocean: The Story of the First Space Age*, 159; McDougall, *...the Heavens and the Earth*, 111

DoD and Air Force leadership in their white papers they felt a need to personally assert their vision for the use for the use of the technology. During this period Merton Davies, an early RAND analyst, argues that the RAND researchers didn't form a passive think-tank but rather an active site of advocacy. They did this by building personal connections with uniformed liaisons such as Leghorn and exploiting their status as the premier Air Force think tank to gain access to uniformed and civilian decision makers.[60]

However, as I argued in the introduction to this section they didn't begin to develop a theory of kinetic strategic warfare to be waged through space but rather a theory of psychological warfare set against the backdrop of growing superpower competition. I speculate that this is because they weren't staffed by military officers seeking to win wars with a new technology, but rather civilian researchers who didn't possess the same tendencies as those who professionally wage war. The RAND researchers were eventually able to find overt success when the Air Force initiated the WS-117L reconnaissance satellite program. However, I argue in the next section that the true success of the RAND researchers was far less straightforward but much greater in magnitude.

4.3.3 The first American Space Policy: NSC 5520

The issuance of NSC 5520 by the Eisenhower Administration would come to define the broad contours of American space policy for the next several decades. Critically, NSC 5520 barred the overt military usage of space and articulated space policy within the imaginary of technological competition developed by the RAND analysts. This document defined the overarching contours of American space policy up until the present: as a support domain. I will argue later in this chapter that the stickiness of NSC 5520 was a consequence of the inter-service rivalry and halting development programs that defined the American military's first encounters with space technology. NSC 5520 deserves discussion because of the probable influence of the RAND analysts on its policy prescriptions.

The proximate cause for the promulgation of NSC 5520 is found in the creation of the Technological Capabilities Panel (TCP) by Eisenhower in March 1954. The panel's mission was to explore technological solutions to the mounting fears of a surprise strategic attack by the Soviet Union. This fear of Soviet surprise attack was borne out of the confluence of several

60. See: *passim* Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 23-39

factors. First, was the overall impact that the surprise attack on Pearl Harbor had on President Eisenhower's generation of military officers. Second, was the detonation of the first Soviet atomic bomb in 1949 and the 1953 detonation of a hydrogen bomb—both of which occurred far in advance of U.S. intelligence estimates. This led the newly created CIA to conclude that there was a real potential for a surprise Soviet nuclear attack. Third, was the advocacy of Trevor Gardner who worked as the Assistant Secretary of the Air Force for Research and Development. After a fateful meeting with Curtis Lemay on the question of surprise attack it is reported that Gardner suggested investigating the issue to the head of the Scientific Advisory Committee of the Office of Defense Mobilization.[61]

The TCP convened in July 1954 and was headed by James Killian of MIT with fifty carefully selected experts from the military, industry, and academia. Three project teams were formed: Strike Forces, Continental Defense, and Intelligence. Of the three panels, the last is the most critical for the formation of NSC 5520. The full report of the intelligence team continues to be classified, however, there are sections available in declassified memorandum. The key spur for NSC 5520 was the intelligence team's recommendation that a trial satellite be orbited for the purposes of establishing the principle of the freedom of space. This trial satellite would be used to pave the legal path for later reconnaissance and intelligence satellites.[62]

The recommendation of the intelligence panel was taken up in 1955 by Eisenhower's National Security Council which issued the NSC 5520 policy directive in May of that year. A substantial portion of this document has been declassified allowing us to view the basic satellite strategy that the Eisenhower administration would employ until the Sputniks crisis.[63] The

61. R. Cargill Hall, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," chap. Origins of U.S. Space Policy, ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1995), 215-216; Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 55-56; Burrows, *This New Ocean: The Story of the First Space Age*, 157

62. Robert R. Bowie, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships," chap. II-2: Robert R. Bowie, Policy Planning Staff, Department of State, "Memorandum for Mr. Phleger," March 28, 1955. Ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1996), 273–274; Robert R. Bowie, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships," chap. II-3: Robert R. Bowie, Policy Planning Staff, Department of State, to Secretary of State, "Recommendations in the Report to the President by the Technological Capabilites Panel of the Science Advisory Committee, ODM (Killian Committee): Item 2–NSC Agenda 10/4/56," October 2, 1956. Ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1996), 274–275

63. Some have suggested that the remaining classified portions may discuss the Air Force WS-117L reconnaissance satellite program. Based on my archival research this seems plausible because many documents on the WS-117L program continue to be classified in 2016. See: Stephen M. Rothstein, "Ideas as Institutions: Explaining the Air Force's Struggle with its Aerospace Concept" (PhD diss., The Fletcher School of Law and Diplomacy, 2006),

statement argues that the primary purpose of launching satellite is the necessity of establishing the principle of "freedom of space" per the TCP recommendation. The statement then goes on to discuss the effects of a satellite launch and the basic strategy to be employed, the crucial portions of the statement reads:

> Considerable prestige and psychological benefits will accrue to the nation which first is successful in launching a satellite. The inference of such a demonstration of advanced technology and its unmistakable relationship to intercontinental ballistic missile technology might have important repercussions on the political determination of free world countries to resist Communist threats, especially if the USSR were to be the first to establish a satellite. Furthermore, a small scientific satellite will provide a test of the principle "Freedom of Space."...
> The IGY [International Geophysical Year] affords an excellent opportunity to mesh a scientific satellite program with the cooperative world-wide geophysical observational program. The U.S. can simultaneously exploit its probable technological capability for launching a small scientific satellite to multiply and enhance the overall benefits of the International Geophysical Year, to gain scientific prestige, and to benefit research and development in the fields of military weapons systems and intelligence.[64]

There are several themes in these passages which should be familiar from the RAND Kesckemati report discussed in the previous section. First, the use of the satellite in order to establish a legal regime that permits peaceful overflight or "freedom of space." Second, the framing that a satellite launch would have "considerable prestige and psychological benefits." Third, that the launch of a satellite is necessarily a world-political act that would affect the ideological struggle with the Soviet Union. Fourth, the implication that a satellite launch would have perceived technical competencies in ballistic missiles. And fifth, using the cloak of civilian science (in the form of participation in the International Geophysical year) as a pretext for deriving military benefits from the satellite launch. The cloak of science would be emphasized in public communications to maintain the peaceful nature of the satellite launch.[65]

Given the continued secrecy over the TCP deliberations and the formulation of NSC

117-118

64. National Security Council Planning Board, *NSC 5520* (May 1955), 3-4

65. ibid., 6

5520, any conclusions derived about influences will necessarily be impressionistic. What is clear, however, is that the portions of the TCP intelligence team's report that are declassified mention neither prestige/psychological benefits nor a strategy for how to launch the satellite. There are two potential influences that I will assess here for the formulation of NSC 5520: the Grosse Report and the series of RAND studies discussed in the previous section.

The Grosse Report was a satellite study commissioned by the Truman Administration from prominent space scientist Aristide Grosse. While Truman commissioned the report its delivery was delayed until after Eisenhower assumed office and it was read by Assistant Secretary of Defense for Research and Development Donald Quarles. It is reported that after reading the Grosse Report Quarles became an advocate for the military development of space.[66] Additionally, Quarles also served as one of the primary drivers for implementing the TCP recommendation of orbiting a satellite.[67] In the report Grosse lays out three basic benefits to pursuing a satellite program: first, the scientific data collected; second, the reconnaissance benefits; and third, the psychological effect. The first two benefits follow on from familiar claims in other studies, however it is the third where the influence of the Grosse report is called into question. Grosse argued that because the basic knowledge required for launching a satellite was already in place it would constitute a smaller feat for worldwide audiences than the explosion of a nuclear weapon. Therefore, in order to generate the psychological effect the satellite should be constructed so that it would be visible to the naked eye as an "American Star."[68] The key assumption that undermines Grosse's potential influence is that he assumes that audiences would have knowledge of the space sciences of Nazi Germany at the conclusion of World War II, rendering the satellite's spectacular nature a function of its construction. Outside of the psychological effects that a highly visible satellite would have, Grosse has little else to say about the strategy for launching a satellite.

66. See commentary: Aristide V. Grosse, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," chap. II-5: A.V. Grosse, The Research Institute of Temple University, to Donald A. Quarles, Assistant Secretary of Defense for Research and Development, "Report on the Present Status of the Satellite Problem," August 25, 1953, pp. 2-7, ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1995), 266

67. Dwayne Day, "Reconsidering Sputnik: Forty Years since the Soviet Satellite," chap. Cover Stories and Hidden Agendas: Early American Space and National Security Policy, ed. Roger Launius, John Logsdon, and Robert Smith (London, United Kingdom: Routledge, 2000), 166-167

68. *passim* Grosse, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration"

The other potential and far more likely influence is the RAND Kecskemeti report discussed in the previous section.[69] NSC 5520 exhibits many of the basic themes of the Kecskemeti report and critically employs the basic communications strategy outlined in it. Quarles would likely have been aware of this report and other RAND work as he was intimately involved with all of the research and development programs being conducted by the Department of Defense. The other conduit for this report was Richard Leghorn, who served as a key liaison between RAND and the Department of Defense from 1951-1953 and introduced the idea for using satellites for strategic reconnaissance into Air Force planning. After leaving the Department of Defense in 1953 Leghorn served as an assistant to Eisenhower's adviser on disarmament—Harold E. Stassen.[70] Given Leghorn's promotion of the value of strategic intelligence, Stassen's focus on disarmament, and Kecskemeti's conclusions about the utility of the satellite towards those ends it is possible/probable that Leghorn brought the report to Stassen's attention. Another piece of suggestive circumstantial evidence is that the Kecskemeti report was "withdrawn" by the RAND corporation six months after the promulgation of NSC 5520.[71] Some scholars have suggested that this was an attempt by RAND to suppress or discredit the report, thereby obfuscating its influence on American space policy.[72]

The success of the RAND advocates in defining the broad contours of early American space policy appears probable. Again, I argue that the RAND corporation came to serve as a de-facto body of advocates but one whose membership composition meant that they would not be forced nor drawn to justify using the technology within the framework of warfighting. What this meant was that the RAND researchers came to articulate the role of the satellite as a dimension of non-kinetic ideological conflict. The satellite was first and foremost a *political* weapon, on the basis of ensuring knowledge about adversary capabilities and the cultivation of prestige. As I argue, a body of advocates is successful if they are able to influence the formulation of doctrine, in this case the RAND advocates were successful insofar as they influenced strategic policy. I suggest that part of this success has to do with the legitimation of advocacy, military advocates become legitimate through experience in operating and conceptualizing the technology over

69. Space Historian Walter McDougall promotes this assessment see: McDougall, *...the Heavens and the Earth*, 108

70. Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 61

71. ibid., 75

72. See: McDougall, *...the Heavens and the Earth*, 107; Rothstein, "Ideas as Institutions: Explaining the Air Force's Struggle with its Aerospace Concept," 125

time. In the case of early U.S. space policy, the only extant coherent and thorough discussions of the uses of satellites during this period were those produced by the RAND corporation.

Critically, the RAND Corporation provided the only compelling rationale for how to react to and interpret the Sputnik Crisis. This early influence of the RAND Corporation was solidified because the military services had undermined their own authority and failed to develop coherent alternative visions of how to operate in space. When the time came to define American space policy in *practice*, RAND's argument that the satellite was fundamentally a political weapon dominated. In comparison, by the time that the First Aero Squadron was established by the Army the early aviators had articulated a suite of aerial reconnaissance techniques which were subsequently codified in official Army doctrine.

4.3.4 From Sputnik to CORONA: Space for Strategic Support

The American response to the Sputnik launches would define the broad contours of American space policy until the present. The chosen policy: a strong civilian space program providing cover for strategic reconnaissance embodied the Janus-like nature of the RAND proposals. A civilian space program, aside from generating prestige, would become the enabling condition of continuous strategic surveillance of the Soviet Union. Thereby, space came to be settled as a domain that supported not only national policy in an ideological competition but also kinetic operations in other domains. As I argue, a support domain develops if the first stage of domain development is marked by periods of high inter-service rivalry which undermines the legitimacy of claims by military services because the rivalry incentivizes them to make broad claims over mission authority. In this case, space enabling technologies triggered multiple sites of rivalry—over satellites, missiles, and space operations (post-Sputnik). This meant that by the time that space policy was being revisited in 1958 the services were viewed as neither legitimate nor possessing a compelling theory of how to use space for military purposes. The lack of a compelling theory/reason is partly a consequence of the hyperbolic claims by the services and the lack of a center of military space advocacy within the services.

In order to explain why there was no military space development after the Sputniks crisis this section will proceed as follows: first, I will discuss the rivalry that existed between the services leading up to the launch of the first Sputnik satellite in the fall of 1957. Second, I will discuss the political settlement that followed the Sputniks launch. Ironically, many of the RAND predictions on how foreign publics would respond to the successful launching of

an American satellite came true in the United States. This led to a period of uncertainty as different interest groups jostled to define to what uses space would be put. Eventually, a dual civilian/military space program was settled on. The civilian dimension was manifested in the creation of NASA, and the military space program was (initially) governed by a new office in the DoD—the Advanced Research Projects Agency. Eventually the Air Force gained management authority over space technologies, while operational authority for the first realized military space program fell to the Central Intelligence Agency. It was also during this time that the Air Force began to advance their vision of the Aerospace domain, this will be discussed in the next section.

Rivalry in the 1950s

While the RAND corporation was developing a series of studies on the feasibility and uses of satellites, the military service departments began aggressively developing ballistic missile technology during the early 1950s. The Navy was developing the Vanguard, the Army was developing the Jupiter/Redstone, and the Air Force the Atlas: thereby re-staging many of the competitive dynamics that marked the mid to late 1940s. The Air Force interest in missiles and satellites continued to be centered around the potential threat that their development by a rival service posed to their core mission—manned strategic bombing. This perception meant the Air Force approach to missiles was to guard their mission prerogatives while slowly integrating strategic missiles into their weapons inventory.[73] Similarly, the Air Force approach to satellites was largely reactive: Space Historian Dwayne Day argues that "as long as neither the Navy nor the Army was developing a military satellite system, the Air Force did not show much enthusiasm for the various military satellite systems—human and robotic—that it was evaluating."[74]

This perception of the threat posed by missile and satellite systems would mean that the Air Force would routinely reject attempts at inter-service cooperation thereby continuing the perception that these programs were marked by duplication and waste. For example, in 1955 Army Ordnance approached the Air Force to collaborate on the development of an intermediate

73. Roy F. Houchin III, "The Dyna-Soar Program: Why the Air Force Proposed the Dyna-Soar X-20 Program," *Quest: The History of Spaceflight Magazine* 3 (Winter 1994): 10

74. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 243

range ballistic missile (IRBM). Bernard Schriever, who led Air Force long-range missile development, argued to his commanding officer that this proposal "should leave no doubt that the Army desires to move into the longer range ballistic field" and that "it would be naive to think that the Army would develop a weapon and turn it over to the Air Force to operate."[75] This rejection meant that the Air Force and Army would develop IRBMs on parallel tracks, continuing program duplication.

While the Army and Air Force were both developing missiles, they also began to pursue satellite programs again in 1954. After the Project FEEDBACK report on the uses of satellite reconnaissance was delivered to the Air Force by the RAND Corporation, the Air Force began the process of developing a reconnaissance satellite.[76] In the same year, Wehrner von Braun and Army Ordnance circulated a proposal to orbit a scientific satellite by 1956.[77] The program cost meant that the Army leadership would not approve the program without the cooperation of the other services. While the Navy accepted the proposal, the Air Force demurred.[78] Bernard Schriever, who would be responsible for the program, argued that the scientific satellite would create management headaches, hinder ICBM development, and provide no military value. Schriever recommended that "the Air Force remain aloof and constructively critical" but if pressed to develop a satellite they should favor an in-house program.[79] The Air Force would pursue the latter strategy—a scientific variant of the WS-117L program until discovering that Eisenhower had selected the Navy Vanguard missile as the booster. The selection of the Vanguard missile meant that any scientific satellite program would require inter-service

75. Comments on Army Proposal that Redstone Arsenal Develop a 1500 N. Mile Missile, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 3 Basic Documents: Chronological: Mar-Apr 1955, Library of Congress Manuscript Division; See also: Memorandum for General Powers Subject: Redstone – Scientific Satellite, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 3 Basic Documents: Chronological: Mar-Apr 1955, Library of Congress Manuscript Division.

76. Though, the program was only funded at 10% of its proposed budget. Burrows, *This New Ocean: The Story of the First Space Age*, 175; Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 61; McDougall, *...the Heavens and the Earth*, 111

77. Wehrner von Braun, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," chap. II-7: Wehrner von Braun, "A Minimum Satellite Vehicle: Based on Components available from missile developments of the Army Ordnance Corps," September 15, 1954. Ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1995), 274–281

78. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 240; Perry, *Origins of the USAF Space Program 1945-1961*, 47

79. Memorandum for General Powers Subject: Redstone – Scientific Satellite, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 3 Basic Documents: Chronological: Mar-Apr 1955, Library of Congress Manuscript Division.

cooperation, something which the Air Force continued to reject.[80]

While the Army and the Navy began a scientific satellite program, the Air Force WS-117L satellite would languish. This is because the Air Force, preferring to maintain their lead position in long-range missile development would back-burner satellite development. Bernard Schriever argued that satellite programs served as a distraction from the development of ICBMs by splitting development focus and resources.[81] Schriever would later come to justify this development focus as providing the stepping-stone to space in a speech in 1957. However, the Air Force staff quickly indicated to Schriever that this view was verboten.[82] As with the late 1940s the Air Force continued to only aggressively develop satellites when pressured by other services.

The faltering development of satellites by the Air Force was also likely symptomatic of a form of technological anxiety. Neither of the satellite programs—scientific or military—would be manned and strategic missiles challenged the primacy of the bomber. Under the image of "technological war" there was a fear that warfare would become a matter of button pushing with the human reduced to managing automated weapons systems. Advances in micro-electronics and computing threatened to usurp the work of warfare—fighting and winning—thereby rendering obsolete the core activities that defined the Air Force service identity.[83] This would mean that after Sputnik and the ascension of a space-friendly Air Force Chief of Staff, the Air Force would continue to falter in their development of space technology and doctrine. The effort of the Air Force to promote the Aerospace Domain in the 1960s would fail because

80. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 242; Perry, *Origins of the USAF Space Program 1945-1961*, 48

81. Memorandum for Lt General Power Subject: Interactions Amongst Ballistic Missile and Satellite Programs, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 2 Basic Documents: Chronological: Feb 1955, Library of Congress Manuscript Division; Memorandum for: General Power Subject: ICBM-TBM Interference and Dilution of Manpower, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 7 Basic Documents: Chronological: Aug 1955, Library of Congress Manuscript Division; Memorandum for: General Power Subject: ICBM-TBM Interference, Schriever, Bernard, 1955, Papers of Bernard Schriever, Box: 1, Folder: 7 Basic Documents: Chronological: Aug 1955, Library of Congress Manuscript Division

82. See commentary and speech text: Bernard Schriever, "I-2: Major General Bernard A. Schriever, Commander, Western Devel opment Division Headquarters, Air Research and Development Command, "ICBM - A STEP TOWARD SPACE CONQUEST," Address to the First Annual Air Force Office of Scientific Research Astronautics Symposium, San Diego, California, 19 February 1957.," in *Orbital Futures: Selected Documents in Air Force Space History*, ed. David N. Spires, vol. II (Peterson Air Force Base, Colorado: Air Force Space Command, 2004), 20–26

83. Dwayne Day notes that this is somewhat paradoxical: "The Air Force, as a young organization that owed its very existence to modern technology, was also the most logical of the services to embrace new technology such as satellites and long-range rockets. But at the same time, the Air Force was also dominated by the culture of the manned strategic bomber, and any new missions often had to serve this culture." Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 243

of this, as will be discussed later in this chapter.

As with the 1940s, this is a case of inter-service rivalry without complete senior leadership interest. Theoretically, I expect that one of the effects of rivalry would be increased intervention and interest by senior leadership. However, in the case of one of the competing parties—the Air Force—the senior leadership only acted when it felt there was a *potential* threat to its core mission. While the other services wanted to enter space, the Air Force was only interested in space enabling technologies insofar as they could complement their core mission, hence they focused on long-range guided missiles to the detriment of satellites. This focus when combined with the technological anxiety that will be discussed later, meant that no element of the Air Force ever engaged in sustained visioning or advocacy for space until after Sputnik.

The bureaucratic squabbling and faltering parallel development programs that characterized this rivalry would delegitimize the service's response to the Sputnik launch. The "flavor of subtle irresponsibility" introduced by the inter-service rivalry in the 1940s would sour the civilian perspective towards the services in the late 1950s.[84] Accusations of incompetence and waste born of these rivalrous dynamics would set the stage for the creation of a civilian dominated space program.[85]

The Sputnik Crisis

On October 4, 1957 the Soviet Union launched the Sputnik I satellite which generated, in the words of Walter McDougall, a "media riot." The hyperbolic reaction that characterized the media reception perplexed the Eisenhower administration, despite their appreciation of the prestige consequences of the satellite in NSC 5520 they had a confidence in the existing space programs. However, Eisenhower's faltering attempts to calm the public in the wake of the launch of the second Sputnik satellite led Senator Lyndon B. Johnson to see this as an issue to press the Republican administration on and scheduled a series of hearings.[86] Therefore, the Sputnik launch drove deep civilian intervention into the development of military space systems—intervention which I theoretically expect provides a forum for domain advocates to advance their claims about the use of the technology. However, by this point there was no clear center of advocacy within the armed services due to the civilian-scientific nature of the Army/Navy development

84. Perry, *Origins of the USAF Space Program 1945-1961*, 20

85. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 246

86. Robert A. Divine, *The Sputnik Challenge* (New York, New York: Oxford University Press, 1993), 44-45; McDougall, *...the Heavens and the Earth*, 150

programs and the integration of space of the Air Force. Moreover, the caustic effects of rivalry on organizational legitimacy meant that Eisenhower and the Congress were skeptical of the armed services' ability to direct space technology and missile research programs. As I argue, the formation of distinctive advocacy needs to occur over time with successive organizational expansions generating organizational legitimacy for the advocates. This meant that the opening for disjunctural change afforded by the Sputnik crisis could not and would not be exploited to advance a new vision of warfare. Ultimately, the overt civilian orientation and covert surveillance orientation of the American space program would be a product of this lack of legitimate advocacy by the services and the lingering effects of RAND advocacy in shaping NSC 5520.

The reaction of the Eisenhower Administration was largely sanguine: the Soviets had previously announced their intention to launch a scientific satellite and American space technologies were, in their view, progressing well. Rather, the administration's policy focus after the launch of Sputnik I and II would have two dimensions following from NSC 5520. First, the maintenance of the "principle of freedom of space." Second, the development of space-based strategic surveillance. This focus can be seen in the initial conference held by Eisenhower and his aides following the launch of Sputnik in which the Deputy Secretary of Defense, Donald Quarles, suggested to Eisenhower that "the Russians have in fact done us a good turn, unintentionally, in establishing the concept of freedom of international space." Quarles notes that after thinking for a moment "the President then looked ahead five years, and asked about a [satellite] reconnaissance vehicle."[87] Crucially, during this moment Eisenhower decided that the United States would both maintain a thoroughly scientific and non-weaponized satellite program as well as tacitly accept the overflight of Sputnik I.[88] Ironically, the Soviets had unintentionally affirmed one of the core policy goals of NSC 5520; "freedom of space" had been established with no risk to the United States. At a National Security Council meeting shortly thereafter these

87. Quoted in: McDougall, *...the Heavens and the Earth*, 134; See also: U.S. Department of State, "Memorandum of a Conference, President's Office, White House, Washington, October 8, 1957, 8:30 a.m.," in *Foreign Relations of the United States, 1955-1957*, ed. Lisle A. Rose, vol. XI (Washington, D.C.: Government Printing Office, 1988), 755–756. Some Air Force leaders desired during this period to protest the Sputnik overflight in order to force space weaponization. See: Terrill Delbert Jr, *The Air Force Role in Developing International Outer Space Law* (Maxwell Air Force Base: Air University Press, 1999), 28

88. U.S. Department of State, "Memorandum of a Conference, President's Office, White House, Washington, October 8, 1957, 8:30 a.m."

objectives—as a conscious continuation of NSC 5520—were re-affirmed alongside an acceleration of the development of key technologies for a surveillance satellite.[89] This signified the acceptance by the administration that orbital space should be understood as an *internationally shared* arena. This carried with it a view that sovereignty and the military defense thereof had a vertical limit.

The scientific orientation of space policy following from NSC 5520 would transmute into a large-scale civilian space program over the next few months. After the launch of the second Sputnik on November 3, 1957 Eisenhower gave a televised address to reassure the restive American public. In the address, titled "Science and National Security," Eisenhower argued that the key deficiency of the United States vis-a-vis the Soviet Union was investment in science and technology.[90] As a curative to this, Eisenhower announced a number of initiatives to accelerate missile development and elevate the place of science in national policy. One of the overarching themes of these initiatives is that they were intended to ameliorate "inter-service competition" in research and missile programs.[91] The continuation of the policy goals of NSC 5520 and the corrosive effects of service rivalry meant that Eisenhower articulated *civilian* scientific and technological development as the response to the Soviet Sputnik launches. This civilian scientific orientation would lead Eisenhower to propose the development of a civilian scientific space agency—the National Aeronautics and Space Administration—the following spring.[92]

Meanwhile, following the call for congressional investigation by Johnson the various services mobilized wide-ranging and outlandish plans to counter the Soviet space achievement.

---

89. National Security Council, "Memorandum of Discussion at the 339th Meeting of the National Security Council, Washington, October 10, 1957," in *Foreign Relations of the United States, 1955-1957*, ed. Lisle A. Rose, vol. XI (Washington, D.C.: Government Printing Office, 1988), 757–764

90. It is notable that this address was approximately eleven years after he penned the memo "Science and Technological Resources as Military Assets."

91. For example, by creating the office of the Special Assistant to the President for Science and Technology, who would ensure that "such things as alleged inter-service competition... shall not be allowed to create even the suspicion of harm to our scientific and development program." As well as expanding the authority of the DoD Guided Missile director "so that no administrative or inter-service block can occur." And finally, ensuring that any new missile program is "put under a single manager and administered without regard to the separate services." Dwight D. Eisenhower, *Radio and Television Address to the American People on Science in National Security*, [Online; accessed 6-Feb-2017], November 7, 1957, `http://www.presidency.ucsb.edu/ws/?pid=10946`

92. The appointment of James Killian to Special Assistant to the President for Science and Technology (see previous note) would be crucial for this shift. Notably, he chaired the Technological Capabilities Panel which spurred the formulation of NSC 5520. Killian became a key point of lobbying for the American scientific community and served a key role in developing the proposal for the National Aeronautics and Space Administration. Burrows, *This New Ocean: The Story of the First Space Age*, 213-214; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 246-247; McDougall, *...the Heavens and the Earth*, 140-143; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 40

Johnson requested a space program to be presented by each of the services in the upcoming hearings: the Army proposed a wide-ranging program including a lunar base, various satellites, and a space borne logistics system; the Navy was a little more modest, perhaps as a consequence of their scientific orientation, merely seeking to expand their satellite inventory; and the Air Force proposed the most expansive program which included nuclear-fueled rockets, a lunar base, a hypersonic bomber, missile interceptors, and a human in space within a few years.[93] While many of these proposals seems banal today, at the time they would have required substantial resources to accomplish individually let alone simultaneously.

The chickens of the rivalry that the services had engaged in would come home to roost in the Johnson hearings. The first session of the hearings was dominated by testimony from leading scientists and public intellectuals. In this session, Johnson advanced the argument that the failure of the United States to orbit a satellite first was the consequence of mismanagement of defense funds. Particularly, how funds were misspent because of the development of missile and satellite technologies by services along parallel tracks.[94] This mismanagement was blamed for the Soviet's ability to orbit a satellite first. Johnson said of the first round of hearings that "there is general agreement among some hundred people that we have interviewed...that the United States urgently needs to bring its missiles [and] satellite program under an independent commission."[95] Johnson's statement demonstrates the degree to which the existing services were delegitimized in their handling of space enabling technologies. Thus, one of the dominant themes of the first set of hearings was not how to expand the existing services military space programs but rather to create a new one.[96]

During the second session, which was dominated by military personnel, officers and

93. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 249; Memorandum for Chief of Staff Subject: Space Technology, Doolitte, J.H., 1957, Papers of Thomas White, Box: 16, Folder: Command ARDC, Library of Congress Manuscript Division

94. For a representative example see: Senate Committee on Armed Services, *Inquiry into Satellite and Missile Programs: Hearings before Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, November 25, 26, 27, December 13, 14, 16, and 17, 1957* (Washington, DC: Government Printing Office, 1958), 758

95. ibid., 856-857; Divine, *The Sputnik Challenge*, 64-65

96. For example, one of the repeated lines of inquiry with civilian and armed service witnesses was whether missiles and satellite programs should be independently managed. Senate Committee on Armed Services, *Inquiry into Satellite and Missile Programs: Hearings before Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, November 25, 26, 27, December 13, 14, 16, and 17, 1957*, See 514, 618 for the Army, 856 for the Air Force, 757-758 for the Navy, 371 and 832 for examples of civilians.

service leaders engaged in a circular firing squad that seemed to only prove Johnson's argument.[97] The Army testimony was dominated by feelings of bitterness over the lack of recognition that ballistic missiles were naturally an extension of artillery. The constant modifications of operational and developmental authority that characterized the dynamic between the Army and Air Force missile programs was to blame, Army leaders argued.[98] The Navy, smarting from the recent failure of the Vanguard rocket to launch a satellite, largely avoided discussing the topic of space but expressed deep dissatisfaction with the management of space research and development.[99] Finally, in response to these hearings the Air Force began to more overtly articulate their Aerospace concept and hence their natural position of authority over space matters. For example, Thomas White and Bernard Schriever discussed the potential for space weaponry as an extension of the core Air Force mission of strategic bombardment. This is because, they argued the atmosphere and space are continuous.[100] The civilians reacted with a sense of skepticism that the services were the proper authority for the development of space and missile technologies. For example, a key ally of Johnson, Edwin Weisl, pressed the Secretary of the Air Force on the deficiencies in military technology programs:

> Mr. Secretary, you have given the committee a very well considered and hopeful program of what you now have and what you expect to have in the future... We have had evidence under oath here of many deficiencies in the present system of getting things done, getting things organized and planning for future weapons. We have been told it takes twice as long for the United States military services to get a weapon into operation as it does the Russians.[101]

97. Or as space historian Robert Divine puts it "the hearings began to degenerate into a military sour grapes session." Divine, *The Sputnik Challenge*, 67

98. Senate Committee on Armed Services, *Inquiry into Satellite and Missile Programs: Hearings before Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, November 25, 26, 27, December 13, 14, 16, and 17, 1957*, See 126 for Major General Medaris of ABMA, 509 for Lt. General John Gavin, 856 for Army Chief of Staff Maxwell Taylor

99. ibid., 705, 753-756, 1757

100. ibid., See: 841-842 for Secretary of the Air Force, 1587-1589 for Thomas White, 1649 for Bernard Schriever

101. Weisl goes on to press the Secretary on whether there is an operational rocket that can match the one used by the Soviets to orbit Sputnik. Weisl responds with incredulity at the Secretary's claims and emphasizes that lack of an *operational* booster.

> Mr. Weisl. Mr. Secretary the fact remains that the Russians have an engine with a thrust sufficient to project a thousand pound satellite in orbit, is that not so?
> Secretary Douglas. Yes, sir.
> Mr. Weisl. We have it now?
> Secretary Douglas. Yes, sir.

Taken together, these hearings led to the conclusion amongst the civilian politicians that while space was important for national security: the military services were not fit to manage space programs. When combined with the policy consequences of the continuation of NSC 5520 by the Eisenhower Administration "both the Congress and executive branch preferred, and even took for granted, the concept of civilian control."[102]

The eventual creation of the National Aeronautics and Space Administration was driven by three factors: first, was the (probable) legacy of the RAND Corporation in influencing NSC 5520; second, was the lobbying by scientific community of the President's new Special Assistant for Science and Technology James Killian[103]; and third, the delegitimization that service rivalry had engendered. These factors worked synergistically: the RAND Corporation studies had convinced the Eisenhower Administration that continuous strategic surveillance enabled by a civilian space policy was a necessary end to prevent the potential for a Soviet surprise attack. Recall that the surprise attack on Pearl Harbor combined with rapid Soviet advances in nuclear technology generated a deep anxiety in the Eisenhower Administration over the potential for strategic surprise. A civilian space program gave cover to the development of reconnaissance satellites and offered a way for the United States to restore its national pride. The existence of a civilian-scientific space program was also strenuously supported by the scientific community. Scientists, as a lobbying body, gained power under the post-WWII imaginary of the technological war as scientific and technological development came to be articulated as a core dimension of national power. That a civilian program gave cover to the strategic policy objectives of the Eisenhower administration worked hand-in-glove with the lobbying of the civilian-scientific community.[104]

> Mr. Weisl. Where is it?
> Secretary Douglas. In all three programs.
> Mr. Weisl. I am not talking about programs. It has been testified that we have no engine with thrust sufficient enough to cast a thousand pound satellite in orbit with guidance to keep it in orbit.

Senate Committee on Armed Services, *Inquiry into Satellite and Missile Programs: Hearings before Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, November 25, 26, 27, December 13, 14, 16, and 17, 1957*, 844-845

102. Robert H. Puckett, "American Space Policy: Civilian/Military Dichotomy," *The Air University Review* 16, no. 3 (1965): 45

103. Killian briefly considered that the Air Force should have a dominant role in space, acknowledging that they had a point about the indivisibility of the atmosphere/space. "But it was negated by their 'fantasies' about space wars and dropping bombs from satellites." Burrows, *This New Ocean: The Story of the First Space Age*, 215

104. ibid., 214-215; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 234; McDougall, *...the Heavens and the Earth*, 159-160, 200-202; Robert H. Puckett, *The Military Role in Space — A Summary of Official, Public Justifications*, technical report (RAND Corporation, 1962), 28

The outcome of these assumptions was the passage of the 1958 National Aeronautics and Space Act, the effect of this belief in the civilian control of space is evident in the preamble which states that space:

> activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States... shall be the responsibility of, and shall be directed by, the Department of Defense.[105]

There are two key dimensions of the control of space activity in this preamble and the bill. First, the primacy of civilian control over non-military space applications, with military uses cast as an exception. Second, that those military uses are not assigned to a service, but rather to the civilian-led Department of Defense. DoD control over space activities led to the creation of the Advanced Research Projects Agency (ARPA), which was meant to sit above the services and hence prevent the formation of rivalry.[106] This confirms my theoretical claim that inter-service rivalry, due to its incentives to make broad and outlandish claims, will have a deeply delegitmizing effect when combined with a deep civilian intervention. The consequence of the creation of ARPA and NASA was that the military space development programs were carved up and removed from the authority of services. For example, the von Braun team was transferred to NASA and the CORONA branch of the WS-117L program was handed to the CIA.[107] However, the situation would soon prove to be unbearable for the services.

Chafing at the butchering of the military space programs in 1958, the leaders of the Army and Navy proposed the creation of a unified DoD space agency. Characteristically, the Air Force opposed the plan out of a belief that the space mission was rightfully their bailiwick. Therefore, rivalry continued even after the creation of NASA and attempts to resolve service conflicts over space technologies. The bureaucratic confusion and squabbling that played out

105. John Logsdon et al., eds., "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration," chap. II-17: "National Aeronautics and Space Act of 1958," Public Law 85568, 72 Stat., 426. Signed by the president on July 29,1958. (Washington, D.C.: NASA History Office, 1995), 335

106. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 253; McDougall, *...the Heavens and the Earth*, 197

107. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 251; McDougall, *...the Heavens and the Earth*, 198

during 1958 due to the creation of ARPA led the Secretary of Defense to transfer back the bulk of the space development programs to the services, with the majority coming under the control of the Air Force. It is not clear why this was the preferable outcome, perhaps the entrenched interests of the extant services meant that a de novo autonomous command within the Department of Defense would face roadblocks from service-friendly civilians. Though theoretically unexpected, the services still suffered from the delegitimization of inter-service rivalry as they gained development authority but not mission authority. For example, while the Air Force regained the CORONA development program, it was in a subjugated role. The Air Force would manage the project while the CIA defined the surveillance mission and had exclusive authority to process the intelligence data.[108] Such would be the order of things as the CORONA satellite program—the first military satellite—became operational in 1960.

Whither Space Advocacy?

The success of Project Rand in defining the early contours of American space policy lies in two features of the military development of space. First, that the services approached the new space technologies in a competitive manner. The greatest offender was the Air Force, which believed that space technologies were rightfully an extension of strategic air power but was unwilling to actually pursue their development except to maintain their own interests. For example, space launch technologies were driven towards the development of ICBMs—integrating the technology within the Air Force conception of war. Consequently, this jockeying for development and operational authority over new technology meant that when civilians were driven to intervene in the development of space technology, none of the services had legitimacy in operating it. This lack of legitimacy was deepened by the fact that the none of the services could provide compelling reasons why they should have control over the technology, the ambitious programs submitted to the Johnson hearings demonstrated an expansive desire without deep thought. What this suggests is that one of the benefits of having a body of advocates coalesce on their own is that they need to make themselves relevant to progressively greater authorities which places a premium on conceptual development and justification. Service leaders chasing a new funding line are not nearly as constrained as a small cluster of officers in the claims that

108. Burrows, *This New Ocean: The Story of the First Space Age*, 238-240; McDougall, *...the Heavens and the Earth*, 199; Rick Sturdevant, "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue," chap. Early U.S. Civil Space Policy, NASA, and the Aspiration of Space Exploration, ed. Roger D. Launius (San Diego, California: American Astronautical Society, 1995), 170

they can make.

The second feature is that, ironically, the RAND Corporation researchers fulfilled the role of a body of advocates. During their period of initial creation they were explicitly given "benign neglect" by the Air Force, much as I expect would implicitly happen with military advocates. Moreover, they had a growing sense of frustration over not being paid their due, and ended up engaging in lobbying that deeply effected the course of American space policy. They argued that in a world where the new symbology of competition was defined by science and technology, the satellite was the ultimate political weapon. What the RAND advocacy suggests is that a civilian advocacy group are not biased towards the kinetic/familiar war-fighting potentials of technology. Additionally, the anxieties which the RAND researchers channeled in developing their arguments were widely shared—they were just successful at interpreting the role that the satellite would play vis-a-vis these technologies.

4.4 Competing Visions

4.4.1 Aerospace

In the Johnson hearings that followed the Sputniks launches the Air Force leaders articulated the still to be named "Aerospace" domain: an understanding that space and air are continuous. This conception of the relationship between space and the atmosphere was for a long time tacitly advocated by the Air Force. Recall, for example, the Vandenberg policy on the satellite from 1948: "The USAF, as the service dealing primarily with air weapons—especially strategic—has logical responsibility for the Satellite."[109] In this statement he implies that satellites, insofar as they would exist above the Earth, are properly the bailiwick of the Air Force. Some, such as Walter McDougall, see the promotion of Aerospace as a public relations stunt in reaction the Sputnik Crisis.[110] While it is easy to dismiss, there is a sense that the Air Force senior leadership actually believed in the concept. However, the main issue facing the Aerospace advocates was that they could not articulate a compelling justification outside of building a new technological

109. Vandenberg, "I-1: Major General S. Craigie, Director of Research and Development Office, Deputy Chief of Staff, Materiel, to Brigadier General Alden R. Crawford, Air Materiel Command, Wright Field, Dayton, Ohio, "Satellite Vehicles", 16 January 1948, with attached: Memorandum for the Vice Chief of Staff, "Earth Satellite Vehicles," 12 January 1948, and General Hoyt S. Vandenberg, Vice Chief of Staff, United States Air Force, "Statement of Policy for a Satellite Vehicle""

110. McDougall, *...the Heavens and the Earth*, 205

system for an independent space mission. A paradigmatic example is a secret study that the Air Force conducted in 1960 that argued that lunar base was feasible within the decade. It is telling that the report readily admits that little thought was put into what military uses the base had.[111] Much of the Air Force's hopes for this period were founded on the development of two manned technological systems—Dyna-Soar and Manned Orbiting Laboratory. These two projects were key to the Air Force because they had human participation in military space systems, which was valued in light of the underlying anxiety over high technology diminishing the role of the human in warfare.[112]

I argue that the overall failure of the Aerospace Domain project to develop was the consequence of two factors: first, that the Air Force senior leadership did not develop a new and coherent war imaginary. Justifications for entering space were either premised on a belief that space technologies were the natural extension of aircraft technologies or that there was a military need to place a human in space. The early aviation advocates were driven to justify the aircraft on a progressively evolving series of claims that demonstrated how the aircraft could resolve tactical, operational, and strategic issues. The core of the Aerospace project was technological tautology: the Air Force had a role in Aerospace because the Air Force operated technological systems in Aerospace. Second, the existence of technological anxiety over the diminishing role of the human in warfare. The Air Force's service identity was structured around the "fighting man in the airplane," a legacy of the Air Force gaining independence following World War II. The rise of complex micro-electronics, the challenges facing bio-astronautics, and the growth in strategic missilery meant that many of the Air Force personnel believed that their role in warfare was being fundamentally challenged. At a theoretical level this resistance to revolutionary change is expected. Service identity structured their raison d'etre around their image of warfare—in the case of the Air Force this was strategic bombing. Service arms, as prescriptive conservative organizations, are resistant to fundamentally revolutionary change in their conception of warfare. This is why a new strategic domain is the product of "bottom-up" distinctive advocacy; a revolutionary conception of warfare necessitates an entirely new

111. Directorate of Space Planning and Analysis, "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships," chap. II-15: "Military Lunar Base Program or S.R.183 Lunar Observatory Study," Study Summary and Program Plan, Air Research and Development Command, Project No. 7987, Task No. 19769, Directorate of Space Planning and Analysis, Air Force Balliitic Missile Division, April 1960, pp. 1-9. Ed. John Logsdon et al. (Washington, D.C.: NASA History Office, 1996), 304–311

112. Roy F. Houchin III, "Why the Air Force Proposed the Dyna-Soar X-20 Program," *Quest* 3, no. 4 (Winter 1994): 5

corporate identity that is willing to break with the fundamental structures of an extant service's identity. The resilience of the Air Force identity is born out in the declining morale and repeated attempts by the Air Force General Staff to assuage fears amongst Air Force rank and file that they would soon be supplanted by "artificial brains."

While Aerospace had long been an aspect of Air Force thinking, the term itself did not come into prominence until 1958 when Air Force Chief of Staff Thomas White used it in a speech before the Los Angeles Chamber of Commerce.[113] Despite this usage, there was still a great degree of uncertainty about what Aerospace meant amongst the rank and file Air Force officers. For example, in mid-1958 the editor of Air Force Magazine wrote a letter to Thomas White that noted "the public understands on an emotional basis that the exploration of and control of space is important, but they can't as a rule formulate logical and precise reason for their convictions." To ameliorate this the editor asks White to author an article that provides an "explicit rationale" for why the Air Force needs to operate in space.[114] Towards the end of this year the Air Force updated their basic doctrine to reflect the usage of "Aerospace."[115]

By 1959 there was growing sense within the Air Force itself that they needed to coordinate internally on how to talk and think about Aerospace leading to the creation of a widely circulated policy statement.[116] The resultant policy statement is fairly short on what exactly Aerospace Power or an Aerospace Capability *is*. Whereas previous generations of Air Force officers had justified "Air Power" on the basis of what it could do (air superiority, strategic bombing) this statement justifies it on the grounds of technology. For example, the statement opens:

> The 'jet age' is rapidly translating into an aerospace age. Heralded by current high performance aircraft, ballistic missiles, and earth satellites, this new age offers potentials challenging imagination. . . A dominant military aerospace capability inherently transcends the foreseen potential of earthbound military force and offers the means for unprecedented world power.

113. Chronology of Development of Concept and Term "Aerospace", nd., IRIS 1024832, Call: 168.603-61, Air Force Historical Research Association

114. Letter to General Thomas D. White from Peter J. Schenk, Schenk, Peter, 1958, Papers of Thomas White, Box: 47, Folder: 7-4 FAA / NAS / CIA / CAP / AEC , Library of Congress Manuscript Division

115. Revision of Air Force Manual 1-2, Jacob Smart, 1958, IRIS 479102, Call K239.01 Vol 4, Air Force Historical Research Association

116. Air Force Responsibilities Regarding Relationship of Aerospace Power to National Defense Strategy, Ritland, O.J., 1959, Papers of Bernard Schriever, Box: 25, Folder: 6 Satellites and Other Space Issues: Early Space Papers 1958-1966, Library of Congress Manuscript Division

Outside of hallucinatory global dominance, the statement does little to actually articulate what "Aerospace" means for military activity. Much of the statement is also reactive, citing the need to counter Soviet aerospace power without any clear detail as to what that would entail.[117] Despite this lack of coherence, the Air Force moved to integrate the term "Aerospace" and the attendant belief that Air and Space are continuous in speeches, doctrine, etc.[118]

Aerospace—The Concept

The lack of deeply conceptual thinking about what Aerospace *meant* for warfare can be seen in the Air Force service magazine the *Airman* during this time period. The launch of Sputnik finally catalyzed sustained Air Force senior officer interest in space technologies *as* space technologies and this magazine served as a key vehicle for the senior officers to promote Aerospace to rank and file Air Force personnel.[119] Additionally, I focus on this magazine because new doctrinal concepts are regularly circulated via public-facing publications: for example, many of the debates of the early aviators over how to employ the airplane took place in the *Air Service Information Circular*, a precursor to the *Airman*. Examining space related articles from this magazine during this time period therefore gives insight into three things: first, how the senior leaders conceptualized Aerospace; second, the doctrinal implications of Aerospace; and third, how Aerospace was sold to the Air Force rank and file.

One of the core tasks of the *Airman* during this period was educating Air Force personnel on space issues. For example, beginning in 1959 the magazine began running a regular column called "Slants on Space" which provided tidbits of astronautical information. The inaugural edition of the column covers the use of photo-spectroscopy to identify the gaseous composition of the sun, atmospheric dust, a discussion of the Kelvin temperature scale, and interplanetary transit times.[120] Through their termination in 1967 these columns focused purely on the scientific and technological dimensions of spaceflight. Outside of this recurring column,

117. Attachment "Policy Statement" in Air Force Responsibilities Regarding Relationship of Aerospace Power to National Defense Strategy, Ritland, O.J., 1959, Papers of Bernard Schriever, Box: 25, Folder: 6 Satellites and Other Space Issues: Early Space Papers 1958-1966, Library of Congress Manuscript Division

118. ARDC Commander's Note — The USAF Role in Space, Schriever, Bernard, 1959, Papers of Bernard Schriever, Box: 26, Folder: 1 Satellites and Other Space Issues: Miscellany, Library of Congress Manuscript Division

119. An editor for *Airman Magazine* recalls that they were tasked with promoting the concept following Sputnik see Frank W. Jennings, "Doctrinal Conflict over the Word Aerospace," *Airpower Journal* IV, no. 3 (1990): 47

120. "Slants on Space," *The Airman* III, no. 2 (1959): 48

Figure 4.1: Comic from the February 1966 Airman

the editors also began integrating space iconography into their graphic design through representations of military astronauts and small comics with a space theme. These representations even intersected with non-space issues—such as a representation of an extraterrestrial anti-war activist.

Outside of the scientific and technical dimensions of spaceflight, there were frequent columns written by Air Force senior officers who argued for the Air Force use of space. The first major piece by such an officer was the October 1959 article, "The Shape of Things to Come" by Bernard Schriever, displays many of the features of the internal attempts to conceptualize aerospace. Schriever begins the piece by aligning the development of space technologies within the broader arc of the development of aeronautics: "the Air Force sees in the present period of dynamic evolution a logical carry-on of a familiar pattern. Each increase in altitude, speeds, and ranges of its equipment achieved over the past half century has marked a steady advance toward the fringe of space where man now gropes adventurously."[121] Entering into a speculative mode, Schriever notes that there is a great deal of disagreement over what the Air Force would and could do in Aerospace but argues that it is the key role of the Air Force to "exploit to the utmost whatever can be learned from the rapid advance of the space sciences and their technologies which will enable us to discharge our assigned mission."[122] Of course, the core mission of this time period was deterring the Soviet Union, which Schriever argued could be maintained by developing the potential for "Aerospace Supremacy." As a parallel to early conceptions of Air Supremacy, he argued that this would be characterized by a moment-to-moment control of regions of orbital space through maneuverable spaceships. However, outside of deterrence, he

121. Bernard Schriever, "The Shape of Things to Come," *The Airman*, October 1959, 18
122. ibid., 19

does little to articulate any further rationale for operating in Aerospace.[123]

Some three years later, there was still no further elaboration of the military uses of space outside of the maintenance of supremacy. The 1962 piece by Curtis Lemay, "The Hour of Decision," argues that "controlling the aerospace from the Earth's surface on out into space is going to take modern versions of missiles and manned aircraft and it is going to take manned and unmanned spacecraft."[124] While Lemay notes that space capabilities could potentially bring about an end for the potential of a nuclear war he does little to elaborate on how that would happen (a thread that would return in the 1980s with the Strategic Defense Initiative.) Much as with the internal deliberations, Lemay ultimately rests his overall argument on the need for technological development. He does this by arguing that there was a fundamental need to control orbital space and that political, economic, or other considerations should not restrain aerospace dominance.

Outside of the development of technology for aerospace dominance there were two other lines of justification advanced in the pages of *The Airman*. First, was the exploratory role historically played by the military. The opening of space to human activity represented an extension of the grand tradition played by military exploration parties. William Kinney, in the 1966 article "The Challenge of Tradition" notes that:

> Giving a military arm... an assignment for research and experimentation in space marks no breach of precedent for the United States. For example, we have sent military parties a number of times to explore the wastes of the Arctic and Antarctic without suspicion or invidious interference being attached to their employment. A change of environment does not mean any change of policy.[125]

There are two additional notable features of this passage and the article: first, that "aerospace" is no longer being used as the primary mode of reference for orbital space/atmosphere. Second, is the unspoken care taken to signal that military exploration and experimentation in space would not violate the policy of "space for peaceful purposes." By 1966 the civilian Apollo Program was in full swing and this care shows the extent to which the idea that space should primarily be peaceful had sunken into American social beliefs about space.[126]

123. See: Schriever, "The Shape of Things to Come," 18-20
124. Lemay, "The Hour of Decision," 7
125. William Kinney, "The Challenge of Tradition," *The Airman*, June 1966, 45
126. Burrows, *This New Ocean: The Story of the First Space Age*, 419-424; McDougall, *...the Heavens and the Earth*, 417

The other and most dominant line of justification was the need to place military personnel in space, which at its core was an attempt to show the continuing relevance of the human in warfare under the conditions of high technology. From 1959-1968 the bulk of the articles on the Air Force uses of Aerospace/Space centered on the positive benefits of placing a human into orbit. The relative success of the CORONA satellite and other remote sensing satellites placed a premium on justifying *any* human role in space. This justification was needed because of a widespread anxiety that advances in computing and micro-electronics meant that most if not all of the primary activities of warfare could be automated.[127] The primary line of argument for putting a uniformed human into space was the flexibility of the human mind. A paradigmatic example of this argument can be seen in Curtis Lemay's February 1962 article "Youth on the Space Frontier" in which he argues "Thus far man has not been able to build an electronic brain that can come up with original thoughts, or display courage and love of liberty. Nor can the machine be dedicated to god and country... Therefore man, because he has a brain and a soul, is going to continue to be key to the kind of national defense we need."[128] The need and desire to justify human involvement in space activities even under-girded the justification for the development of new weapons systems. The X-20 Dyna-Soar—a hybrid rocket-airplane that represented the core wager of Aerospace—was justified to Air Force personnel on this basis. For example, "the real value of Dyna-Soar must be seen in the light of the long term central requirement of establishing man in a space environment."[129] This anxiety even bled into articles which had no relationship with Aerospace doctrine or weapons systems. In the opening paragraphs of a 1965 article on the Aerospace industry the author saw a need to write that the technological systems produced by industry "together with the essential human element—the men who give them purpose and direction... provide the United States with military strength unequaled by any other nation in history."[130] The need to address this anxiety is apparent, in many of these articles the necessity of human involvement is always mentioned within the first

127. This went so far as to have an entire article about why people shouldn't fear the development of computers. See: Edmond Fortin, "Don't Be Afraid of Computers," *The Airman*, June 1964, 12–15

128. Curtis Lemay, "Youth on the Space Frontier," *The Airman*, February 1962, 15 Cf. Schriever, "The Shape of Things to Come," 20-28; Dean Strother, "Man in Aerospace," *The Airman*, December 1961, 15–17; "Slated For Space," *The Airman*, January 1963, 50; Curtis Lemay, "The Future of Piloted Aircraft and Aerospacecraft," *The Airman*, May 1963, 1; Curtis Lemay, "Men Will Always be Leading the Way," *The Airman*, January 1964, 2; "Military Man in Space," *The Airman*, August 1964, 6–10; John O'Doherty, "How big is Aeropsace?," *The Airman*, December 1965, 12; Kinney, "The Challenge of Tradition," 45; "Out into the Wild Blue Yonder," *The Airman*, September 1967, 12–14

129. Edison T. Blair, "This is Dyna-Soar," *The Airman*, October 1960, 12

130. O'Doherty, "How big is Aeropsace?," 14

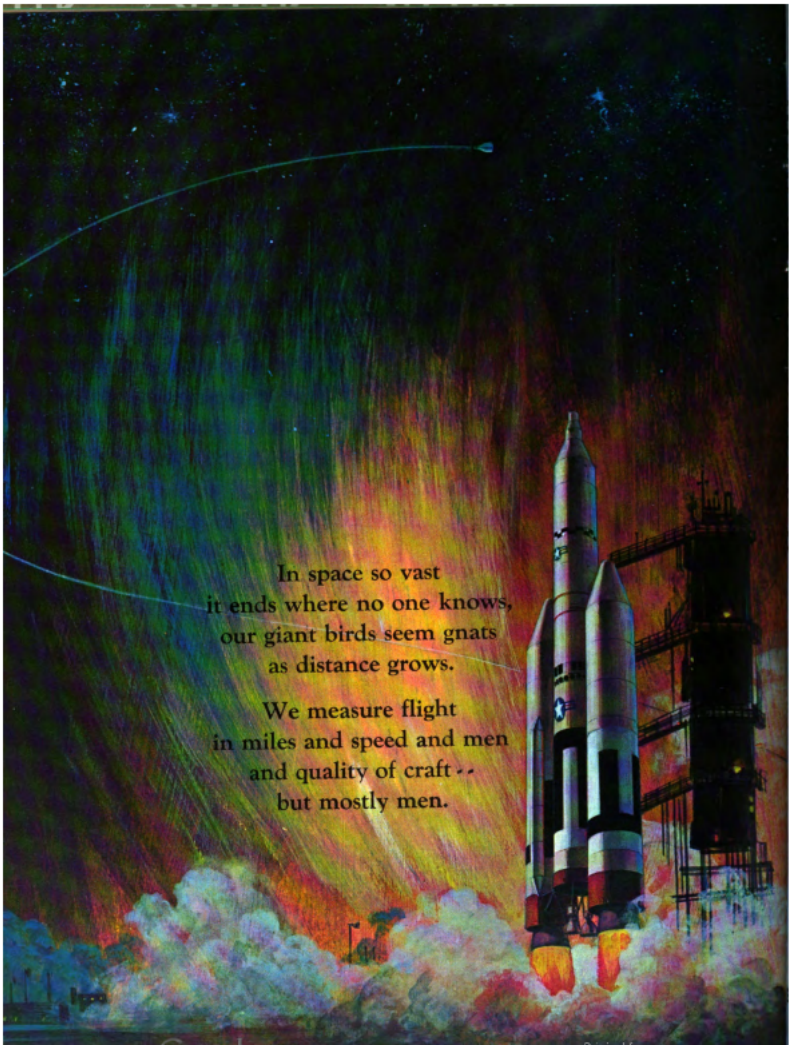

Figure 4.2: An inelegant poetic reminder of the role of the human from January 1965

2-4 paragraphs and at least once a year during this period a special inside or back cover design promoting the continuing relevance of humans was printed.

There is evidence for this deep anxiety at both service academies and the main space technology development division. For example, a 1960 lecture given by General B. Holzmann, a high level officer in the Air Force Research and Development Command, at the Command and Staff College exhibits a similar need to reassure officers about the role of the human. In the lecture Holzmann spends a substantial amount of time promoting the benefits of having a

human in the loop. Regarding microelectronics in missiles and satellites he states "it cannot be told to use a little judgement. It cannot be told to go out there and look the situation over and if things are as we suspect explode, but if our reports have been inaccurate turn around and come home."[131]

This sense of anxiety was even palpable amongst the development staff for Air Force space systems headed by Bernard Schriever. A string of letters from 1959 between Bernard Schriever and Thomas White discusses plummeting morale within the Ballistic Missile Development staff because they believed they were undermining their own pilot training.[132] These tensions would continue to both the development of Aerospace as a domain and the justifications used for developing Aerospace capabilities.[133] This is surprising given the status of Schriever as the primary Aerospace visionary of the Air Force—it would be expected that his staff would be the most committed to the development of Aerospace within the Air Force. Therefore, even at the main site of space systems development a body of advocates failed to form.

Altogether, this shows the challenge of imposing potentially revolutionary change on an existing military service. When defining conceptually what Aerospace would contribute to war, senior officers either drew on technological or deterrent justifications. Viewing orbital space as an extension of the existing mission of an Air Force meant that even when the senior officers speculated on what to do in space they merely extended "Air Supremacy" into "Aerospace Supremacy." These weak rationales seemingly did little to excite the Air Force rank and file. The recurrent need to assuage fears of technological substitution shows how military services are culturally resistant to fundamental alterations to their character and core mission. The need to reinforce the central role of the human controlled airplane in Air Force identity is expressed in many of the articles on Aerospace/Space that argued winged aircraft would continue to have a place in an Aerospace Force. Schriever's 1959 article spends three pages explaining the ways in which flight training and aircraft would continue to be relevant as space technologies developed. Near the end of this piece he states categorically "I do not and cannot imagine the Air Force

131. Scientific Research in a Technological Air Force, B.G. Holzman, IRIS 907709, Call 147.051-4, Air Force Historical Research Association, 14

132. Letter to Thomas White from Bernard Schriever, Schriever, Bernard, 1959, Papers of Thomas White, Box: 27, Folder: Command ARDC, Library of Congress Manuscript Division

133. Cf. National Security, Technology, and the Military Role in Space, Schriever, Bernard, 1963, Papers of Bernard Schriever, Box: 25, Folder: 9 Satellites and Other Space Issues: Military Space Policy, Library of Congress Manuscript Division; Report: Manned Space Programs, 1964, IRIS 1003005, Call K130.8636-2, Air Force Historical Research Association; Decision on Manned Orbiting Laboratory and Related Matters, 1965, NASA HQ Historical Reference Collection, record #15122, MOL AES, Washington, D.C.

virtually without planes a decade hence, with exclusive reliance on a 'mix' of missiles and manned spacecraft."[134]

Technological Systems

These issues generating a compelling reason to pursue offensive space technologies would filter into the debates over the development of the Dyna-Soar and Manned Orbiting Laboratory Programs. The X-20 Dyna-Soar had been under development since the early 1950s, a hybrid rocket/plane, the original idea for it came from Walter Dornberger of the Peënemunde staff. As the Dyna-Soar approached testing in the early 1960s, there was a sense within civilian DoD leadership that the Air Force had not actually done enough to justify developing it. In early 1963, before a congressional committee, McNamara remarked on this by stating "Do we meet a rather ill-defined military requirement better by proceeding down that track [Dyna-Soar development], or do we meet it better by modifying Gemini in some joint project with NASA?"[135] In response to this dearth of conceptualization, Secretary of Defense MacNamara in early 1963 began to suggest that the Air Force investigate new missions outside of bombing including satellite interdiction and reconnaissance.[136] However, by late 1963 the situation had become untenable—Dyna-Soar came to be perceived primarily as a nuclear bomber that operated in orbital space, thus threatening the "weaponization of space." This concern along with the price tag and lack of compelling justification led McNamara to terminate the program.[137]

At the same moment that McNamara terminated the Dyna-Soar program, he approved the Manned Orbiting Laboratory (MOL). MOL was a space station which had been proposed by the Air Force to "demonstrate and assess qualitatively the utility of man for military purposes in space."[138] However, the same problems dogged MOL as Dyna-Soar, the Air Force could only

134. Schriever, "The Shape of Things to Come," 20-23; See also: Blair, "This is Dyna-Soar"; Strother, "Man in Aerospace"; Edison T. Blair, "Why Wings in Space," *The Airman*, November 1962, 7–8; Lemay, "The Future of Piloted Aircraft and Aerospacecraft"; Donald W. Coble, "The World's First Space Trainer," *The Airman*, October 1964, 8; Lemay, "Men Will Always be Leading the Way"; "Our Space Age Flying Professors," *The Airman*, October 1964, 29

135. Quoted in Carl Berger, *History of the Manned Orbiting Laboratory Program (MOL)*, technical report (MOL Program Office, 1970), 39. The Gemini program referenced was a short lived potential partnership between the Air Force and NASA to develop a military space capsule. See: ibid., 39-42; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 259; McDougall, *...the Heavens and the Earth*, 339-340

136. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 261

137. Burrows, *This New Ocean: The Story of the First Space Age*, 254-255; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 262; McDougall, *...the Heavens and the Earth*, 340

138. Air Force Assistant Secretary for Research and Development quoted in Day, "Invitation to Struggle: The

justify it on the basis of having a man in space. The pursuit of the MOL, much like Dyna-Soar, was justified on circular grounds—in order to determine the utility of a military man in space they must put a military man in space. Eventually the Air Force began to articulate the MOL as a tool for real-time analysis of photo-reconnaissance but this ran afoul of the highly successful CORONA program.[139] Since the only justification for the MOL was ultimately in duplication and because it constituted the single largest budget item for the DoD, the program was canceled in 1969.[140] The cancellation of MOL thereby ended the Air Force dream of proving the value of placing a human into space, and left a legacy whereby the Air Force leadership "were forever after very skeptical of human spaceflight."[141]

The failure of the Aerospace Domain project was therefore the confluence of two factors: first, the lack of visioning by senior officers. The failure of these officers to present a compelling rationale or theory of how and why the Air Force needed to operate in space had two effects. First, they had little success in convincing the Air Force rank and file of the need to operate in space. Second, they failed to justify before civilian defense planners and politicians the necessity of placing complex offensive or support systems into space. Ironically, it was the very success of automated systems that made this a challenge for the Air Force. The second factor was the inability of the Air Force senior leadership to drive revolutionary change in the character of the service. The continuous need to assuage technological anxiety in the pages of *The Airman* show the extent to which space technologies posed a challenge to the core identity of the Air Force. What this confirms is the need for the development of bottom-up distinctive advocacy, which is further confirmed by the morale issues that existed even amongst the staff of the core Aerospace visionary—Bernard Schriever.

History of Civilian-Military Relations in Space," 261

139. The director of the CIA had "'seriously questioned' the benefits or value of MOL's [redacted] photography 'compared to that of the present [redacted] photography' [which] made it 'highly questionable that the MOL's marginal improvement beyond an already impressive capability is worth the huge cost."' The CIA's approval of the program was crucial since they would be consuming the intelligence produced by MOL. Berger, *History of the Manned Orbiting Laboratory Program (MOL)*, 62-66, 275

140. Around the time of the MOL cancellation then President Nixon gave a speech in which he argued "there is no justification for wasting money on unnecessary military hardware."ibid., 290-291; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 263; Carl Posey, "A Sudden Loss of Altitude," *Smithsonian Air & Space Magazine*, July 1998,

141. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 263

4.4.2 Seizing the High Frontier: The Strategic Defense Intiative

> The only ultimate weapon is to not rest on your laurels.
> - Maxwell Hunter II[142]

A decade after the Manned Orbiting Laboratory program was canceled a new manned space technology would trigger another round of challenges to the existing policy framework of "space for peaceful purposes." The late 1970s saw the development of the Space Shuttle (formally known as the Space Transportation System), which, while operated by civilians, would also carry military payloads.[143] A core selling point for the Space Shuttle was that it promised to revolutionize the economies of placing payloads in orbit. The coming deployment of this space technology spurred two threads that collided in President Reagan's strategic modernization program known as the Strategic Defense Initiative (SDI). The first was the advocacy for the weaponization of space to break the strategic stalemate of Mutually Assured Destruction. Second, a push by some in the Air Force leadership to create a Space Command to take advantage of the opportunities presented by the Space Shuttle.

From Pax Americana to the SDI

One of the key processes inspired by the development of the Space Shuttle was the formation of advocacy for a new strategic framework. David Baucom, an intellectual historian of the SDI, argues that the late 1970s was characterized by a breakdown in the consensus on strategic nuclear policy that had long been characterized by Mutually Assured Destruction (MAD).[144] This intellectual opening combined with the development of the Space Shuttle and the decreasing size requirements of Directed Energy Weapons (DEWs)[145] led to a belief that orbital space held the promise for strategic defense. Strategic defense in orbital space was articulated as part of a broader belief that space weaponization and commercialization could produce a state of "Pax

142. Maxwell Hunter III, *Strategic Dynamics and Space-Laser Weaponry*, technical report (Sunnyvale, California: Lockheed Missiles & Space Company, 1977), 1

143. Military payloads were necessary for NASA to justify the cost of developing the shuttle. For a discussion of why the Space Transportation System was developed see: Burrows, *This New Ocean: The Story of the First Space Age*, 518-523; Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," 263-266; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 182

144. He argues that it constituted the collapse of a Kuhnian Paradigm. See: Donald R. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, technical report (Strategic Defense Initiative Organization, December 1989), 330-331

145. Such as lasers or energy/particle beams.

Americana." Advocacy for this belief was initiated by an aerospace engineer who, by building political alliances, brought the potential for space-based ballistic missile defense (BMD) to the attention of the Reagan Administration. This alliance-building process culminated in the SDI, which jettisoned the revolutionary vision of orbital space developed by this advocacy line. The filtering effects of political alliance-building meant that the core wagers encountered a set of critics who reconstructed the promise of space-based DEWs into a suite of BMD technologies.

The advocacy for strategic defense in orbital space would not be born out of a restive group of service members, but rather the fevered imagination of an aerospace engineer. In the fall of 1977 Maxwell Hunter III, an aerospace engineer working for Lockheed Martin, revived his long dormant dream of weaponizing orbital space with DEWs because of the reduction in space transportation costs promised by the Shuttle. This revival came in the form of a white paper circulated among his colleagues titled "Strategic Dynamics and Space-Laser Weaponry." The thesis advanced by Hunter was:

> High energy lasers are proliferating, and space transportation is about to become sufficiently economical that, if it is used to place such lasers in space, an effective defense against even massive ballistic missile exchanges... is, indeed possible. This is the only new strategic concept to present itself in a number of decades and the only one which merits the word potentially decisive.[146]

He argues that the ossification of MAD as the dominant orientation of strategic thought was dogma born of a dependence on "psychology rather than physics, diplomacy rather than engineering, to protect the greatest technological power on the planet." The development of new technologies, therefore, opened the path to a new strategic policy that harnessed American technological dominance.[147] Technological change promised to make orbital space an arena of true strategic defense.

Thus continuing to maintain the long-time policy of "space for peaceful purposes" constituted a "cruel, genocidal hoax" for Hunter. This is because DEW systems in space presented the ability to move strategic nuclear warfare from the Earth to orbital space, thereby removing the most severe consequences of a nuclear exchange.[148] Orbital DEWs, he argued, resolved

146. Hunter III, *Strategic Dynamics and Space-Laser Weaponry*, 1
147. ibid., 2-3
148. Hunter argues that an "advanced strategic arsenal could be detonated in its entirety with no direct damage to the earth or its peoples."ibid., 4 Notably, Hunter is ignoring the evidence from the STARFISH PRIME tests in

previously intractable issues with previous ballistic missile defense systems allowing for a defensive shield against a Soviet nuclear missile attack.[149] Not only would it ensure dominance in nuclear warfare, these weapons could be used for cheap force projection to maintain overseas security commitments without the politically fraught and expensive base system. Overall, the weaponization of orbital space, he argued, presented the opportunity for an unparalleled "Pax Americana."[150]

The set of concepts and claims developed by Hunter in this paper bears many similarities to a war imaginary; the core wager is that technological change has enabled a new form of strategic warfare in a distinct arena. By resolving MAD and its human costs as well as the political and fiscal costs of American empire, DEWs in orbital space allowed for technological global domination. One of the key differences between Hunter's argument for orbital DEWs and the Air Force promotion of Aerospace is that Hunter does not focus on the vague requirement of humans in space. Rather, the very automaticity of defensive DEWs was beneficial because of its potential to either prevent an accidental nuclear exchange or slow an escalatory spiral through an increase in decision-making time.[151] Perhaps this focus on largely automated weapon systems—exceeding the fears of warriors reduced to button-pushing technicians that underwrote the 1950s-1960s anxieties of the Air Force—was a function of Hunter's civilian status: he was not socialized into a service culture which centered the role of the human in warfare. His comfort with automaticity and high technology was likely a function of his work as an aerodynamic engineer for Lockheed Martin. Similar to RAND, Hunter was not bound by the grammar of human-fought warfare, however, unlike RAND he sees space weaponry as holding strategic promise. This is perhaps a reflection of the differing roles and professions of the RAND analysts and Hunter: the former were partly constituted by civilian strategic analysts whereas the latter designed weapons systems. For Hunter then, weaponizing orbital space promised a revolution in the overall nuclear strategic posture of the United States.

Hunter's paper was consciously circulated amongst defense professionals until it came

---

the early 1960s. In 1962 the Atomic Energy Commission and Defense Atomic Support agency conducted several experimental detonations of thermonuclear warheads in orbital space. One of which disabled multiple satellites and caused severe damage to power infrastructure in Hawaii.Bert Chapman, *Space Warfare and Defense: a Historical Encyclopedia and Research Guide* (Santa Barbara, California: ABC-CLIO, 2008), 300

149. This was primarily accomplished by targeting ICBMs while they were in their boost phase, previous ballistic missile defense systems and schemes targeted missiles during their terminal phase during which MIRV warheads and decoys could quickly overwhelm point defenses.

150. Hunter III, *Strategic Dynamics and Space-Laser Weaponry*, 4-8

151. ibid., 5

to the attention of Senator Malcolm Wallop, who had long wondered why the United States poured billions of dollars into defense without developing ballistic missile defenses. The paper intrigued Wallop and he invited Hunter in 1978 to a symposium on strategic defense. At this symposium, primarily attended by conservative defense intellectuals, Hunter met and befriended several future members of the Reagan administration.[152] The excitement of these defense officials and news of Army and Air Force opposition to missile defense led Wallop to begin a series of informal briefings for other senators to convince them of the promise of strategic defense.[153] The sensitivity of the topic, which would likely violate the Anti-Ballistic Missile Treaty, meant that Wallop had to engage in organizational maneuvering to gain industry participation and an audience.[154] Wallop's efforts were rewarded as interest in the orbital DEW concept, Maxwell Hunter recalled, began "spreading beyond all expectations."[155]

The development of a political constituency for orbital DEWs was further extended in 1979 by Wallop. During that summer he published an article entitled "Opportunities and Imperatives of Ballistic Missile Defense" in a conservative strategic policy journal. In this paper Wallop advanced Hunter's core claim to a broader audience, arguing that "several dozen laser weapons systems deployed in space would revolutionize the strategic equation as we have known it for nearly two decades... by decisively tipping the balance of modern warfare in favor of the defense and radically mitigating the potential destructive effects of war."[156] Critically, this paper made its way into the hands of then-candidate Reagan, who had a deep dissatisfaction with the MAD status of the American strategic posture.[157] This article and a later meeting between Reagan and Wallop would lead Reagan to bring retired General Daniel Graham, a missile defense advocate, into his campaign as an advisor.

While Graham had been a longtime advocate of missile defense, his inclusion in Reagan's campaign brought the potentials of space technologies for missile defense to his attention.

152. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 233-234

153. ibid., 238

154. This included having industry officials attend only in an unofficial and volunteer capacity.

155. Quoted in: Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 242

156. Malcolm Wallop, "Opportunities and Imperatives of Ballistic Missile Defense," *Strategic Review* 7, no. 4 (1979): 18

157. Baucom reports that "Reagan described this doctrine as being like a situation in which each of two men attempts to control the other by pointing a cocked and loaded gun at this head. If either flinched, they would both die."Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 249; Also see the discussion in Chapman, *Space Warfare and Defense: a Historical Encyclopedia and Research Guide*, 219-221; James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, California: Stanford University Press, 2011), 187-188

As a consequence of this Graham came to believe that a new form of strategic stability between the United States and Soviet Union could be achieved, premised on weaponizing space and made missile defense a key part of the Republican platform.[158] However, after the election of Reagan there was little progress on missile defense as a consequence of Secretary of Defense Casper Weinberger's skepticism of space technologies. The missile defense constituency built by Wallop and Hunter would see little progress due both to this administration and armed service opposition.[159] This lack of progress led Graham and Wallop to spearhead the creation of an advocacy group in 1981 at the Heritage Foundation—the High Frontier Panel.[160]

The composition of the High Frontier Panel was designed to exert maximum influence on the Reagan Administration—its membership was comprised of prominent Republicans who had ties to Reagan and included Reagan's science advisor, George Keyworth, as an observer.[161] The mission of the panel was to explore initiatives that

> include measures for the exploitation of space; for assuring its continued availability to us. Space-borne ballistic missile defense and other defense systems which will make possible a break-away from the stultifying constraints and brooding menace of the Mutual Assured Destruction (MAD) syndrome will be put forward. A strategy of Assured Survival for ourselves and our allies would take its place.[162]

Despite Graham and Wallop's advocacy for space systems on this panel, consensus was only formed around the need to develop point defense systems with space systems being deployed in the medium to long-term. Crucially, one of the key opponents to space systems was George Keyworth who believed that the claims over the development of space systems were too speculative to be actionable.[163] Another point of conflict between Graham and the other members was

158. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 251-255

159. For example, they proposed creating an office for investigating space DEWs in the Air Force and the Air Force leadership reacted by proposing to staff the office with officers who had failed to achieve promotion. This was meant to ensure that the office was viewed as a dead end position. The Air Force and other services resisted these plans because they feared it would draw resources away from their own priorities. ibid., 261, 264, 266-267; Edward Reiss, *The Strategic Defense Initiative* (New York, New York: Cambridge University Press, 1992), 93

160. During this same year Graham also engaged in the ritual of publishing an advocacy piece in the *Strategic Review*. "Toward a New Strategy: Bold Strokes Rather than Increments" rehashed many of the same arguments posed by Wallop and Hunter. See: Ret. Lieutenant General Daniel O. Graham, "Toward a New U.S. Strategy: Bold Strokes Rather than Increments," *Strategic Review* 9 (Spring 1981): 9–16

161. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 274-279, Reiss, *The Strategic Defense Initiative*, 52

162. Daniel O. Graham, *High Frontier: a New National Strategy* (Washington, District of Columbia: High Frontier Inc., 1982), v

163. This was partly the consequence of Edward Teller's inclusion on the panel as he strenuously argued for an

what role that the panel should play: Graham wanted to engage in strenuous public advocacy for space DEWs whereas the others preferred a quieter advisory role. It was in this advisory role that the panel met with Reagan in January 1982 to present their findings, however, little was done due to the opposition of Keyworth and Weinberger.[164]

The lukewarm reception of the Reagan Administration and the cautious approach of the High Frontier Panel led Graham to make public the more speculative claims about weaponizing space by publishing a white paper entitled "High Frontier: A New National Strategy" in order to generate public pressure.[165] The basic wager of Graham's articulation of these ideas is this:

> Our best hope is to change our strategy and to move the key competition into a technological arena where we have the advantage. A bold and rapid entry into space, if announced and initiated now, would end-run the Soviets in the eyes of the world and move the contest into a new arena where we could exploit the technological advantages we hold.[166]

This "bold and rapid entry" would have two dimensions: first, the economic development of orbital space by constructing orbiting solar arrays to revolutionize the production of power and trigger the commercial development of space industry.[167]

The second was the weaponization of space for strategic defense across two stages. These stages were meant to begin the process of space weaponization by initially drawing on existing technologies to provide "Global Ballistic Missile Defense" with the long term deployment of more exotic technologies. The first stage was characterized by the development of a "multiple kill, orbital system." Rather than relying on DEWs, these would be satellites hosting multiple kinetic interceptors that would target Soviet missiles during the boost phase. These would be augmented in the second phase with advanced missile tracking systems, ground[168] and space based anti-missile laser systems, as well as a "high performance space plane." The

---

exotic proton beam weapon that depended on the detonation of a nuclear bomb. Keyworth stated "it's an area, in my opinion, where there has been a definite lack of expert involvement and, I would say, there have been a lot of unrealistic arguments made for accelerating the program." Quoted in Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 287, 295

164. ibid., 297

165. ibid., 307-311 The report was published under his name but discusses and credits the work of the panel in the forward. Graham, *High Frontier: a New National Strategy*, xi-xii. In keeping with the technological symbology of this line of advocacy, the cover was adorned with an image of the Space Shuttle launching.

166. ibid., 3

167. ibid., 6, 31-47

168. The beams of these lasers would be aimed by orbiting mirrors which would direct them onto targets.

former weapons were meant to form the core of a new strategic defensive system, whereas the latter would perform satellite interdiction and protect commercial assets in space.[169] The commercial and military aspects of this proposal were meant to work hand in glove and Graham argues that the United States should follow the structure of the British colonial empire by placing the "equivalent of the British merchantment and men-of-war into space." Reprising Hunter, he argues that this would open an age similar to "Pax Britannica" through the imbrication of military and commercial domination in orbital space.[170]

Figure 4.3: Artist's Conception of the First Stage "Global Ballistic Missile Defense"

The publication of this report, in the words of SDI historian David Baucom, "broke the logjam" on BMD in the Reagan Administration and in late 1982 a White House Science Council was formed to study strategic defense.[171] This council, with little input from the military

169. Graham, *High Frontier: a New National Strategy*, 8, 68-71; See also the discussion in: ibid., 53-55, 115-142
170. ibid., 3
171. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 322

community, would influence the SDI concept in their deliberations. Crucially, the council focused primarily on ballistic missile defense systems that were feasible in the near term, thereby de-emphasizing exotic space systems. Moreover, the proposals were shaped so as to outflank the increasingly powerful Nuclear Freeze movement which further de-emphasized the development of highly exotic technologies that could be perceived as attempting to create a new arms race with the Soviet Union.[172] Of the space systems that remained under consideration, interest primarily focused on the development of ground based laser arrays which would be aimed by orbiting mirrors.[173] These studies along with an increasing consensus for the need for strategic defense culminated in Reagan's 1983 speech that introduced the Strategic Defense Initiative.[174]

On March 23, 1983, with only two days notice to the civilian and military leadership in the Pentagon[175], Ronald Reagan announced the SDI in a nationally televised address. In this speech, Reagan argued that the United State's long-held qualitative technological superiority in strategic nuclear forces was rapidly declining in the face of Soviet technological advances. The risk of Soviet qualitative parity and quantitative superiority in ballistic missiles meant that MAD was an increasingly fragile construct. After developing these claims, Reagan posed this question to the American people: "What if free people could live secure in the knowledge that their security did not rest upon the threat of instant U.S. retaliation to deter a Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?"[176] In answer to this Reagan—mirroring the claims of Hunter, Wallop, and Graham—argued that the United States should take advantage of its technological superiority

172. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 356, 358, 380; Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 187; Reiss, *The Strategic Defense Initiative*, 36

173. This is because it increased the survivability of laser systems (it would be easier and cheaper to replace an orbiting mirror than a laser system) and the promises of miniaturization were still hypothetical. Crucially, this new focus brought Reagan's science advisor—George Keyworth—on board for the development of laser systems. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 323

174. The Joint Chiefs of Staff and the Deputy Advisor for National Security Affairs Robert McFarlane came to press Reagan for the development of strategic defense. ibid., 355, 358-360, 362, 379; Reiss, *The Strategic Defense Initiative*, 42-44

175. While the JCS came to conclude that there was a need for strategic defense, apparently they were kept unaware of the program that Reagan would announce. The lack of coordination and consultation with defense officials (including the Secretary of Defense) would have consequences for the future development of the SDI. Alexander Haig recalled that "the next day in the Pentagon... they were all running around saying 'What the hell is strategic defense?" Quoted in ibid., 38. See also: Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 191

176. Ronald Reagan, *Address to the Nation on Defense and National Security*, [Online; accessed 10-May-2017], March 23, 1983, `https://reaganlibrary.archives.gov/archives/speeches/1983/32383d.htm`

to develop new missile defense technologies. The development of new BMD technologies for Reagan not only held out the promise of eliminating the potential of nuclear war, but also the very weapons themselves.[177] After the speech, Reagan briefed the JCS and other civilian defense officials but directed the National Security Advisor—a political appointee—to develop the implementation plans.[178]

By the time that the SDI was announced, what had been a grand vision of "Pax Americana" exercised through the military and economic domination of orbital space became an effort to develop ground and space based BMD systems.[179] Despite these more limited aims, the public association of Graham with the program and the perceived exotic nature of the space systems under consideration led to the SDI being mockingly referred to as "Star Wars."[180] The expansive and perhaps overly speculative visions of Graham and Hunter were filtered through Reagan's policy making process and became a set of development programs. Despite some interest from the Reagan Administration in commercializing space transport, little interest was expressed in exploring orbital solar arrays or industrialization.[181]

The SDI was the process of civilian advocacy like RAND, however, unlike RAND the line of advocacy embodied in *High Frontier* had less impact on space policy. It is not clear that this is the result of technological limitations, the underlying technologies for satellite photo-reconnaissance during the most intense period of RAND advocacy were still nascent.[182] While Edward Teller's proton beam satellites were expensive, politically fraught[183], and largely hypothetical, Hunter and Graham's chemical lasers existed and were rapidly increasing in power and decreasing in size.[184] It is unclear why exactly Reagan advanced this specific vision, many

177. Reagan, *Address to the Nation on Defense and National Security*

178. NSDD 85: Eliminating the Threat from Ballistic Missiles (687684) [Electronic Record]; National Security Decision Directives (NSDDs), 1/20/1981 - 1/20/1989, Numbered Security Policy Papers, 1981 - 1989, National Archives, Washington, D.C

179. The main talking points about the SDI distributed several months after the speech continue the same themes. NSDD 172: Presenting the Strategic Defense Initiative (6879765) [Electronic Record]; National Security Decision Directives (NSDDs), 1/20/1981 - 1/20/1989, Numbered Security Policy Papers, 1981 - 1989, National Archives, Washington, D.C

180. Chapman, *Space Warfare and Defense: a Historical Encyclopedia and Research Guide*, 120

181. NSDD 94: Commercialization of Expendable Launch Vehicles (6879693) [Electronic Record]; National Security Decision Directives (NSDDs), 1/20/1981 - 1/20/1989, Numbered Security Policy Papers, 1981 - 1989, National Archives, Washington, D.C.

182. Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*, 10, 27

183. They relied on the detonation of a nuclear weapon to fire.

184. Baucom, *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*, 230-231, 277, 322; Reiss, *The Strategic Defense Initiative*, 43

of the key players in the administration were kept in the dark as to the details of the program.[185] What is clear is that Reagan had been for some time focused on the issue of strategic defense, and took a particular interest in it during a visit in 1979 to NORAD wherein a commander informed Reagan that nothing could be done to protect against a nuclear strike (see note 156). Various constituencies had concurred with Reagan on the need for a new strategic paradigm and some had suggested space-based systems as a solution. The consequence of various political filtering processes and Reagan's own particular focus on strategic defense (and not necessarily weaponizing space) likely led to this more limited vision.

Compared to the Eisenhower Administration's promulgation of NSC 5520 and the influence of RAND this is not surprising. The overarching strategic concern of Eisenhower when NSC 5520 was drafted—strategic surprise attack by the Soviet Union—could be straightforwardly addressed through the development of photo-reconnoissance satellites. Moreover, satellite overflights of the Soviet Union necessitated the development of a norm of free overflight by artificial satellites. In the case of Eisenhower, the technological resolution to his overall policy concern *necessitated* the status of orbital space being a primary concern. In the case of Reagan, his focus on strategic defense could (potentially) be achieved by following any number of ground and space based technological programs and thereby the status of orbital space was a secondary concern. This outcome is more theoretically expected than the RAND influence: the conceptual work of distinctive military advocacy for a new domain necessarily centers the status of a new military space. The alliance building process of Hunter, Wallop, and Graham meant that their military and commercial vision of orbital space was subject to contestation and modification from other parties. Due to the socialization processes of the military, military advocates are far more likely to hew to foundational concepts for their vision of warfighting. Moreover, the comparison to RAND is instructive—the RAND advocates had a shared institutional structure and established (if not always effective) pathways for lobbying and alliance building. What this suggests is that the success of a domain vision is unlikely to be the work of independent visionaries. Shared institutional structures allow for the coalescing of advocacy

185. These included the Secretary of Defense, Secretary of State, JCS, White House Science Council, White House Science Advisor, Under-Secretary of Defense for Research and Engineering, Director of DARPA, and DARPA's Director for Directed Energy Research all were kept largely in the dark until days or hours before the speech. Reiss, *The Strategic Defense Initiative*, 38-40

around foundational wagers and form constituencies which advance these wagers.[186] The external nature of this process and lack of consultation meant that little support would come from the services when the Strategic Defense Initiative began to receive funding the next year.

4.4.3 The Military and the SDI

The background against which Reagan announced the SDI was defined by a movement by the services to further develop their involvement in space through the creation of Space Command. This was not born of a desire to weaponize space, but rather the desire of Air Force leadership to 'operationalize' space by integrating the long-distinct Air Force space cadre into the overall service.[187] However, the extant integration of space systems into separate commands and the distinct culture of Air Force space personnel meant that the Air Force Space Command would not be able to seize on the SDI. Furthermore, the lack of consultation with the services and the constraining influence of "space for peaceful purposes" would mean that the space aspects of SDI would falter, ending in a theater defense program.

In the Air Force, as with the *High Frontier* advocates, the development of the Space Shuttle renewed interest in the military uses of orbital space. In response to the potential for cheaper transport of payloads to space, the Air Force began to study how to 'operationalize' space.[188] This is because, after the cancellation of MOL, management of space systems had been assigned to Air Force commands on the basis of function: Air Force Systems Command (AFSC) ran communications satellites and development programs, Strategic Air Command

186. This is perhaps reflected in the fact that the administration's public rationale for the SDI was ever shifting and at times incoherent during Reagan's presidency. At various times the purpose of the SDI was described as: strategic defense, "assured survival," deterrence, a bargaining chip for arms negotiations, an attempt to "transform the relationship with the Soviet Union," the elimination of nuclear weapons, a minor research and development program or a fundamental redefinition of American grand strategy.Reiss, *The Strategic Defense Initiative*, 52-59

187. I focus primarily on the Air Force in this section because it controlled approximately 80% of the funds for military space programs.Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 180 Additionally, much of this account follows from Spires 1998 as it is the most referenced source for much of the military space history for this period. Most of the documents utilized by Spires are alas not readily accessible to the public.

188. Following the successes of the Apollo program in the late 1960s and the cancellation of MOL the Air Force space community went into disarray. The senior leadership of the Air Force quickly lost interest in space issues as their remaining programs were largely development and management for the intelligence community or joint service efforts. Being that the only Air Force space programs were conducted in a support role the senior leadership of the Air Force put little thought or effort into space. Moreover, this lack of interest in space meant that there were few career progression and promotion opportunities for personnel specializing in space systems, which weakened the hand of any potential advocates.ibid., 174-176

(SAC) managed meteorological satellites, and the Aerospace Defense Command (ADC) operated surveillance and early warning satellites. The activation of the Space Shuttle and the development of the Global Positioning System satellite network promised to strain this existing management structure by blurring functional lines.[189]

Another issue that drove the Air Force's attempt to 'operationalize' space were the cultural gaps within the Air Force space community. The roots of the Air Force space community in the research and development focused Western Development Division meant that they saw themselves as technicians and not warriors.[190] Moreover, the split management structure (involving the AFSC, SAC, and ADC) meant that these technicians developed their own subcommunities and participated in the turf battles between the commands. The Air Force leadership saw a need to unify these disparate communities and integrate them into the operational culture of the Air Force if they were to take advantage of these satellite and space systems.[191] Overall, the increasing management burden, coordination issues, and cultural divides led the Air Force senior leadership to consider the creation of an independent command to consolidate Air Force space activities.

These currents converged in the early 1980s when, after the election of Reagan promised an infusion of defense funds, the Air Force Senior leadership decided to push forward the activation of the Air Force Space Command in March 1982. The mission of the command, the first commander argued, was to *operationalize* space: the command would provide "a focus for centralized planning, consolidated requirements and an operational advocate and honest broker for USAF space systems. We will provide the operational pull to go along with the technology push which has been the dominant factor in the space world since its inception."[192] This 'operationalization' of space through the creation of the Air Force Space Command was also a bureaucratic maneuver to assure continued Air Force control over space systems. One of the core tensions for military space development for this period was whether space was a mission which required a distinct force structure or if it was merely an operating medium (Aerospace.)

189. Curtis Peebles, *High Frontier: the U.S. Air Force and the Military Space Program* (Washington, District of Columbia: Air Force History / Museums Program, 1997), 72; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 182

190. The space systems development community would end up being housed in the AFSC after the Western Development Division was deactivated. Lt Col J. Kevin McLaughlin, *Military Space Culture*, [Online; accessed 10-May-2017], n.d. `https://fas.org/spp/eprint/article02.html#iiia1`

191. ibid.; Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 176, 195

192. ibid., 205

As part of the creation of Space Command, the newly appointed Air Force Chief of Staff resurrected the Aerospace concept in official Air Force doctrine. However, this new articulation of Aerospace focused on how space operations contributed to the fulfillment of Air Force missions in other media.[193] Another aspect of the creation of the Air Force Space Command was the hope by the Air Force leadership that it would be nucleus around which a distinct United States Space Command could be formed, thereby ensuring continued Air Force domination of space funding and operations.[194] Given the extant Air Force domination of military space, it was the Army and Navy who pushed for a joint United States Space Command as it would solidify their role in space operations.[195] Despite this, the United States Space Command after it was activated in 1985 largely reflected the prerogatives of the Air Force Space Command.[196] Therefore, the organizational developments in military space during the run-up to the SDI reprised some of the themes of the earlier military space developments: organizational maneuvering by the Air Force to maintain their own prerogatives.

After the SDI was announced, the services had hoped that the United States Space Command would take the lead role in developing the SDI BMD in space.[197] However, the dominant position of the Air Force meant that the bulk of the SDI space research funds were directed to the AFSC and not to programs directly controlled by the US Space Command.[198] The flow of funds to the AFSC as opposed to the Air Force Space Command was a function of internecine politics—AFSC, SAC, ADC all put up bureaucratic roadblocks to transferring programs to the Air Force Space Command (and by extension, US Space Command.)[199] Moreover, the lack of consultation with the senior service leaders meant that there was little interest in the strategic defense programs, which threatened various existing fiefdoms and focal points of technological development. A retired Air Force general from this time stated "there's no strong support for the [SDI] in the hard-core Air Force, the Tactical Air Command[200] types, and there's even less

193. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 206-207

194. The press release announcing the activation of the command ended by stating "It is the Air Force's hope and belief that Space Command will develop quickly into a unified command." Quoted in: ibid., 205

195. Insofar as the joint command would permanently include elements from all three services.

196. Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 206, 215, 218

197. ibid., 218

198. Reiss, *The Strategic Defense Initiative*, 59

199. The AF Space Command would not finish consolidating its authority until the late 1990s. See discussion: Spires, *Beyond Horizons: a Half Century of Air Force Space Leadership*, 210-215 These struggles also meant that the Air Force Space Command failed to update its doctrine, mission or make any other major modifications due to an inability to achieve consensus amongst the different Air Force Space constituencies. ibid., 221

200. TAC officers had risen to leadership positions following the Vietnam War.

in the Navy, which doesn't really have a piece of this."[201] Rather, the SDI "programme was a new channel of funding to existing empires, rather than a new empire itself."[202]

Another constraining factor on the development of SDI space systems was the policy of "space for peaceful purposes." One of the core tensions was whether and how the SDI programs violated the 1972 Anti-Ballistic Missile Treaty which expressly prohibited the development of space based BMD.[203] The Reagan Administration had relied on baroque interpretations of the treaty in order to argue that it did not constitute a violation. However, the restrictions on space-systems in the treaty had become bound up with the norm of "space for peaceful purposes." The threat that the SDI posed to this norm and the fear of a potential arms race meant that there was massive political and civil society opposition. The practical effect of this was that funding for the SDI was tightly controlled, a moratorium was placed on testing satellite interceptors, and many key researchers refused to participate in SDI programs.[204] The effect of these currents together with poor program management meant that over the course of Reagan's presidency the SDI scope progressively diminished until it became focused on battlefield and theater missile defense.[205]

The overall failure of the SDI to revolutionize space policy is founded on two factors. First, the development of the core revolutionary vision of space by independent visionaries. The roots of the space dimensions of the SDI sprung forth from the alliance building activities of an aerospace engineer, senator, and retired general. Building the political alliances necessary to bring these ideas before the Reagan administration necessitated subjecting the expansive space visions to contestation and re-interpretation. Second, was the lack of interest from the services

201. The Navy received only 5% of SDI funds in the first year. Reiss, *The Strategic Defense Initiative*, 62, 89

202. ibid., 89

203. The relevant treaty text reads

> Further, to decrease the pressures of technological change and its unsettling impact on the strategic balance, both sides agree to prohibit development, testing, or deployment of sea-based, air-based, or space-based ABM systems and their components, along with mobile land-based ABM systems. Should future technology bring forth new ABM systems "based on other physical principles" than those employed in current systems, it was agreed that limiting such systems would be discussed, in accordance with the Treaty's provisions for consultation and amendment.

USA-USSR, *TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYSTEMS*, [Online; accessed 7-May-2017], 1972, `https://www.state.gov/www/global/arms/treaties/abm/abm2.html`

204. Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 200-202; Reiss, *The Strategic Defense Initiative*, 88-89; Sheehan, *The International Politics of Space*, 103-105

205. Chapman, *Space Warfare and Defense: a Historical Encyclopedia and Research Guide*, 123-125

and the trouble in establishing the Air Force and United States Space Commands. The integration of space systems into distinct commands on the basis of function by the Air Force blocked the development of comprehensive advocacy because of intra-service rivalry and cultural differences. Together, these demonstrate the necessity for slow developing distinctive advocacy in a shared institutional environment. These social and institutional dynamics encourage coherence and regulate potential deviation from core wagers as well as ensure a continuity of vision.

4.5 Alternative Explanations

Perhaps one of the most powerful alternative explanations for why orbital space was not weaponized during the 1960s rests on technological determinism: that orbital mechanics[206] are too difficult and space technologies too expensive for orbital space to have become an arena of direct conflict.[207] This explanation would then hold that the *political* and prestige uses of space were the most obvious paths to pursue in the development of space technologies. However, this explanation is not convincing for four reasons: first, Dyna-Soar, the premier Aerospace weapons system, was not canceled primarily because of concerns about cost or technological limits. Rather, it was canceled both because of political considerations and the inability of the Air Force to justify its continued development. The program was in an advanced stage of development and was canceled shortly before its first scheduled flight outside of the atmosphere. To be sure, Dyna-Soar represented a trans-domain hybrid capability but it also would have enabled the potential for a direct confrontation between military space systems. Second, this does not explain why the services were never able to place a "military man" in orbit, something which almost certainly would have driven advocacy for military space systems. Third, one of the greatest potential objections—the cascading failure of space systems due to the generation of a debris field in orbital space—was not described until 1978.[208] Thus, this only became a concern after the policy of "space for peaceful purposes" had become both socially and legally codified. Finally, this presumes that a rational assessment of technological limits and potentials

206. For example, the problem of space debris.

207. For a recent reflection on this see: Martin Libicki, "Why Cyber War Will Not and Should Not Have Its Grand Strategist," *Strategic Studies Quarterly* 14, no. 1 (Spring 2014): 28

208. Michelle La Vone, *Kessler Syndrome: 10 Interesting and Disturbing Facts*, Space Safety Magazine, [Online; accessed August 3, 2017], n.d. `http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/`

drives developmental pathways and the envisioning of warfare in a new domain. The maintenance of strategic bombing as a core doctrine by the Air Force, despite repeated signs that it is ineffectual, reveals that military thinking does not operate according to this premise.

As to other potential alternative explanations, such as structural pressure, there is little evidence to suggest that the United States developed a civilian space program to counter Soviet space innovation. Unfortunately, there are few sufficiently accurate or detailed accounts of early Soviet space history through which to assess my theoretical claims on domain development for the crucial period in the run-up to the Sputnik Crisis.[209] What is known, is that the Soviet space program was run by their equivalent of Army Ordnance and that the United States knew this during the period of the Sputnik Crisis.[210] Despite the widespread perception that the Soviet space program was fundamentally military in nature[211] The United States pursued a primarily civilian program and ultimately stemmed the development of any armed space systems. Moreover, the decade prior to the SDI saw the Soviet Union develop Anti-Satellite Missiles and establish the PKO—a unit within their Strategic Missile Forces to operate these systems—and yet the United States did little to respond. By the mid-1980s both states observed an informal moratorium on Anti-satellite weapon testing.[212] The SDI episode also challenges the core premise of structural accounts such as Posen's as the SDI was a direct response to the potential for Soviet parity in nuclear forces. However, the SDI largely failed, not because of problems with technological systems, but because of the organizational politics of the military and the norm of "space for peaceful purposes." What this suggests is that the United States neither sought to emulate Soviet space development nor innovate to directly challenge it. That being said, the spread and codification of "space for peaceful purposes" seems to confirm normative emulation, however, it does not possess causal power for initial space developments.

4.6 Conclusion

The technologies that enabled military activity in orbital space demonstrate two of the potential outcomes that can occur during domain development: integrated capabilities and a support

209. William P. Barry, "Foreword," in *Cold War Space Sleuths: The Untold Secrets of the Soviet Space Program*, ed. Dominic Phelan (New York, New York: Springer-Praxis, 2013), xiii; Asif Siddiqi, *Challenge to Apollo: The Sovet Union and the Space 1945-1974* (Washington, District of Columbia: NASA History Office, 2000), xi

210. ibid., 33; McDougall, *...the Heavens and the Earth*, 141-143

211. For example, there were contemporary concerns that Sputnik II could carry a nuclear warhead. ibid., 142

212. Sheehan, *The International Politics of Space*, 102-103

domain. These two developmental paths intersected with, and developed alongside, one another. The early moves to develop space-launch technologies as guided missiles by the services meant that distinctive advocacy could never form as the technologies were woven into existing service conceptions of war. This pathway is most clearly demonstrated by the Air Force, which viewed ICBMs as a threat to their core mission—strategic nuclear delivery—and sought to integrate them into their existing conception of war. Thus, one of the core drivers of the Air Force approach to space was a form of technological anxiety: automated space and missile systems fundamentally challenged the central role of the human in warfare and by extension, the bomber. Further, this anxiety shot through the Air Force's attempt to weaponize space with the Aerospace Domain. The 1960s effort to promote this concept was limited by a need to justify the place of the human in weapons systems and a commitment to maintaining the extant Air Force conception of war. The long-term integration of satellite systems by function into different Air Force commands led to a cultural and organizational splintering of the Air Force space community. This meant that when there was a potential political opening for advocacy when Reagan announced the SDI, the struggling Air Force Space Command was not able to leverage existing advocacy or organizational legitimacy. Together, these blinkered the military vision of orbital space that the Air Force would offer.

Second, the development of space as a support domain was a function of the lack of credible advocacy from the armed services prior to the Sputnik Crisis. The integration of launch technologies as guided missiles and the organizational sparring over satellite systems that predated the Sputnik Crisis both delegitimized the services and prevented centers of advocacy from forming. Instead, when space policy came under deep civilian intervention following Sputnik, the RAND corporation conception of space would dominate: a civilian space program giving cover to strategic surveillance. This is because the RAND corporation was the only clear space advocacy center that existed prior to Sputnik, and articulated a compelling rationale—that the satellite was fundamentally a political weapon. The satellite as a political weapon necessitated an overt civilian space program to cultivate ideological prestige and a non-weaponization of space which could threaten the overflight needed for strategic surveillance. This latter dimension would mean that the permitted space systems, photo-reconnaissance, and other remote sensing technologies would be employed to support military operations in other domains. The long run effect of this was that it enhanced the functional integration of satellite systems into existing conceptions of war which undermined the ability for later advocacy to form.

That neither of these outcomes could be effectively challenged or altered by the Aerospace Domain or the High Frontier advocates demonstrates the necessity of a specific form of domain advocacy—slow building bottom-up distinctive advocacy. RAND advocates' success, while not theoretically expected in itself, contributes to this interpretation because it demonstrates several theoretically expected features. The formation of RAND advocacy was defined by benign neglect, a shared institutional site, the slow development of a distinctive vision, and a belief in the necessity of active advocacy. That the RAND advocates articulated the satellite as a political weapon is not expected, however, I suggest that this was a function of the differences in socialization between the RAND analysts—who were civilian—and military officers. The socialization of military personnel into *fighting wars* means that their thinking is canalized towards articulating new technologies within the grammar of military confrontation. But, this thinking is necessarily limited if it is conducted by the senior leadership of a service as the failure of Aerospace demonstrates that top-down attempts to revolutionize a service conception of warfare fail for two reasons. First, because it challenges the core identity of the service. Second, because the rigors of bottom-up advocacy demand serious and sustained thought contributing to the development of a distinct war imaginary. Institutionally, the Air Force raison d'etre was constituted by the image of the "fighting man in the airplane" and the automation and non-aerodynamic nature of space systems fundamentally challenged this. Therefore, both the acceptance and envisoning of Aerospace faced internal conceptual limitations and resistance. The Air Force leadership was drawn to either technological justifications for Aerospace Supremacy or the basic necessity of developing "man-in-space" capabilities. Consequently, the Air Force was never able to justify non-support space systems to civilian politicians.

The failure of the High Frontier advocates further contributes to this conclusion by demonstrating the failures of independent external advocates. That this line of advocacy was directed by a set of independent civilian advocates necessitated that they engage in political alliance building in order to get a hearing. While the process of domain advocacy necessitates alliance building, the military nature of distinctive domain advocacy and a shared institutional site means that they are better to maintain their core wagers. Thus, the process of public political alliance building meant that their vision was subject to contestation and reformulation as it progressed towards a hearing by the Reagan administration. This meant that when the SDI was announced, it did not embody the expansive vision of "Pax Americana" advanced by these advocates and instead was a suite of BMD development programs. Further, the lack of service

consultation and the long-run effects of integrating space systems meant that there was largely no service buy-in for the programs.

The overall failure of the SDI also indicates that the status of a domain becomes institutionally and socially sticky over time. The ABM treaty that the SDI likely violated was viewed as part of the American commitment to "space for peaceful purposes." Moreover, the fact that the ABM treaty expressly prohibited the development of BMD in orbital space and the 1967 Outer Space Treaty formalized the international status of orbital space demonstrates how domain visions become encoded into the institutional infrastructure of the world order.[213] That orbital space should be peaceful had become a form of "common sense" by the time of the SDI which helped fuel civil society opposition. The speed of the social acceptance of this vision of space can even be seen during the period of the promotion of the Aerospace Domain. Over time the justifications for Air Force activity in orbital space proffered in the *Airman* magazine became more and more careful to avoid the appearance of violating this policy.

If these beliefs and norms that restrain the weaponization of orbital space will be permanent is uncertain. One of the few political scientists who works on the politics of orbital space, Michael Sheehan, argues that civilian competition in orbital space during the Cold War functioned as a safety release valve between the United States and Soviet Union.[214] Notably, there has not yet been a direct and sustained military conflict between spacefaring nations and therefore adversary space systems have yet to be contemplated as targets during a military operation. I posit that the support domain and peaceful status of orbital space is only likely to come under serious contestation or modification in the case of a large-scale military confrontation between spacefaring states. In particular, if the conflict includes a state that has recently

213. The Outer Space Treaty expressed that:

- The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind.
- Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.
- States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner.
- The Moon and other celestial bodies shall be used exclusively for peaceful purposes

UN General Assembly, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)*, [Online; accessed 7-May-2017], 1967, `http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html`

214. Sheehan, *The International Politics of Space*, 105

developed spacefaring capabilities. I make this claim for two reasons: first, the exigencies of large-scale conflict could provide the "oomph" to break with prior consensus and overcome existing institutions. Second, that a newly spacefaring state could either lack the same domestic set of institutions that would challenge any attempt to weaponize space or could develop a body of powerful space warfare advocates. For example, the development of spacefaring by China over the last decade has seen the People's Liberation Army seriously consider the implications of space warfare.[215] At the same time, the United States military has begun to again consider the possibility of war in space, including the 2017 announcement of a new space warfare directorate by the Air Force.[216] Unfortunately these developments are too recent for any extended discussion, however, they do suggest that the peaceful and support status of orbital space may be fundamentally altered in a conflict between China and the United States.

215. Pollpeter, "Space, the New Domain: Space Operations and Chinese Military Reforms"

216. Shannon Stirone, *Our Next World War Might Be Fought in Outer Space*, [Online; accessed 20-May-2017], 2017, https://newrepublic.com/article/142365/next-world-war-might-fought-outer-space-trump-reagan; Secretary of the Air Force Public Affairs, *Air Force Stands Up New Headquarters Space Directorate*, [Online; accessed June 16, 2017], 2017, http://www.afspc.af.mil/News/Article-Display/Article/1217866/air-force-stands-up-new-headquarters-space-directorate/. United States Space Command was deactivated in 2001 and the Air Force Space Command has come to largely focus on computer network operations.Chapman, *Space Warfare and Defense: a Historical Encyclopedia and Research Guide*, 79

Chapter 5

This New Geography

> We have become, rather than gatherers of the past, hunters in cyberspace.
> —Bill Black, Former Director of Information Warfare at NSA[1]
>
> This is America's gift to warfare.
> —Admiral William Owens[2]

5.1 Post-Kinetic Warfare?

Some fifty years after the rising anxieties over "push-button warfare" helped to scuttle the development of the Aerospace Domain, a new domain premised purely on the pushing of buttons is coming into existence. While the parameters of the air and orbital space domains have, through socialization and institutionalization, become inscribed in the "common sense" of military activity, the status of Cyberspace as a domain still remains under contestation.[3] Moreover, Cyberspace—as an arena of conflict—has inspired and continues to inspire a veritable cottage industry of prognostication from scholars, journalists, and practitioners.[4] This profusion of prognostication is symptomatic of the rapidly evolving information and communication

1. Quoted in: Inside Defense, "AFTER 40 YEARS AT NSA, BILL BLACK IS SIGINT WORLD'S AGENT FOR CHANGE," *Inside Defense*, 7-4-2002, `https://insidedefense.com/inside-pentagon/after-40-years-nsa-bill-black-sigint-worlds-agent-change`

2. Quoted in: Douglas Waller and Mark Thompson, "Onward cyber soldiers," *Time Magazine* 146, no. 8 (8-21-1995): 39

3. Cf. The point / counterpoint between former NSA Director Michael Hayden and RAND analyst Martin Libicki. Libicki, "Cyberspace is a not a Warfighting Domain"; Hayden, "The Future of Things "Cyber""

4. A representative selection: Betz and Stevens, *Cyberspace and the State: Towards a Strategy for Cyber-Power*; Joel Brenner, *Glass Houses: Privacy, Secrecy, and Cyber Insecurity in a Transparent World* (New York, New York:

technologies underpinning Cyberspace and to what uses they are being put in politics, media, culture, diplomacy, warfare, etc. A marquee example of this is the contemporary (2016-2017) controversy over Russian cyber-intrusion into the 2016 U.S. Election. One of the core political tensions over this event is whether to characterize it as an "act of war" or espionage/subversion.[5] Whereas a foreign military aircraft dropping a bomb on the territory of the United States or a U.S. military installation would almost certainly be understood within the grammar of war, the interpretation of state-to-state computer network operations (CNO)[6], while clearly moving into the grammar of war, is still unsettled.[7] As Michael Hayden puts it: "we haven't gotten the deeper understanding required to really operate in this domain—what constitutes normal state-to-state activity, what constitutes a crime, what constitutes espionage, what constitutes war."[8]

These tensions and contestations are a sign that the Cyberspace Domain is still undergoing development, as the basic interpretive schema for inter-state interactions in Cyberspace is not settled. I argue in this chapter that Cyberspace is, as of 2017, in the realization phase of

---

Penguin, 2013); Richard A. Clarke and Robert Knake, *Cyber War: The Next Threat to National Security and What to Do About It* (New York, New York: Ecco, 2011); Choucri, *Cyberpolitics in International Relations*; Gartzke, "The myth of cyberwar"; **thermnukelindgart**; Kello, "The Shape of Cyber Danger"; Ted Koppel, *Lights Out: A Cyberattack, A Nation Unprepared, Surviving the Aftermath* (New York, New York: Crown, 2015); Nye Jr, "Nuclear Lessons for Cyber Security?"; Dennis F. Poindexter, *The New Cyberwar: Technology and the Redefinition of Warfare* (New York, New York: McFarland, 2015); Rid, *Cyber War Will Not Take Place*; Adam Segal, *The Hacked World Order* (New York, New York: PublicAffairs, 2016); P.W. Singer and Allan Friedman, *Cybersecurity and Cyberwar: What Everyone Needs to Know* (New York, New York: Oxford University Press, 2014); Valeriano and Maness, *Cyber War versus Cyber Realities: Cyber Conflict in the International System*; Gabriel Weimann, *Terrorism in Cyberspace: The Next Generation* (Washington, District of Columbia: Woodrow Wilson Center Press, 2015)

5. Morgan Chalfant, "Democrats step up calls that Russian hack was act of war," [Online; accessed June 20, 2017], *The Hill*, 3-27-2017, `http://thehill.com/policy/cybersecurity/325606-democrats-step-up-calls-that-russian-hack-was-act-of-war`; Kristine Philips, "Cheney Delivers a statement on Russian meddling: It's an 'act of war'," [Online; accessed June 20, 2017], *Washington Post*, 3-28-2017, `https://www.washingtonpost.com/news/the-fix/wp/2017/03/28/cheney-is-the-latest-republican-to-call-russias-alleged-meddling-in-u-s-elections-an-act-of-war/?utm_term=.53f6a38fe487`; Morgan346 Chalfant, "Former CIA director: Don't call Russian election hacking 'act of war'," [Online; accessed June 20, 2017], *The Hill*, 4-11-2017, `http://thehill.com/policy/cybersecurity/328344-former-cia-director-dont-call-russian-election-hacking-act-of-war`; Max Boot, "Was Russia election hack an act of war?: Max Boot," [Online; accessed June 20, 2017], *USA Today*, 4-6-2017, `https://www.usatoday.com/story/opinion/2017/04/06/russia-election-hack-act-of-war-max-boot-column/100030944/`. Further, the unique composition of cyberspace, a non-territorial "space" composed of what is functionally infrastructure, poses unique challenges to international law. See: Michael N. Schmitt, ed., *Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations* (New York, New York: Cambridge University Press, 2017)

6. Inclusive of computer network attacks, computer network exploitation, computer network defense.

7. The cyber-utopian debate briefly discussed in the introduction has become a debate over whether Cyberspace represents a global commons or just another "space" subject to militarization and sovereign control. Though, as will be seen in this chapter the latter view has been winning in practice.

8. Quoted in: Chalfant, "Former CIA director: Don't call Russian election hacking 'act of war'"

domain development. This is the phase between the creation of an operationally autonomous command structure and a strategically autonomous command structure.[9] The 2009 creation of the U.S. Cyber Command as a subordinate unified combatant command under the United States Strategic Command was the first creation of an operationally autonomous Title 10 military organization responsible for CNO.[10]

Cyber Command possesses one major theoretically unexpected feature: it is not subordinate to a service arm, but rather a major combatant command—U.S. Strategic Command. As a subordinate unified combatant command, Cyber Command is commanded by the Director of the NSA and is composed of elements of all service departments.[11] It is theoretically expected that a group of distinctive advocates working within a service department would develop this form as a manifestation of their distinctive advocacy. Part of the reason that U.S. cyber forces manifested themselves in this way is the legal tension between intelligence activities (Title 50) and military force (Title 10).[12] The suite of activities that compose CNO blur the distinction between Title 10 and Title 50 activities and are intimately intertwined. This is because the basic activities of preparing for cyberwarfare—the creation of target lists, "weapons," and access vectors—can be accomplished without constituting force under Title 50 authority but the production of effects—the use of force—necessitates Title 10 authority.[13] The structure of Cyber

9. Notably, Marco Rubio, a candidate for the 2016 Republic Presidential nomination, argued during his campaign that a separate Cyber service department should be studied. Gizmodo Staff, "The 2016 Presidential Candidates' Views on Cyber Warfare," [Online; accessed March 2, 2016], *Gizmodo*, 3-1-2016, `https://gizmodo.com/the-2016-presidential-candidates-views-on-cyber-warfare-1760899365`

10. Robert M. Gates, *Memorandum for Secretaries of the Military Departments, Chairmain of the Joint Chiefs of Staff, Under Secretaries of Defense, Deputy Chief Management Officer, Commanders of the Combatant Commands, Assistant Secretaries of Defense, General Counsel of the Department of Defense, Director Operational Test and Evaluation, Director Cost Assessment and Program Evaluation, Inspector General of the Department of Defense, Director Administration and Management, Director Net Assessment, Directors of the Defense Agencies, Directors of the DOD Field Activities; Subject: Establishment of a Subordinate Unified U.S. Cyber Command Under U.S. Strategic Command for Military Cyberspace Operations*, George Washington University National Security Archive, [Online; accessed June 13, 2017], 6-23-2009, `http://nsarchive.gwu.edu/NSAEBB/NSAEBB424/docs/Cyber-029.pdf`

11. 24th Air Force, Navy's 10th Fleet, and the Army Cyber Command.

12. See: Robert Chesney, "Military-Intelligence Convergence and the Law of the Title 10/Title 50 Debate," *Journal of National Security Law and Policy* 5, no. 2 (2012): 539–629; Andru E. Wall, "Demystifying the Title 10-Title 50 Debate: Distinguishing Military Operations, Intelligence Activities, and Covert Action," *Harvard National Security Journal* 3, no. 1 (2011): 85–142

13. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 136-142; *passim* Nolte, "Anticipating Cyberspace Security: NSA's Experience 1992-1997"; Fred Kaplan, *Dark Territory: The Secret History of Cyberwar* (New York, New York: Simon / Schuster, 2016), 125. In this chapter I do not attempt to explain the development of computer network surveillance techniques in and of themselves. Rather, this chapter focuses on how active SIGINT techniques came to be articulated as a form of *force*. For a discussion of the evolution of computer and network based surveillance see: Gordon Corera, *Cyberspies - the secret history of surveillance, hacking, and digital*

Command is meant to resolve these tensions: the "dual-hatting" of the Director of the NSA as the commander of Cyber Command allows for the simultaneous execution of Title 10 and Title 50 activities.[14]

These legal tensions are also a consequence of the theoretically unexpected fact that cyber-advocacy grew out of the interaction between the NSA and service cryptologic elements (SCE).[15] SCEs were the Signals Intelligence (SIGINT) organizations for the service departments and occupied a dual-role: they were administered by their parent service departments but for all other purposes were part of the NSA Central Security Service (CSS).[16] Moreover, the directorship of the NSA rotates between the service departments and the officers nominated for NSA Director are typically drawn from SCEs with the consequence that the NSA and service SIGINT units are tightly connected.[17] For example, former NSA Director and one of the loudest advocates for understanding Cyberspace as a domain, Michael Hayden, was drawn from the Air Force where he commanded the Air Intelligence Agency (the Air Force SCE) prior to his assumption of the NSA directorship.[18] Due a dearth of sociological analysis of the internal workings of intelligence units and agencies it is unclear whether and to what extent this affects

---

espionage (New York, New York: Pegasus Books, 2015); Ronald J. Deibert, *Black Code: Surveillance, Privacy, and the Dark Side of the Internet* (New york, New York: Penguin, 2013); Michael Warner, "Reflections on Technology and Intelligence Systems," *Intelligence and National Security* 27, no. 1 (2012): 133–153;. For a history of the NSA and U.S. SIGINT see: James Bamford, *The Puzzle Palace: Inside the National Security Agency, America's Most Secret Intelligence Organization* (New York, New York: Penguin, 1983); James Bamford, *Body of Secrets: Anatomy of the Ultra-Secret National Security Agency* (New York, New York: Anchor, 2002); Stephen Budlansky, *Code Warriors: NSA's Codebreakers and the Secret Intelligence War Against the Soviet Union* (New York, New York: Knopf, 2016); Howe, George F., *The Early History of NSA*, George Washington University National Security Archive, [Online; accessed June 21, 2017], http://nsarchive.gwu.edu/NSAEBB/NSAEBB278/13.PDF

14. Ellen Nakashima, "Dual-leadership Role at NSA and Cyber Command Stirs Debate," [Online; accessed March 11, 2017], *Washington Post*, October 6,2013, https://www.washingtonpost.com/world/national-security/dual-leadership-role-at-nsa-and-cyber-command-stirs-debate/2013/10/06/ffb2ac40-2c59-11e3-97a3-ff2758228523_story.html

15. Now termed service cryptologic components.

16. The CSS is colloquially referred to the as the "fourth service department." Keith P. Clive, *NSA's Central Security Service*, Federation of American Scientists, [Online; accessed March 11, 2017], 2002, https://fas.org/irp/eprint/css.htm; Department of Defense, *DOD Directive 5100.20: National Security Agency/Central Security Service (NSA/CSS)*, [Online; accessed June 12, 2017], 2010, http://www.dtic.mil/whs/directives/corres/pdf/510020p.pdf.; Air Force ISR Agency, *Air Force Instruction 14-128* (Secretary of the Air Force, 2011), 2-3

17. National Security Agency, *Former Directors, NSA*, [Online; accessed June 26, 2017], 5-3-2016, https://www.nsa.gov/about/leadership/former-directors/

18. National Security Agency, *Biography — 15th Director*, [Online; accessed June 26, 2017], 5-3-2016, https://www.nsa.gov/about/leadership/former-directors/bio-hayden.shtml

how SCE operators conceive of their own identity vis-a-vis the CSS and their parent service department.[19] What is clear from the empirical record is that these relationships became conduits for conceptual cross-pollination between the SCEs and the NSA. Given the multivalent nature of SCEs and NSA command relationships, I posit that the intelligence personnel grew their organization through joint structures because that is the nature of the intelligence community organizational environment. The core conceptual shift caused by this cross-pollination was a shift from CNOs as purely a data collection activity (Title 50) to CNOs as a use of *force* (Title 10) with tactical, operational, and strategic effects.

Outside of legal tensions, the other key reason that cyber developed in this fashion is a consequence of the utilization of cyber-enabling technologies for both the "Revolution in Military Affairs" (RMA) and its integration into Information Warfare following the Gulf War. With regard to the former, the rise of complex information technologies allowed for the development of new forms of coordination and action on the battlefield. In this view, the information and communication technologies that undergird Cyberspace function purely as enabling infrastructure. Given this purely infrastructural role of the domain-enabling technology, I will not discuss the RMA at length in this chapter.[20] As to Information Warfare, CNOs were initially integrated as part of the broader spectrum of capabilities (including Electronic Warfare, Psychological Warfare, and Military Deception) to affect adversary decision-making cycles (OODA loop) and command and control (C2). Therefore, the initial utilization of cyber as a *capability* was its integration into Joint[21] Information Warfare doctrine. However, SCEs (at least in the case of the Air Force) and eventually the NSA were tasked with developing the CNO techniques for the service Information Warfare elements, I posit that the range of experimentation enabled by this

19. For Samuel Huntington, the service department identity should override this dual-allegiance structure. Huntington, *The Common Defense: Strategic Programs in National Politics*, 404-407. However, the functional similarities between service SCEs is far greater than for any other unit type, something which has only increased with the use of digital information and communication technologies.

20. See: John Arquilla and David Ronfeldt, "Cyberwar is Coming!," *Comparative Strategy* 12, no. 2 (Spring 1993): 141–165 (In this article the authors use "Cyberwar" to mean conducing "military operations according to information-related principles" (30). The prefix "cyber" is used in a sense much closer to cybernetics than cyberspace.); Alan D. Campen, *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War* (Fairfax, Virginia: AFCEA, 1992); Arthur K. Cebrowski and J. J. Garstka, "Network-centric warfare: its origin and future," *Proceedings*, January 1998, Andrew F. Krepinevich, "Calvary to Computer: The Pattern of Military Revolutions," *The National Interest*, Fall 1994, 3042; Stephen Peter Rosen, "The impact of the office of net assessment on the American military in the matter of the revolution in military affairs," *Journal of Strategic Studies* 33, no. 4 (2010): 469–482; Richard Stiennon, "A Short History of Cyberwar," in *Cyber Warfare: A Multidisciplinary Analysis*, ed. James A. Green (New York, New York: Routledge, 2015), 14-15

21. That is, it was articulated in Joint Doctrine as opposed to service specific doctrine.

turned the SCEs into centers of advocacy for CNOs as force (Title 10). The joint nature of the SCEs and intelligence organizations meant that the advocates' organizational forms necessarily grew up through joint and not single service organizations.

In this chapter I will arge that cyber reached the realization phase through the cross-pollination of advocacy by tracing the development of advocacy for operational (Title 10) CNOs in the NSA and the SCEs. The case begins with a brief discussion of the development of computing networks following World War II until the adoption of Transmission Control Protocol/Internet Protocol (TCP/IP). I analytically mark the adoption of TCP/IP by the Department of Defense as being initial acquisition for two reasons. First is technical: TCP/IP are the fundamental software protocols of the open Internet as we understand it today. These protocols are fundamental to the Internet because they enable an open-architecture network or "network of networks." Previous computer network protocols (e.g.: NCP that was used on the early ARPANET[22]) had a low tolerance for variation in network architecture; thus, TCP/IP are foundational to the interoperability that allows the control systems of a Nuclear Power Plant and a refrigerator to operate on the same wide area network. The extensibility and agnostic nature of TCP/IP are key to the structure and operation of what we call today the Internet.[23] Thus, the adoption of these open network protocols enabled and enables the ability to affect actions at a distance through heterogeneous communication and computing networks. Second is definitional: the Internet and interopability enabled by TCP/IP have long been central features of what defines "Cyberspace" as a distinct space in the eyes of the military[24] Moreover, to the extent

22. The curious reader might wonder why I did not mark the development of ARPANET as "initial acquisition." While some claim ARPANET was developed to improve the reliability of C2 in the case of nuclear warfare this is not likely the case. The developers of ARPANET (and later TCP/IP) deny this, arguing that this is likely because their initial paper on ARPANET appeared alongside a study on survivable voice communication networks by Paul Baran. Rather, ARPANET was built for resource sharing, network experimentation, and research collaboration. See note 5 Barry M Leiner et al., *Brief History of the Internet*, Internet Society, [Online; accessed June 20, 2015], 1997, `http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet`; For more on Baran and ARPANET see: Jane Abbate, *Inventing the Internet* (Cambridge, Massachussetts: MIT Press, 1999), 10-16, Chapter 2; Defense Advanced Research Projects Agency, *A History of the ARPANET: The First Decade*, George Washington University National Security Archive, 4-1-1981, Section II, `http://nsarchive.gwu.edu/dc.html?doc=3678207-Document-01-Defense-Advanced-Research-Projects`; S. Lukasik, "Why the Arpanet Was Built," *IEEE Annals of the History of Computing* 33, no. 3 (March 2011): 4–21. Additionally, ARPANET was not operated with TCP/IP until 1983.

23. Leiner et al., *Brief History of the Internet*; Abbate, *Inventing the Internet*, 124-130

24. For example, in 1997: "cyberspace is both real and virtual: while the real portion consists of physical assets (computers, network terminals, satellites, fiber optic cables, etc.) located on earth and in space, it is the virtual aspect - all interconnected, all networked, all compatible and interoperable–that is the most important." William B. Black Jr., "Thinking Out Loud About Cyberspace," *Cryptolog* XXIII, no. 1 (Spring 1997): 3; In 2013, "Cyberspace consists of many different and often overlapping networks, as well as the nodes (any device or logical location with

to which the existence of Cyberspace is not a function of the materiality of *a* space but rather developed as a manifestation of the category of "domain" it is necessary to rely on definitions used in practice at the risk of tautology.

After discussing the early history of networks until the adoption of TCP/IP in 1983, I will discuss developments in CNO usage by the military until 1995 when the 609th Information Warfare Squadron (IWS) was established by the Air Force. The 609th IWS was the first operational unit to conduct CNO, however, it was in service of Information Warfare. I theoretically expect that this period between initial acquisition and the formation of the first operational unit should see the development of distinctive advocacy. The available evidence for evaluating the formation of advocacy vis-a-vis the 609th IWS is relatively sparse, this is partially because the unit was formed in order to provide an Information Warfare capability (integrated capability). However, based on accounts it is likely that advocacy formed out of SCE elements who developed CNO techniques. In particular, the Joint Special Studies Group (JSSG) in the 1980s, Joint Intelligence Center during the Gulf War, and the Air Intelligence Agency (AIA). The latter was the Air Force SCE tasked with developing SIGINT CNO techniques in support of the 609th IWS. The relationship between advocacy and organization here is likely a function of the fact that the AIA was governed by Title 50, whereas the IWS was governed by Title 10. The next section discusses the period from 1995 to 2008 when the United States Cyber Command was formed. Cyber Command is (likely) the first operationally autonomous command organization for conducting the offensive side of CNO—Computer Network Attack (CNA). Theoretically, I expect this period should involve the development of a distinctive war imaginary premised on military activity in the new domain. There is some evidence that this occurred with the members of the 609th IWS but there is stronger evidence that the AIA and NSA were the main centers of (en)visioning what cyberwarfare would look like. This alternative center of visioning is both theoretically expected and unexpected. Theoretically, I expect that advocacy should grow out of a service department rather than an intelligence agency. However, the 609th IWS was being woven into existing war plans while the AIA and elements of the NSA were tasked with experimenting with and developing CNO techniques. Evidence suggests that the AIA and the NSA were the main conceptual movers in the lead-up to the development of Cyber Command. I posit

---

an Internet protocol address or other analogous identifier) on those networks, and the system data (such as routing tables) that support them." Joint Chiefs of Staff, *Joint Publication 3-12, Cyberspace Operations*, Defense Technical Information Center, [Online; accessed March 11, 2017], 2-5-2013, v, `http://www.dtic.mil/doctrine/new_pubs/jp3_12R.pdf`

that advocacy formed in this manner due to the statutory separation of intelligence gathering (Title 50) and warfighting (Title 10) authority. The correspondence between SIGINT techniques and CNA meant that the development and experimentation that characterized the early stages of advocacy occurred in the service SCEs.[25] Following the discussion of the creation of Cyber Command I will also briefly outline trends towards strategic autonomy.

5.2 Early Information Networks

How modern society understands the Internet and Cyberspace is fundamentally bound up with computers, software, and networking technology. While computers have a long history dating back to at least the Victorian Era with the work of Charles Babbage and Ada Lovelace, the first of what would today be considered the modern computer and information networks emerged out of World War II.[26] Prior to this period computers were generally seen as isolated calculating machines, and it was only with the rise of networking technologies that they came to be associated with communication.[27] The ability for computers to communicate—interoperability—is crucial to our modern conception of Cyberspace.

The first known communications network between computer-like devices was created by the United States in reaction to the growing nuclear arsenal of the Soviet Union. The development of nuclear weapons that could be capably carried by Soviet strategic bombers led the Air Force to begin studying automated air defense systems. This led to the creation of the SAGE air defense network wherein radar information was transmitted over phone lines and analyzed by computers.[28] However, this network was rudimentary and lacked the ability for computer-to-computer communication.

The major advances that allowed computer-to-computer communications occurred during the 1960s, an era during which computers became increasingly powerful and began to appear in popular culture.[29] One of the core visionaries for computer-to-computer communication

25. This is probably because the SCEs and NSA were the first agencies to treat information and communication technologies as something other than infrastructure.

26. On Babbage and Lovelace see Martin Campbell-Kelly et al., *Computer: A History of the Information Machine* (Boulder, Colorado: Westview Press, 2014), 1-20

27. Abbate, *Inventing the Internet*, 1

28. Lukasik, "Why the Arpanet Was Built," 5-6

29. Megan Prelinger, *Inside the Machine: Art and Invention in the Electronic Age* (New York, New York: Norton, 2015), 123

networks was J. C. R. Licklider of MIT. In 1960, he published an influential paper called "Man-Computer Symbiosis" in which he articulated his hope that:

> in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today.[30]

In order to achieve this he advocated for the democratization of computing: better interfaces, data communications, and more complex programming languages. This line of thought led to him issuing a series of memos on the "Galactic Network" in 1962, which envisioned a globe spanning set of connected computers that would allow instant point-to-point access of data.[31] Licklider during this period also worked as a consultant for ARPA on computers, and before his departure impressed on the staff the need for advanced networking concepts.[32]

The crucial figure influenced by Licklider's prognostications was Robert Taylor, who worked for an ARPA research contractor named IPTO. When he became the director of IPTO in 1966, he began to investigate linking the various IPTO computer research centers. In so doing, he hoped to "build metacommunities out of these by connecting them."[33] Taylor pitched the idea to the head of ARPA who agreed to allocate funding for what was initially called the "ARPA Network."[34] This network was attractive to the ARPA managers because it would provide cost-savings and new opportunities for computer science research. The network was therefore designed to enable time-sharing and remote access between the various ARPA research centers. However, it would be several more years before the first connections were established between four computers in 1969.[35] By 1972 the ARPA network had begun to mature with researchers conducting public demonstrations and utilizing the first email system. At this point communication through and between computers was established.

It was also at this time that ARPA researchers began considering the development of an "open-architecture" or interoperable computer network. The extant ARPANET protocols and structure were tailored to the computer systems being used by ARPA contractors. The bespoke

30. Joseph C. R. Licklider, *Man-Computer Symbiosis*, [Online; Accessed June 10, 2017], 1960, `https://groups.csail.mit.edu/medg/people/psz/Licklider.html`
31. Leiner et al., *Brief History of the Internet*
32. Abbate, *Inventing the Internet*, 43-44; Leiner et al., *Brief History of the Internet*
33. Quoted in Abbate, *Inventing the Internet*, 44
34. ibid.; Leiner et al., *Brief History of the Internet*
35. Abbate, *Inventing the Internet*, 44

nature of these protocols constrained the expansion of ARPANET thereby necessitating a new protocol that would allow interopability.[36] This led to Robert Kahn and Vincent Cerf to begin working on the TCP/IP protocols in Fall of 1973. TCP/IP allowed for a wide area network connecting computers and networks of differing architectures. By the following year they had finished the first specification and testing began. However, during this testing period ARPANET continued to operate with its previous procotol—NCP. By the early 1980s TCP/IP began being adopted by industry and on January 1, 1983 it was adopted as the protocol for ARPANET. By this time ARPANET had spread significantly, integrating various research contractors, military bases, and other agencies. The adoption of TCP/IP led to a split in these networks between ARPANET (researchers) and MILNET (military). [37]

By this time computers and communications networks between them were becoming an increasingly large dimension of popular culture. Advertising and art during the period from the creation of SAGE to TCP/IP increasingly began to portray computers and information structures as a space in which humans could exist.[38] Movies such as *Dr. Strangelove* (1964), *Colossus: The Forbin Project* (1973), and *Wargames* (1983) raised questions about what consequences computer networks posed for war and peace. The last movie, *Wargames*, in particular deeply influenced early hackers and computer enthusiasts.[39] At the same time, elements of the 1960s counter-culture began to see computers and computer networks as enabling new forms of non-hierarchical politics.[40] These beliefs set the foundations for the "cyber-utopian" perspective of John Perry Barlow's 1996 "Declaration of the Independence of Cyberspace" which articulated Cyberspace as a distinct place.[41] The name "Cyberspace" would be coined in 1984 by William Gibson in his science fiction novel *Neuromancer.* A character describes Cyberspace as

> A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts... A graphical representation of data abstracted from the banks of every computer in the human system.

36. Abbate, *Inventing the Internet*, 114; Leiner et al., *Brief History of the Internet*
37. ibid.
38. *passim* Prelinger, *Inside the Machine: Art and Invention in the Electronic Age*, 29-144
39. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 7
40. Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago, Illinois: The University of Chicago Press, 2008)
41. Barlow, *A Declaration of the Independence of Cyberspace*

> Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights, receding...[42]

Altogether, by the adoption of TCP/IP the idea that computers and communications networks were meaningful for politics and war was becoming a significant dimension of popular culture.

5.3 1983-1995: Counter-C2 Warfare or Information Environment?

The initial development of advocacy for CNOs as *force*, a foundational concept for the cyber domain, occurred through various joint intelligence organizations. The development of advocacy in this manner is theoretically unexpected: I expect that a body of distinctive advocates grow out of the initial operators of a technology within a service department. Initial advocacy grew out of a joint intelligence organization—the Joint Special Studies Group (JSSG)—created to study Soviet submarine command and control networks during the 1980s. The "jointness" of this organization and movement of intelligence officers between various organizations meant that their advocacy diffused throughout the services and intelligence community. Crucially, the Joint Intelligence Center during the Gulf War was led by a JSSG participant whose actions inspired an Air Force intelligence officer, Keith Minihan. Minihan was instrumental to the early conceptual development of the cyber domain in the Air Force and at the NSA. While the organizational form of the JSSG is theoretically unexpected, the process by which advocacy developed possesses many theoretically expected dynamics—experimentation, openness as well as a lack of direction from senior leadership, inter-service rivalry, and civilian intervention.

While the intelligence community drove early cyber advocacy, the initial service department reception of Internet and other communication technologies was largely in favor of developing them to fulfill a mission area that emerged out of the first Gulf War—Information Warfare (IW). The inauguration of an Information Warfare mission following the Gulf War also briefly generated inter-service rivalry, which was sufficient to lead services to articulate CNOs as an integrated capability. Ultimately the Air Force drove much of the development of CNO as

42. William Gibson, *Neuromancer* (New York, New York: Berkley Publishing Group, 1989), 128The prefix "cyber" came from cybernetics which was coined in 1948 by Norbert Wiener. See: Norbert Wiener, *Cybernetics: or, Control and Communication in the Animal and the Machine* (Cambridge, Massachussetts: MIT Press, 1948). For a history of cybernetics as a concept see: Thomas Rid, *Rise of the Machines: A Cybernetic History* (Boulder, Colorado: Westview Press, 2014)

an Information Warfare capability during this period through the Air Intelligence Agency (commanded by Minihan) and the creation of the 609th Information Warfare Squadron. The latter organization was created as a Title 10 (force using) unit to conduct information warfare operations and was the first CNO wielding combat unit. This large role that the Air Force played in Information Warfare development was both the product of "bottom-up" advocacy and moderate senior leadership interest. The former led to the creation of the AIA and 609th IWS, while the latter drove doctrinal development that articulated CNO as an integrated capability.

Curiously, the AIA and 609th IWS both drove the conceptual development of cyber as a distinct domain, a belief that was not reflected in the DoD guidance which created the information warfare mission. Moreover, two AIA commanders—Keith Minihan and Michael Hayden—would be instrumental in conceptually and organizationally developing CNO capabilities at the NSA. I theoretically expect that the development of an integrated capability should foreclose the development of this distinctive belief set by binding the initial developers and operators into the overarching service identity and conception of war. This lack of organizational stickiness is likely the consequence of two factors: first, the travel and jointness of service intelligence agencies meant that these intelligence officers did not have a deep organizational allegiance to a specific conception of warfare. Furthermore, the statutory separation between intelligence and force activities meant that the AIA officers were not prepared to engage in actual warfighting. And second, the Information Warfare mission was consciously shared—none of the services claimed exclusive authority over it. Thus, Information Warfare could not become bound-up in an underlying service department conception of war. In contrast, the development of long-range guided missiles out of space enabling technologies by the Air Force, Navy, and Army were accompanied by claims that these missiles fulfilled a specific service mission. I posit that these two factors allowed for the flourishing of distinctive advocacy at the AIA, which would then be further diffused as AIA officers such as Minihan and Hayden moved on to different parts of the intelligence community.

I will proceed by first outlining what is known about the conceptual development of CNO as *force* at the JSSG. Then, I will turn to the impact of the Gulf War on the formulation of the Information Warfare mission. This section will conclude with a discussion of the role of the AIA and the creation of the 609th IWS.

5.3.1 JSSG: Acting Against Beams

In late 1983 the JSSG was formed as an inter-agency and inter-service activity at the NSA with representatives from other intelligence agencies as well as the Army, Navy, and Air Force SCEs. The purpose of the JSSG was to analyze intelligence gathered through "critical node analysis" (likely a descendant of industrial-web theory), in the process of developing target lists for a nuclear strike. This extended to a study of Soviet communication networks, in particular the command and control system for Soviet nuclear submarines.[43] The initial drive to exploit this knowledge of the command and control system was driven by Naval intelligence analysts who brought this information to the intelligence agencies for further study.[44] The Deputy Director of Naval Intelligence during this time, Rich Haver, recalls that "At this point in time we realized we were looking at an automated system that was meant to keep the Soviet leadership in control of their forces—basically it was an early digital system, a Soviet-style concept of a network."[45]

The JSSG was formed to study how to move deeper into these networks in order to enable greater SIGINT collection.[46] Importantly, the group's internal structure and mode of operation were largely left open to the participants, and after personnel had been requisitioned they maintained a freewheeling spirit of experimentation.[47] Eventually, they began to study how to disrupt this network in order to influence the ability of Soviet commanders to transmit orders. One outcome of these studies was that they began to develop what were called "special

43. Bruce D. Berkowitz, *The New Face of War: How War Will Be Fought in the 21st Century* (New York, New York: Free Press, 2003), 57; This was likely the product of undersea cable taps accomplished by Operation IVY BELLS. See: Jeffrey T. Richelson, *The U.S. Intelligence Community*, 7th ed. (Boulder, Colorado: Westview Press, 2015), 247

44. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 26-27; Craig J. Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation" (PhD diss., George Mason University, 2016), 86

45. Interviewed in: ibid., 95; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 28

46. Another high level Naval Intelligence officer and future Director of the NSA, Bill Studeman, recalls that the JSSG was "really invented to deal with 'the material' [network intelligence] and was targeted at deep penetration of Soviet Command and Control capabilities through the application of complete SIGINT, where computer systems were not necessarily the target of interest." Quoted in Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 95; See also: Kaplan, *Dark Territory: The Secret History of Cyberwar*, 28. The NSA, overall, was not at this time interested in the penetration of automated or computer networks for SIGINT. Rather, they remained committed to the collection of beams and cracking codes, something which was accomplished passively by tapping cables or intercepting microwave communications. However, the NSA's in-house journal, during this time, published an article that suggested that the NSA would eventually have to reckon with Active SIGINT (CNO). See: Joseph Meyer, "SIGINT 1990," *Cryptolog* IX (September 1982): 13–28

47. Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 95

technical operations" (STO) units whose job it was to break into the nodes of this network. At the same time, the JSSG directed the creation of a computer network to link the STOs to the Joint Staff, commands, intelligence agencies to improve coordination. This command and control network, the JSSG members discovered, could be used to model the Soviet submarine networks. They experimented with their own network in order to further refine their techniques into a rudimentary computer network attack capability. [48]

However, the activities of the JSSG would go on to irk the DoD bureaucracy and powerful interest centers in the NSA. Fundamentally, the leadership of the DoD did not understand what this rudimentary CNO was, as Rich Haver recalls "NSA's explanation of the new approach led DoD to view the activity through their previous experience, and improperly concluded that the capability was EW jamming activity. NSA explained to DoD that the new IW capabilities were the combination of collection (signals interception) and execution of action against the beams in real time." Moreover, the operationalization of this capability brought up tensions between intelligence activities (Title 50) and warfare (Title 10) for the Joint Staff which complicated implementation.[49] As for the NSA, it was dominated by Soviet-focused cryptanalysts wedded to passive SIGINT.[50] The "breaking and entering" dimension of the JSSG CNO capability caused alarm in the traditional power centers of the NSA, who were concerned that acting against a target would disrupt their ability to gather intelligence.[51] The confusion and opposition presented by the DoD and the NSA limited the ability for the JSSG to operationalize this rudimentary capability, but at the same time neither organization sought to quash it. Despite these struggles the JSSG continued to work on their techniques until the Soviet Union collapsed and the target of their efforts disappeared.[52]

While the evidence on which to judge the formation of advocacy is scant, there is some suggestion from interviews with the core players in the JSSG that their work began to take on the features of distinctive advocacy. For example, Bill Studeman reflecting on his experience with the JSSG remarked that "it is usually a small core of interconnected people 'pushing other people, programs and ideas around' to achieve a transformational goal... There is usually a

48. Apparently the actual efficacy was questionable. See: Berkowitz, *The New Face of War: How War Will Be Fought in the 21st Century*, 58-59

49. Rich Haver, quoted in: Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 99-100

50. Such as the interception of microwave beams.

51. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 18; Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 102

52. Berkowitz, *The New Face of War: How War Will Be Fought in the 21st Century*, 59

collective spiraling up of an idea, opportunities to develop the idea present themselves operationally and soon you'd have a doctrine—the technology comes first, and then the doctrine."[53] Moreover, the fact that the JSSG also experimented with their own networks and were given space to organize according to their own interests further confirms the expected dynamics of the formation of distinctive advocacy. While the JSSG would be dis-established, many of its members would go on to play crucial roles in the development of Cyberspace as a domain. For example, the next two directors of the NSA who began the process of developing active SIGINT capabilities—Bill Studeman and Mike McConnell—were involved in this group.[54] Moreover, the vice director of the JSSG from 1987-1989, Grover E. Jackson, was an Air Force intelligence officer.[55]

The composition of the JSSG, I posit, led to a cross-pollination of ideas that eventually led the NSA and the Air Force to become the dominant centers of visioning and advocacy for Cyberspace as a domain. Theoretically, I expect distinctive advocacy to form out of the initial operators of the domain enabling technology. Insofar as the information and communication technologies that compose Cyberspace were largely infrastructural during this time period—ARPANET and eventually MILNET (after 1985)[56] were utilized for resource sharing, communications, and systems management—the JSSG staff are likely the closest analog to "initial operators" for the operational adoption of this technology. Haver, Studeman, and McConnell would all come to believe that CNO was the future of SIGINT and that the NSA needed institutional change in order to accomplish this.[57]

Evidence for the operation of any the intervening variables is at best impressionistic given how little is known about the JSSG. That the officers of the Joint Chiefs of Staff were reportedly confused by the CNO capability indicated that there was little senior leadership interest in the operations of the JSSG and the outcome. If sustained or built interest in the concept existed then I would expect that it would not have been shut down following the end of the Cold War. Moreover, there is no evidence that service rivalry existed: the mission was developed by the JSSG and there is no indication that any of the services (or even the NSA) attempted

53. Quoted in: Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 104

54. National Security Agency, *Former Directors, NSA*

55. United States Air Force, *Brigadier General Gover E. Jackson, Biography*, Official United States Air Force Website, [Online; accessed July 5, 2017], 8-1-1991, `http://www.af.mil/About-Us/Biographies/Display/Article/106658/brigadier-general-grover-e-jackson/`

56. Abbate, *Inventing the Internet*, 185

57. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 28

to take over the joint organization.[58] Tellingly, the first known case of espionage via computer networks happened during this time, called the "Cuckoo's Egg," wherein East German hackers searched military computer networks for information on the Strategic Defense Initiative. The espionage was discovered, traced, and largely resolved by an astronomer at Berkeley, Cliff Stoll, with minimal involvement or interest from the military, intelligence agencies, or FBI.[59] It is also not clear whether there was any real civilian involvement in the JSSG's operations, the one public moment of clear civilian political intervention into computer and network security during this period was intended to bolster telecommunication network security.[60] However, this situation would change following the first Gulf War.

58. Furthermore, there is little observable evidence that ideas or debates about the exploitative use of computers and computer networks existed in the services or the NSA. They and civilian politicians were certainly aware that computers and networks were fundamentally insecure, but were mainly focused on resolving these weaknesses in their own systems. The government held hearings on the privacy implications of computers and the Air Force, in cooperation with other services, produced a study on computer insecurity. Additionally, based on a study of declassified issues of NSA's own internal journal, Cryptolog, computer security was freqeuently discussed in the context of a threat, not as an opportunity. See: James P. Anderson, *Computer Security Technology Planning Study*, technical report (Electronic Systems Division, Air Force Systems Command, 1972); [Author Redacted], "Best Location for Computer Applications," *Cryptolog* 3, no. 4 (April 1976): 6–9; Cecil Phillips, "Central Computer Complex in 1970s-1980s," *Cryptolog* IV, no. 3 (March 1977): 5–14; [Author Redacted], "Data Security and Human Errors," *Cryptologc* V, no. 10 (October 1978): 1–4; [Author Redacted], "Computer Operating System Vulnerabilities," *Cryptolog* 6, no. 3 (March 1979): 13–15; [Author Redacted], "The Personal Computer: A Current Cryptanalysis Support Tool," *Cryptolog* IX, no. 3 (March 1982): 1–3; William Lutwiniak and Robert E. Rich, "SIGINT IN THE 80s: Two Views," *Cryptolog* VIII, nos. 1-3 (April 1981): 1–6; [Author Redacted], "Future Powerful Personal Computers: an Overview of the Technology," *Cryptolog* IX, no. 11 (November 1981): 1–8; [Author Redacted], "The Personal Computer: A Current Cryptanalysis Support Tool"; Robert J. Hanyok, "Some Reflections on the Reality of Computer Security," *Cryptolog* IX, nos. 6-7 (June 1982): 23–24; Roger R. Schell, "Computer Security: the Achilles' heel of the electronic Air Force?," Originally published 1979 27, no. 1 (January 2012): 158–192; United States House of Representatives, *The computer and invasion of privacy. Hearings, Eighty-ninth Congress. July 26, 27, and 28, 1966.* (Washington, District of Columbia: Government Printing Office, 1966); Willis H. Ware, *P-3544 Security and Privacy in Computer Systems* (Santa Monica, California: RAND Corporation, April 1967). See also: Michael Warner, "Cybersecurity: A Pre-history," *Intelligence and National Security* 27, no. 5 (2012): 783-784; Michael Warner, "Notes on the Evolution of Computer Security Policy in the US Government 1965-2003," *IEEE Annals of the History of Computing* 37, no. 2 (April 2015): 9.

59. Cliff Stoll, *The Cuckoo's Egg* (New York, New York: Pocket Books, 1990)

60. In 1983 Reagan screened the movie *Wargames*, which featured the unintentional hacking of NORAD by a teenager. Apparently this movie led Reagan to direct the Joint Chiefs of Staff to investigate whether the scenario in the movie was plausible, which it was. This led to the drafting of NSDD-145, which granted the NSA executive agent status in securing government and civilian telecommunication networks. However, Congress became concerned over the civil liberty implications of the NSA handling domestic telecommunication networks and restricted the NSA's purview to government networks with the 1987 Computer Security Act. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 1-4; Warner, "Notes on the Evolution of Computer Security Policy in the US Government 1965-2003," 10-12; The White House, *National Security Decision Directive Number 145: National Policy on Telecommunications and Automated Information Systems Security*, Federation of American Scientists, [Online; accessed June 12, 2017], 9-17-1984, `https://fas.org/irp/offdocs/nsdd145.htm`

5.3.2 Desert Storm and the Information Warfare Mission

The swift victory of American and coalition forces against Iraq in 1990-1991 demonstrated, according to some commentators, a "Revolution in Military Affairs." Precision guided munitions, the coordination enabled by telecommunication networks, real-time intelligence, space reconnaissance systems, and other technological advances confirmed that technology was fundamentally reshaping warfare. In the view of the RMA advocates, these technologies enabled novel and highly effective organizational structures and increased battlefield coordination (See note 20). Outside of civilian prognosticators, whether the Gulf War and information technologies heralded the RMA (or 'post-industrial warfare') would continue to be debated within the services for the next decade.[61]

The critical outgrowth of the use of these technologies in Desert Storm was the creation of the Joint Intelligence Center under the Joint Chiefs of Staff. The center was nominally created to fuse the intelligence activities of the various agencies and services to aid the coalition forces but also it came to experiment with CNO against Iraqi C2 systems. This experimentation was likely a consequence of the involvement of two individuals with ties to the JSSG. First, the center was led by Mike McConnell who, following the dissolution of the JSSG, led the Joint Staff

61. The marquee service journals: Airpower Journal, Naval War College Review, and Parameters: US Army War College Quarterly regularly published articles on the RMA. See: Antulio J. Echevarria and John M. Shaw, "The New Military Revolution: Post-Industrial Change," *Parameters: US Army War College Quarterly* XXII, no. 4 (Winter 1992): 70–79; Douglas A. Macgregor, "Future Battle: The Merging Levels of War," *Parameters: US Army War College Quarterly* XXII, no. 4 (Winter 1992): 33–47; John W. Bodnar, "The Military Technical Revolution: From Hardware to Information," *Naval War College Review* XLVI, no. 3 (Summer 1993): 7–21; Edward Mann, "Desert Storm: The First Information War?," *Airpower Journal* VIII, no. 4 (Winter 1994): 15–25; Owen Jensen, "Information Warfare: Principles of the Third-Wave War," *Airpower Journal* VIII, no. 4 (Winter 1994): 35–44; Ralph Peters, "After the Revolution," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 7–14; Kenneth F. McKenzie, "Beyond Luddites and Magicians: Examining the MTR," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 15–21; Mark Clodfelter and John M. Fawcett, "The RMA and Air Force Roles, Missions and Doctrine," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 22–29; James R. FitzSimonds, "The Coming Military Revolution: Opportunities and Risks," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 30–36; David A. Fastabend, "Checking the Doctrinal Map: Can We Get There from Here with FM 100-5," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 37–46; Frank J. Stech, "Sociopolitical Stresses and the RMA," *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 47–54; Colin S. Gray, "The Changing Nature of Warfare?," *Naval War College Review* XLIX, no. 2 (Spring 1996): 23–32; James H. Patton, "The New "RMA": It's Only Just Begun," *Naval War College Review* XLIX, no. 2 (Spring 1996): 7–22; Jeffrey A. Harley, "Information, Technology, and the Center of Gravity," *Naval War College Review* L, no. 1 (Summer 1997): 66–87

Intelligence Directorate.[62] Second, was the involvement of Rich Wilhelm, the executive assistant of NSA Director Bill Studeman, who served as the NSA liaison for the center.[63] During the war McConnell and Wilhelm, not content to merely gather beams or tap cables, experimented with active SIGINT, and so they developed computer network exploitation techniques. Moreover, after gaining access they directed their SIGINT operators to disrupt Iraqi command and control systems—particularly air defenses. While their more ambitious plans were stymied due to civilian and senior officer skepticism, they were able to conduct active SIGINT and counter-C2 operations similar to those proposed by the JSSG.[64] In 1992, following the war, Mike McConnell assumed the directorship of the NSA.[65]

One of the key catchwords that emerged from the Gulf War was "Information Warfare" as the first book on the RMA and the Gulf War was entitled *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War* by Alan Campen.[66] Fred Kaplan, in *Dark Territory*, suggests that this term came into vogue following Mike McConnell's viewing of the 1992 spy vs spy caper *Sneakers*. Kaplan argues that McConnell subsequently advocated for the concept and established an office at the NSA—Director of Information Warfare—occupied by Rich Wilhem to further develop active SIGINT and CNO techniques.[67] Whatever the reason for this term rising to prominence, in late 1992

62. The center and position were a consequence of the 1986 Goldwater-Nichols Act James D. Marchio, "The Evolution and Relevance of Joint Intelligence Centers," [Online; accessed June 30, 2017], *Studies in Intelligence* 49, no. 1 (2006), https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol49no1/html_files/the_evolution_6.html. It is unclear whether McConnell's participation in the JSSG had anything to do with this. His appointment to the group was not exclusive and it seems that he was generally well respected for his work with Naval intelligence.

63. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 22-23

64. Based on descriptions in: ibid., 21-24

65. Though, again, it is not clear that the counter-C2 experiments were the cause of his appointment.

66. Campen, *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War*; Also, see the titles of the service journal articles in note 40. Also see discussion in: Warner, "Reflections on Technology and Intelligence Systems," 790 The term "Information Warfare" was probably first coined in 1976 by a Boeing engineer named Thomas P. Rona. The conception of information warfare posed by Rona involved the manipulation of weapons systems telemetry and other guidance systems. Thomas P. Rona, *Weapon Systems and Information War*, technical report (Seattle, Washington: Boeing Aerospace Company, July 1976)

67. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 32-33. Apparently, due to internal NSA opposition the office consisted only of Rich Wilhelm for the entirety of McConnell's tenure. Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 136 While McConnell was an advocate for active SIGINT / CNO, he was able to accomplish little in the way of NSA reform during his tenure. There was a large degree of opposition from career NSA officers and McConnell eventually became consumed by the "Clipper Chip Controversy." Kaplan, *Dark Territory: The Secret History of Cyberwar*, 35. NSA opposition, while based in the entrenched interests that favored mid-point collection, was also likely due to concerns over whether information warfare would violate the boundaries of their Title 50 authority. Nolte, "Anticipating

the Assistant Secretary of Defense for Command, Control, Communications and Intelligence issued a directive entitled "TS-3600.1 Information Warfare" which is the first known statement of DoD policy on the topic. It is probable that McConnell, in his role as NSA director and JIC head, influenced the formation of this policy statement. The Assistant Secretary's bailiwick extended to Joint Intelligence operations but not the NSA.[68] Moreover, as will be seen in the next section, there is a great deal of similarity between the JSSG rudimentary CNO and how the Assistant Secretary defined "Information Warfare."

TS-3600.1 and MOP 30: Creating a New Mission

TS-3600.1 and its implementation in Memorandum of Policy 30 created an Information Warfare mission which spawned a brief period of inter-service rivalry. These documents are the first articulation of Information Warfare doctrine, and in particular the first official direction for the development of capabilities to counter information systems. TS-3600.1 defined Information Warfare as:

> The competition of opposing information systems to include the exploitation, corruption or destruction of an adversary's information system through such means as signals intelligence and command and control counter-measures while protecting the integrity of one's own information system from such attacks. The objective of information warfare is to attain a significant enough information advantage to enable the force overall to predominate and do so quickly.[69]

A crucial feature missing from this statement is the overt conception of information systems as a separate medium. Information systems, per this document, exist in competition with each other as opposed to being part of a continuous network. "Information System" is defined for the purpose of this document as:

Cyberspace Security: NSA's Experience 1992-1997," 30

68. For a description of the position from this period see: Department of Defense Historical Office, *Department of Defense Key Officials*, Office of the Secretary of Defense, 2004, 38. Also, see commentary in Michael Warner, "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014," *Cyber Defense Review*, 8-27-2015, http://cyberdefensereview.army.mil/The-Journal/Article-Display/Article/1136012/notes-on-military-doctrine-for-cyberspace-operations-in-the-united-states-1992/

69. Atwood, Donald J, *Department of Defense Direction Number TS 3600.1*, DOD FOIA Online Reading Room, 12-21-1992, 1, http://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/14-F-0492_doc_01_Directive_TS-3600-1.pdf

> The organized collection, processing, transmission, and dissemination of information, in accordance with defined procedures, whether automated or manual. In the context of information warfare, it includes the entire infrastructure that collects, processes, stores, and disseminates information regarding both one's own forces and opposing forces and the means to determine and display the status of one's own forces and to direct those forces.[70]

Unlike air or orbital space where the distinctiveness of a new medium was overtly articulated, this does not express the idea that infrastructure is a medium in itself. That being said, it does identify the totality of an enemy's information infrastructure as a coherent target during warfare. This suggests an understanding that information infrastructures were consolidating and is a subtle conceptual movement towards the broader infrastructural understanding of Cyberspace. Thus, Information Warfare, in this document, is the competition between opposing infrastructural arrangements. As a description of a military activity, it bears a strong resemblance to both the concepts developed by the JSSG and the activities of the JIC during the Gulf War. Specifically, the centering of signals intelligence activities as a method for disrupting the command and control systems of an adversary. This suggests that McConnell or another participant in either of these organizations, had some influence over the development of the directive. In the end, this document was a statement of policy and it directed the Joint Chiefs of Staff to promulgate joint-warfighting doctrine and provide implementation guidance.[71]

Several weeks after the Assistant Secretary issued this directive, Chairman of the Joint Chiefs of Staff Colin Powell issued Memorandum of Policy 30 (MOP 30) which implemented the directive. Curiously, MOP 30 contained several conceptual shifts that broke with the Assistant Secretary's directive: it subsumed "Information Warfare" under "Command and Control Warfare." Given that information warfare was fundamentally about the degradation of C2 systems this may seem like a matter of preferred nomenclature. However, Powell goes on to define "Command and Control Warfare" as being:

> the integrated use of operations security (OPSEC), military deception, psychological operations (PSYOP), electronic warfare (EW), and physical destruction, mutually supported by intelligence, to deny information to, influence, degrade or destroy

70. Atwood, Donald J, *Department of Defense Direction Number TS 3600.1*, 1
71. ibid., 4

> adversary C2 capabilities, while protecting friendly C2 capabilities against such actions. Command and Control warfare applies across the operational continuum and all levels of conflict.[72]

Thus, what was war between competing *information systems* that centered SIGINT becomes about a spectrum of capabilities to "decapitate the enemy's command structure from its body of combat forces." Moreover, SIGINT, as a capability, was articulated as providing a support function for other capabilities. The direct manipulation of *information systems* became destruction and psychological exploitation. DoD Historian Mark Warner suggests that this might have been a "subtle contravention of civilian policy guidance" through its redefinition of the core activities of information warfare.[73] Moreover, this caused confusion among the service leaders as TS-3600.1 had directed them to: "develop information warfare doctrine and tactics; and organize and train to ensure that these are well-integrated into overall doctrine and tactics and become an essential element in our warfighting capability."[74]

Despite the confusion over the differences between TS-3600.1 and MOP 30 the services established information warfare units including the Naval Information Warfare Activity, Army Land Information Warfare Activity, and the Air Information Warfare Center as part of the Air Intelligence Agency.[75] The attitude of the services in developing these organizations (all of which were Title 50 SCEs), according to Mike McConnell, was "Mine is better than yours, but I will not show you mine."[76] Outside of a competitive logic of competency, it is not clear that there was any sustained rivalry for control of the mission. Rivalry was likely weak because MOP 30 articulated a joint-C2 warfighting program that employed extant capabilities within all three services. More significantly, TS-3600.1 and MOP 30 did not include any new funding lines or appropriations over which services could compete. As Fred Kaplan notes "the top generals had

72. Colin Powell, *Chairman of the Joint Chiefs of Staff Memorandum of Policy No. 30 (CMOP); Command and Control Warfare*, Defense Technical Information Center, [Online; accessed June 11, 2017], 3-8-2013, 2, `http://www.dtic.mil/docs/citations/ADA389344`

73. Warner, "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014." Between TS-3600.1 and the issuance of MOP 30 the Assistant Secretary left office with the end of the George H.W. Bush Administration. Additionally, this conceptual shift is curious, Fred Kaplan suggests that MOP 30 was issued as a result of McConnell's ties to Powell. However, the contents of MOP 30 seems to contradict McConnell's own advocacy. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 32

74. Atwood, Donald J, *Department of Defense Direction Number TS 3600.1*, 4. Also see commentary in Warner, "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014"

75. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 34; Warner, "Reflections on Technology and Intelligence Systems," 790

76. Quoted in: Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 132

signed doctrinal documents on 'information warfare' but they didn't appear to take the idea very seriously."[77] The long-run effect of these directives would be that the Air Force, as the premier developer of CNO during this period, would develop the first operational (Title 10) organization to conduct CNO as an integrated capability.[78]

A New Center of Advocacy: the Air Intelligence Agency

Of the three Information Warfare SCEs established after MOP 30 in 1993, the most influential would be the Air Information Warfare Center under the Air Intelligence Agency. Crucially, an Air Force intelligence officer, Ken Minihan, had closely followed the JSSG inspired counter C2 operations conducted by the JIC during the Gulf War.[79] Immediately following the Gulf War, the Air Force Chief of Staff had sought to shut down the Air Force Intelligence Command (which preceded the AIA) because he saw it as a waste of valuable resources that could be utilized for aircraft systems. The command was only preserved because of Minihan's intercession, when he argued to the Chief of Staff that it provided the foundation for a powerful information warfare unit.[80] Consequently, Minihan was placed in control of the Air Force Intelligence Command, which was renamed the Air Intelligence Agency in 1993.[81]

In September 1993 Minihan stood-up the Air Force Information Warfare Center. The center was shaped by Minihan to reproduce and extend the C2 and SIGINT techniques that he observed the Joint Intelligence Center conducting during the Gulf War.[82] As part of this Minihan intentionally created an atmosphere of creativity and experimentation. He describes the center as a:

---

77. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 118

78. I focus on the Air Force AIA, which birthed the 609th IWS, because neither the Navy nor the Army created a Title 10 entity during the 1990s.

79. Based on interview material reproduced in Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 125. Minihan during this time period was the Deputy Chief of Staff for Intelligence in the HQ Tactical Air Command. It is not clear whether this meant that he was involved with the Air Force SCE. However, this position likely made him interested in the JIC actions against Iraqi air defense systems.United States Air Force, *Lieutenant General Kenneth A. Minihan, Biography*, Official United States Air Force Website, [Online; accessed July 5, 2017], 10-1998, `http://www.af.mil/About-Us/Biographies/Display/Article/106229/lieutenant-general-kenneth-a-minihan/`

80. Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 125

81. *TWENTY-FIFTH AIR FORCE: BRIEF HISTORY*, [Online; accessed June 12, 2017], 3, `http://www.25af.af.mil/Portals/100/Documents/AFD-150520-021.pdf?ver=2016-02-11-123439-690`; United States Air Force, *Lieutenant General Kenneth A. Minihan, Biography*

82. John P. Casciano, *Los Angeles - October 18, 1996*, Air Force Association National Symposia, 10-18-1996, `http://secure.afa.org/aef/pub/la9.asp`

> freeform think tank staffed by 22-year-old repurposed electronic warfare guys; what I wound up creating were 'demon dialers'[83] who developed ideas and began to create capabilities for IW. Once these capabilities were demonstrated, requirements would flow from our ops center, warfare center and cryptologic center to create 21st century Information Warfare exploitation tools.[84]

One of the more notable episodes of experimentation conducted by the demon-dialers occurred during war-planning for a potential invasion of Haiti in 1994. Apparently, one of Minihan's officer's had studied the Haitian air defense network and discovered that it ran on phone lines which could be easily jammed. While the invasion never occurred, Minihan successfully integrated the phone jamming operation into the Air Force's plans.[85] As the AIA was an intelligence organization (Title 50) it was legally prevented from directly conducting the operation, the phone jamming would constitute a use of force. Rather, an officer at the Air Combat Command, Walter Rhoads, was tasked with developing the plans to implement the attack. Rhoads, realizing that this arrangement was nonsensical, proposed to Minihan that an *operational* unit (Title 10) should be formed with the express purpose of carrying out these sorts of attacks. Minihan agreed, and after being re-assigned to the Office of the Chief of Staff of the Air Force, successfully lobbied for the creation of the 609th Information Warfare Squadron.[86]

5.3.3 The 609th IWS and Air Force Information Warfare Thought

While the debates that attended the formation of the 609th IWS are inaccessible, by the year the IWS was established (1995) information warfare as a distinct activity had taken hold in the broader Air Force consciousness.[87] In the 1995 Air Force Annual Report Sheila Widnall, the Secretary of the Air Force, for the first time included a section on the necessity for the Air Force to maintain "information dominance." Widnall stated: "the 1990s have seen the ascendance of another Air Force role—dominating the information environment—by providing global situational awareness and denying or corrupting that of our adversary. Information operations are

83. An early name for hackers who had exploited quirks in telephone switching systems.

84. Quoted in Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 122. See also: *609 IWS: A Brief History Oct 1995-Jun 1999*, 1999, `https://securitycritics.org/wp-content/uploads/2006/03/hist-609.pdf`; Casciano, *Los Angeles - October 18, 1996*

85. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 59

86. ibid., 107-108; United States Air Force, *Lieutenant General Kenneth A. Minihan, Biography*.

87. They seem to have eschewed the language of MOP 30.

no longer a cost of doing business but presence and war-fighting methods in their own right."[88] Curiously, she does not claim that the Air Force has exclusive authority over this medium as occurred during the debates over orbital space.[89] 1995 would also see the first of many articles being published in the main Air Force scholarly journal, Airpower Journal, that articulated information as a distinct medium. While some of these articles were a reaction to the publication of *War and Anti-war* by the futurists Alvin and Heidi Toffler, it seems that the ambitious officers who published in the journal were beginning to take information warfare seriously.[90]

Additionally, in early 1995 the Air Force published the first service doctrine on information warfare, entitled *Cornerstones of Information Warfare*.[91] This doctrine was published prior to the creation of the IWS and was likely under development for some time. The publication of *Cornerstones*, which articulated CNOs as capability for Information Warfare, is theoretically consistent with the outcome of integrated capability. CNOs under the name of "information attack" were woven into an existing conception of warfare. However, those charged with operating under this text—officers of the AIA and 609th IWS—drove forward the conceptual development of cyberspace as an exclusive domain of operations. As I argued previously, the jointness of the Information Warfare mission and travel of intelligence officers likely meant that this integrative effort did not bind the developers and operators into this non-exclusive conception of warfare. In contrast, the Air Force viewed ICBMs as an overt threat to their core

88. However, the rest of Widnall's discussion is largely vague. She stated that this goal is achieved by

> not a grand design but a set of nested strategic plans that will allow rapid migration toward the goal—harmonizing efforts throughout the Department of Defense. The objective is a global network with a worldwide information plug-in, common tactical pictures, bandwidth on demand for any application, in any form, to and from anywhere, allowing all war fighters to access the information they need.

Sheila Widnall, "State of the Air Force," *Airpower Journal* IX, no. 1 (Spring 1995): 13

89. ibid.

90. The Toffler's present a historical materialist argument that war and wealth production were aligned within historical epochs (Agrarian, Industrial, Information), and that the information age demands its own form of post-industrial warfare. Alvin Toffler and Heidi Toffler, *War and Anti-War* (New York, New York: Grand Central Publishing, 1995) Apparently by 1996 the book was being taught in the elite service academies and the Tofflers were regular guest lecturers at the Army War College and Air War College. Ryan Henry and Edward C. Peartree, "Military Theory and Information Warfare," *Parameters: US Army War College Quarterly* XXVIII, no. 3 (Autumn 1998): 122; R. L. DiNardo and Daniel J. Hughes, "Some Cautionary Thoughts on Information Warfare," *Airpower Journal* IX, no. 4 (Winter 1995): 69–79

91. The Army would publish their own information warfare manual the following year but it is not clear if they created an operational unit akin to the IWS during this period. HQ TRADOC, *Field Manual 100-6*, Federation of American Scientists, [Online; accessed June 12, 2017], 1999, `https://fas.org/irp/doddir/army/fm100-6/`

mission—flying bomber aircraft—and sought to weave these missiles in their existing conception of warfare. Before turning to this doctrinal statement and the IWS, I will first review the articles published in the Airpower Journal in order to assess the status of information warfare thought within the Air Force during this time.

Information Warfare in the Airpower Journal

Over the course of 1995 three articles were published in Airpower Journal that discussed information warfare as a distinct activity. Of the three, two of the articles wrote approvingly of the basic principles of information warfare. "A Theory of Information Warfare" by Richard Szafrinski fuses the Tofflers' "Wave Theory" to the basic concepts of MOP 30. For example, he argues that information age warfare is waged utilizing the same set of techniques: "deception and disinformation, radioelectronic combat, propaganda, and the whole gamut of 'psychological warfare' or command and control warfare."[92] These "information weapons" are used to target the epistemological structures of militaries and civilian populations in order to disrupt their perception of reality. The malleability of these perceptions has only increased with the Information Age, for Szafrinski, and made possible strategic action: "in states or groups with high technomic[93] capability, the target set for information warfare at the strategic level is wonderfully rich software that constitutes how the adversary knows and what the adversary believes."[94] However, Szafrinski remains vague on how exactly these strategic effects are produced outside of mere confusion or disorientation.

In "Information Warfare," George Stein agrees with Szafranski on the target of information warfare: the epistemology of enemies and their societies. However, unlike Szafranski, Stein argues that information warfare is primarily fought through a distinct media: "[it] would be waged largely, but not entirely, through the communication nets of a society or its military."[95] The integration of these "nets," Stein posits, allows for the production of strategic effect. He explains this through a hypothetical:

> Through hitching a ride on an unsuspecting commercial satellite, a fictive simulation is broadcast. . . . Simultaneously, various 'info-niches' in the target state

92. Richard Szafranski, "A Theory of Information Warfare: Preparing for 2020," *Airpower Journal* IX, no. 1 (Spring 1995): 63

93. Presumably a portmanteau of technological and economic.

94. Szafranski, "A Theory of Information Warfare: Preparing for 2020," 63

95. George J. Stein, "Information Warfare," *Airpower Journal* IX, no. 1 (Spring 1995): 31

> are accessed via the net. Some of the targets receive reinforcement for the fictive simulation; others receive slightly misleading variations of the target state's anticipated responses, and the whole of the opponent's military is subject to a massive electronic deception operation. What is happening here? ... At the strategic level, this is the paralysis of the adversary's observation, orientation, decision, action (OOODA) loop.[96]

Therefore, for Stein, information war is fundamentally about action in and through information or the "infosphere."[97] Whereas Srzafinski sees the Information Age as heralding the increased vulnerability of epistemic infrastructure, Stein sees the formation of a distinct medium of warfare in the ongoing consolidation and construction of a global media and telecommunications infrastructure. Strategic information warfare is a function the ability to act upon information provided by these changes. Together, both of these authors move beyond the claims of TS-3600.1 and MOP 30, both of which were premised on degrading the ability for a commander to issue orders or trust their information systems. Rather, they posit that strategic effects can be produced by undermining or modifying the very beliefs about reality held by militaries and societies.

Later in 1995, R. L. Dinardo and Daniel J. Hughes in "Some Cautionary Thoughts on Information Warfare" sound a note of warning about the information warfare hype that was sweeping the armed services. Outside of criticizing the core thesis of the Toffler's oeuvre, which by this point had been become fairly popular across the service departments, they argue that the claims of Stein and Szrafinski are far too speculative and fraught with uncertainty. In particular, they take to task "those who wish to substitute a new form of mind control for violence" for claiming to be able to predict how an enemy would react to a deception campaign or other attempts to alter their belief set. Rather, how a commander, political leaders, or society would react to such campaigns is deeply unknown, meaning that strategic information warfare could be a pandora's box.[98] These authors go on to highlight how these prognostications threaten to collapse the category of war into meaninglessness and fundamentally threaten civil liberties. Information, they argue, has always brought promise and peril and the current growth of telecommunications technologies are no different.[99]

96. Stein, "Information Warfare," 33
97. ibid., 32
98. DiNardo and Hughes, "Some Cautionary Thoughts on Information Warfare," 3, 4
99. ibid., 6-7

Based on these articles, it is clear that at this point the thinking on information warfare within the Air Force was becoming both more speculative and more expansive. However, unlike our contemporary understanding of Cyberspace as an infrastructural medium, they see the consolidation of computer and telecommunication networks as generating the ability to act through and on epistemological structures. Moreover, this ability to act provides avenues for independent strategic warfare—thus this set of beliefs about information warfare has many of the expected characteristics of a distinct war imaginary. Unlike the military conceptual work examined in the previous chapters, this body of thought has clear relationships to the work of futurologists such as the Tofflers. However, the Dinardo and Hughes article also indicates that the Tofflers were not without their critics in the service academies, both authors were professors at the Air War College. While the terms of what information war is and will be were under contestation, the Air Force made clear their official position in this matter with the publication of the first service manual on information warfare.

The doctrinal manual published during this time, "Cornerstones of Information Warfare," falls somewhere between these two views: it embraces epochal language ("Information Age") but maintains a focus on degrading systems regardless of means (thereby reflecting MOP 30).[100] Technological developments that integrate disparate information systems (presumably information communication networks) are what define the "Information Age" in view of the drafters. Thus, the Information Age has rendered "information as a separate realm, potent weapon, and lucrative target."[101] However, largely reflecting the capabilities set described by MOP 30, information is not the *exclusive* weapon in the view of this document. It argues that:

> **Information Warfare:** *any action to deny, exploit, corrupt, or destroy the enemy's information and its functions; protecting ourselves against those actions; and exploiting our own military information functions.*
>
> **Information warfare is any attack against an information function, regardless of the means.** *Bombing a telephone switching facility is information warfare. So is destroying the switching facility's software.*[102]

100. Interestingly, this manual opens with an acknowledgment that the Air Force does not claim exclusive authority over the information warfare mission: the Air Force Chief of Staff and the Secretary of the Air Force state in the foreword that "information warfare is not the exclusive domain of the Air Force, or any other service."Air Force Office of the Chief of Staff, *Cornerstones of Information Warfare*, http://www.c4i.org, [Online; accessed May 25, 2017], 1995, `http://www.c4i.org/cornerstones.html`

101. ibid.

102. Emphasis in original. ibid.

What distinguishes this document from MOP 30's capabilities list is the inclusion of "information attack," which is akin to the uses of SIGINT described in TS 3600.1. Information attack is defined as the "*directly corrupting information without visibly changing the physical entity within which it resides*." Moreover, the document argues that information attack can be used to produce strategic effects, by providing an overview of how oil refinery control systems could be mapped and then disabled during wartime. However, the document is quick to note that information attacks and information warfare do not constitute a discrete "end" but merely another way of fulfilling existing Air Force missions.[103]

Overall, the document seems to reflect an amalgam of the Airpower prognosticators, MOP 30, and TS-3600.1. First, it embraces the epochal language and sense of world-spanning change proposed in Airpower Journal. Second, the document articulates that information warfare can be conducted through a variety of means like MOP 30. However, it does include "information attack" which more closely reflects the capabilities described in TS-3600.1. Moreover, information attack is not about the manipulation of adversary epistemology but rather about the degradation of information systems including industrial infrastructure. Thus, the proposed effects of this document move beyond the limited counter-C2 aims proposed in MOP 30 and TS-3600.1. Whether the AIA had any influence is uncertain as the document was drafted by the Air Force doctrine directorate. The proposed refinery attack, while in a broad sense conceptually similar to the Haiti war plans, could also be an extension of the manipulation of information systems proposed in TS-3600.1. That being said, it is known that one of the drafters of this document was the second officer recruited to the 609th IWS.[104]

Creating the 609th IWS

Due to Minihan and Rhoad's advocacy, on May 5, 1995 the 609th IWS was approved by the senior leadership of the Air Force. Rhoads, who was the first commanding officer of the IWS, stated "I liken this to the very first aero squadron when they started with biplanes. We're at the threshold of a new era…We are not exactly sure how combat in this new dimension will unfold. We only know that we are the beginning."[105] Much as with the First Aero Squadron

103. Air Force Office of the Chief of Staff, *Cornerstones of Information Warfare*

104. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 108

105. Quoted in: *609 IWS: A Brief History Oct 1995-Jun 1999*, 1. It is striking that the founder of the IWS utilized domain language, by referring to a "new dimension" and drawing a conscious parallel with the work of the first aviators. Though the significance of this statement hinges on when it was written which is not indicated in the

under Foulois, Rhoads and the two other initial members of the IWS would be largely left to their own devices in outlining the basic contours of their operations. Again, Rhoads notes that "there was no official Air Force IW doctrine[106] from which to glean basic guidance. No 'how to' manuals were available for reference. The unit was without any precedent upon which to draw experience or lessons learned."[107] The first members of the IWS were therefore given a fairly expansive task, they were charged with developing staffing and facilities requirements, mission, doctrine, a concept of operations, and operating procedures. Some of this burden was a result of their governing command failing to provide a Site Action Task Force, which was normally supplied for new units. This meant that they had to do all basic organizational tasks of establishing a unit (such as finding offices) themselves.[108] This lack of support might have been a function of the fact that many elements of the Air Force and Joint Staff opposed the creation of the IWS.[109] However, there is no direct empirical evidence to assess how this opposition impacted the development of the IWS.

By 1996, the IWS had expanded to sixty officers, many of whom were drawn from the AIA.[110] One of the basic wagers of the fledgling IWS was that "dependence [on information technology] fostered an opportunity to wage war within a new dimension or realm—cyberspace."[111] Despite this expansive view, the mission that the IWS officers drafted was deeply conservative and largely reflected the mission outlined by *Cornerstones*. It stated that the unit was responsible:

> for employing tactics, techniques and procedures to affect adversary command, control, communications, computers, and intelligence (C4I) systems and protect friendly information systems.
>
> In order to meet that mission, the 609 IWS is responsible for accomplishing three primary tasks. Those tasks are: to develop IW strategies that support component and theater plans and objectives; to plan, integrate, and orchestrate offensive IW capabilities and concepts into air component missions; and to plan and conduct

quoting document.

106. It is not clear what this means in light of *Cornerstones*, perhaps he means that there was no specific doctrine for information attack.

107. *609 IWS: A Brief History Oct 1995-Jun 1999*, 3

108. ibid., 6-7

109. ibid., 2

110. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 108; Eight of the initial billets were reserved for AIA officers. See: *609 IWS: A Brief History Oct 1995-Jun 1999*, 38

111. ibid., 3

Defensive Counter Information (DCI) operations[112]

However, it had strong connections with the AIA center of advocacy—while the IWS was charged with developing the plans for using *all* IW capabilities, the actual responsibility for developing methods for information attack remained with the AIA.[113] This role of the AIA seems to have nurtured and preserved the conceptual development of Cyberspace, not information, as a domain. Michael Hayden, who joined the AIA in late 1995, recalled that "the first article of faith at AIA was simply that cyber was a 'domain.'"[114] He credited this belief set to the work of the Minihan, claiming that he had been "proselytized by [Minihan's] disciples."[115] Owing to the secretive nature of SCEs, there are no writings that can be traced to AIA officers from this time so the full depth of the conceptual development at AIA cannot be assessed. What is known is that Minihan and Hayden's directorships at NSA were critical to the creation of Cyber Command. The partnership between the IWS and the AIA would be one of the first moves to resolve the Title 10 and Title 50 tensions and provide an operational IW unit. However, as the IWS grew it became increasingly responsible for coordinating and developing techniques for the full range of IW capabilities outlined in MOP 30 and *Cornerstones* including: psychological operations, electronic warfare, military deception, and operational security.[116] The broader remit of the IWS is perhaps why the AIA assumed primacy in diffusing consequential cyber-advocacy.

While the 609th IWS represented a combat unit created to operationalize an integrated capability, it did not produce theoretically expected effects. I theorize that the development of an integrated capability, in this case through service rivalry and moderate senior leadership interest, serves a social function to bind potential distinctive advocates into their service's conception of warfare. The pioneering allusion drawn by Rhoads—likening the IWS to the first Army aviators—suggests that the IWS staff saw their work as fundamentally new and different. Moreover, Hayden's description of the status of AIA thought suggests that they had conceptually broken with the *Cornerstones* manual by 1995. The weakness of these bonds, I argue, is likely a function of two factors: first, the (potentially) weaker allegiance that intelligence officers hold to their service and its conception of warfare. Second, that the Information Warfare mission was articulated as a non-exclusive activity, it did not become an exclusive dimension of

112. *609 IWS: A Brief History Oct 1995-Jun 1999*, 7
113. Casciano, *Los Angeles - October 18, 1996*
114. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 122; See also: Kaplan, *Dark Territory: The Secret History of Cyberwar*, 122
115. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 136
116. *609 IWS: A Brief History Oct 1995-Jun 1999*, 18

a service's identity. These weak bonds and the diffusion of advocacy from JSSG participants to Minihan helped turn the AIA into a primary driver of cyber-conceptual development.

Conclusion

The development of CNO as *force* and cyberspace as a distinct arena occurred through the dispersion of advocacy via intelligence officers during this period. This outcome is theoretically unexpected as I expect that the initial operators of the technology will form the core of advocacy that leads to the first operational unit. In this case, distinctive advocacy formed through cross-pollination between different intelligence officers over a decade. I posit that advocacy formed in this way due to the development of joint intelligence structures: the JSSG and the Joint Intelligence Center during the Gulf War appear to be the key sites through which ideas about CNO as *force* were developed and shared. Both of these organizations were formed with a composite of SCE and intelligence community personnel. The JSSG in particular exhibits some expected organizational features for the development of distinctive advocacy. First, their experimentation was not guided by senior officers, the group had been formed just to study Soviet submarine command and control systems. Second, the participants describe the JSSG as have a free-wheeling and experimental character. And third, there does not appear to be either intentional civilian intervention or senior leadership direction, in fact what they developed confused the senior leadership of the services. Perhaps the most crucial bridge between them was Mike McConnell, who participated in the development of the rudimentary network attack capability of the JSSG and then utilized similar techniques through the Joint Intelligence Center during the Gulf War. McConnell and Studeman (also from the JSSG) would go on to lead the NSA during this time period, which they believed was the best placed to more fully develop CNO. However, they were severely limited in their organizational impact because of the end of the Cold War (Studeman) and debates over telecommunications encryption or the "clipper chip controversy" (McConnell).

While neither of these figures would not be able to deeply influence the NSA during this time period, the work of McConnell and the Joint Intelligence Center inspired Ken Minihan, who became a cyber-advocate. It is not clear why Minihan in particular was so influenced by the work of the Joint Intelligence Center, it is possible that it is because some of the attacks directed by McConnell were aimed at air defense systems. Another puzzle is why, given that Studeman and McConnell were both Naval intelligence officers, did the Navy not move aggressively into

CNOs as well. While both left Naval intelligence shortly after the JSSG was disbanded, they continued to have duties with the Navy while the JSSG existed. Regardless, Minihan clearly became a key cyber-advocate and turned the AIA into a site of CNO development and advocacy. Michael Hayden, who succeeded Minihan as commander of the AIA, argues that Minihan was responsible for developing the conceptual foundations for cyberwarfare and CNO at AIA.[117]

While I theoretically expect that the advocacy period, between initial acquisition and first formal combat unit, should see the development of a single body of distinctive advocates, this case seems to demonstrate two waves of interrelated advocacy. The first is the JSSG which, despite evolving out of a joint intelligence organization, possessed many theoretically expected dynamics. Second is the AIA, which was created in response to the Information Warfare mission post-Gulf War. The latter helped to drive the creation of the first formal combat unit: the 609th IWS. One of the core expected outcomes for the advocacy period is that distinctive advocates are able to influence the promulgation of doctrine. Owing to a lack of accessible evidence, the direct influence of neither the JSSG on TS-3600.1 nor the AIA on *Cornerstones* can be easily evaluated. However, in both cases there are suggestive similarities and potential linkages. Overall then, the development of advocacy for cyberspace and CNOs as *force* happened through the cross-pollination of advocacy in joint-intelligence organizations. While this is theoretically unexpected, several of these organizations seemed to exhibit characteristics consistent with the conditions under which distinctive advocacy is expected to form.

5.4 1996-2008: Cyber Command

While the services were developing CNO in whatever limited capacity for a supporting role in Information and Counter-2 Warfare, the NSA came to prominence due to the work of Directors Minihan and Hayden. These directors had become advocates for CNO and understanding Cyberspace as a domain through their work in Air Force intelligence and sought to use the NSA to further develop and operationalize these beliefs. Hayden in his memoir, *Playing to the Edge*, notes that he and Minihan saw CNOs through a structural metaphor premised on the Air Force. Hayden recalls that "our categorization had an eerie resemblance to the way that American air power is organized and explained, reconnaissance (CNE), bombers (CNA), and fighters

117. Hayden writes "Ken had also been one of my predecessors in Texas [AIA was located in Texas], and a lot of what I had learned there was actually started and nurtured by him. I had been proselytized by his disciplines." Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 136

(CND)."[118] This conceptualization underwrote the chain of organizational developments that led to the creation of Cyber Command in 2008. Both of them believed that it would be incoherent to maintain these as separate activities and sought to consolidate all three functions under the control of the Director of the NSA, as Hayden states: "to us that made about as much sense as America having three air forces... when it really was all about control of the air."[119] The dual-hatting of the NSA Director as head of Cyber Command resolved these issues, and was meant to emulate the structure of a service department. This dual-hatting allowed the NSA director to control all three CNO functions, CND and CNE were performed by the NSA and CNA role was performed by the SCEs that were granted Title 10 authority. Thus, the NSA director came to control both the NSA, and Title 10 SCEs (Navy's 10th Fleet, 24th Air Force, and Army Cyber Command) through Cyber Command. However, Cyber Command does not enjoy (as far as is known) full strategic autonomy, rather it enjoys operational autonomy in service of the strategic objectives of United States Strategic Command to which it is subordinate.

Theoretically, I expect the period between the creation of the first combat unit and the creation of an operationally autonomous command structure to be defined by the development of a war imaginary. While the Information Warfare theories developing in the Air Force and across the services had distinctive elements of a war imaginary—a distinctive medium or domain and a belief that this enabled unique strategic action—the imaginary of cyberwarfare most clearly developed first out of the cross-pollination between the NSA and the AIA. Minihan and then Hayden worked to create a center whose relationship the services was similar to that of the AIA and the IWS: the Information Operations Technologies Center (IOTC). At the same time, the services began develop joint organizations to provide computer network defense. These organizations served as a template for the NSA directors to cultivate a CNA unit. However, the creation of the IOTC by the NSA senior leader is theoretically surprising. I expect that these types of organizational developments are the outcome of "bottom-up" advocacy, whereas the IOTC was created by the work of successive NSA directors. Moreover, the cultivation of CNOs as *force* and theories of cyberwarfare at the NSA constituted a form of revolutionary change which contributes to the theoretically unexpected nature of these developments. While there are no useful sociological accounts of the intelligence community, in the conclusion of this chapter I posit several reasons why these directors were able to drive revolutionary change.

118. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 140
119. ibid., 142

During this period the intervening variables were either sidestepped by this intelligence-led advocacy or enabled the development of an operationally autonomous organization and war imaginary. First, there is little evidence that the senior leadership of the service departments (Army, Air Force, Navy) were actively intervening into the development of IW capabilities to create CNOs. This lack of interest was so apparent that a Director of the NSA, Minihan, developed an exercise called ELLIGIBLE RECEIVER to convince the senior leadership of the significance of CNOs. Moreover, outside of the NSA there were no sustained efforts to take control of the Joint Task Forces developed during this period. Second, owing to a lack of senior leadership interest there was no sustained inter-service rivalry. This is potentially a consequence of the Task Forces defending the entirety of DoD cyber infrastructure. Third, there is only one clear case of civilian intervention—the creation of Cyber Command after BUCKSHOT YANKEE. This intervention and its outcome is theoretically consistent with the theory of domain development because by this time the NSA had developed a distinctive war imaginary and organizational capital. Together, these meant the NSA was viewed as the most legitimate authority on operating CNOs.

This section will proceed in the following fashion: first, I will describe the rise of CNOs and active SIGINT both conceptually and organizationally at the NSA under Minihan and then Hayden. Then I will explain how the two cyber-attacks on the United States military led to successive organizational developments. The first, ELIGIBLE RECEIVER/SOLAR SUNRISE, drove the services to develop a joint computer network defense organization. This organization became the seed that the NSA directors cultivated to achieve offensive CNA authority. The second was BUCKSHOT YANKEE, which spurred civilian intervention leading to the development of Cyber Command.

5.4.1 NSA: Hunters in Cyberspace

Minihan Becomes Director

The NSA during this time period was facing deep issues in its collection programs and powerful career NSA bureaucrats remained committed to traditional mid-point collection methods, e.g.: intercepting microwave or satellite communications. These issues were the consequence of

the growth of the public Internet over the course of the 1990s: high strength encryption[120], data storage systems, and fiber optic lines meant that the volume of communication that could be passively intercepted was rapidly decreasing. At the same time, organizational inertia and internal cultural differences made movement towards active SIGINT or CNE difficult.[121]

After Mike McConnell's tenure as NSA director came to an end, Minihan was tapped by the Secretary of Defense, William Perry, to head the NSA. Minihan had first come to Perry's attention because of the Haiti war-planning effort that he led at the AIA. This and his leadership of the AIA garnered Minihan a reputation for being an eccentric who got his way and this reputation led Perry to see Minihan as potential change-agent for NSA operations. The previous two NSA directors—Bill Studeman and Mike McConnell—had attempted to impose reforms at NSA but were ultimately unsuccessful due to the collapse of the Soviet Union (Studeman) and a high profile fight over encryption technologies (McConnell.)[122] One of Minihan's first actions after assuming the directorship in 1996 was to close the dominant "A" group and empower individuals within NSA who were future-oriented. Crucial to the development of cyber, Minihan created the Special Assistant to the Director for Information Warfare office. This was an expansion of an office created under the previous NSA director, McConnell, called the Office of Information Warfare. Whereas the previous office only had one staff member, the new office included multiple positions. The first Special Assistant was Bill Black, who had previously run "A" Group and had defended the small section of the NSA ("G" Group) that was working on CNE techniques.[123] A skilled bureaucratic operator, Black began the process of building up CNO capacity in the NSA.

---

120. The growing use of computer based encryption inspired the "Clipper Chip" proposal. This was an initiative pushed by the NSA and other federal agencies to provide encryption an encryption arrangement that provide backdoor access to the NSA or other investigative agencies. Sean Gallagher, "What the government should've learned about backdoors from the Clipper Chip," *Ars Technica*, December 14, 2015, `https://arstechnica.com/information-technology/2015/12/what-the-government-shouldve-learned-about-backdoors-from-the-clipper-chip/`

121. These were issues that were actively acknowledged by 1995 in the main NSA internal journal. See: [Author Redacted], "Global Network Intelligence and Information Warfare: SIGINT and INFOSEC in Cyberspace," *Cryptolog* XXI, no. 1 (1995): 29, 35

122. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 58; Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 147

123. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 59; Nolte, "Anticipating Cyberspace Security: NSA's Experience 1992-1997," 33; Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 152-155

(En)visioning Cyberwarfare at the NSA

While little is known of the activities that Bill Black and the rest of the office engaged in, there is a special issue of the NSA internal journal—Cryptolog—that featured a series of articles written by Black and his staff. These articles, published in 1997, give insight into what theories and concepts of cyberwarfare were being developed at NSA during this time period. The first article in the issue, entitled "Thinking Out Loud About Cyberspace," was written by Black. In this article, he argues that the rise of digital telecommunications meant that NSA needed to stop thinking about cryptology and start working on "cyberology." Cyberology, Black explains, consists of three "central activities, i.e.: 'exploitation', 'protection', and 'attack.'"[124] These activities are only possible because the "Information Age" has brought into being a "totally new sphere of operations, a new environment called cyberspace." Black defines Cyberspace as being:

> both real and virtual: while the real portion consists of physical assets (computers, network terminals, satellites, fiber optic cables, etc.) located on earth and in space, it is the virtual aspect—all interconnected, all networked, all compatible and interoperable—that is the most important.. . . The more important aspect of this inter-connectivity is the fact that, as we move into this complex networked future, computers are in charge, and physical geography becomes less and less important.[125]

Thus, Black articulates Minihan and Hayden's trinity against the epochal backdrop of the Information Age. Cyberspace, not the "infosphere," will be the new arena of war during this era. Contra to the conceptualizations in Airpower Journal, Cyberspace in this view is not about the media environment as such, but rather about the consolidation of telecommunication and computer networks that creates a material infrastructure and a virtualized space.

Black goes on to argue that warfare in Cyberspace is "Information Warfare," and that it has its own set of weapons and logic. The logic of Black's conceptualization of information warfare is premised on "digital coercion," or the degradation of information systems and infrastructure on which a military depends. The weapons used are "viruses, worms, logic bombs, trojan horses, spoofing, masquerading, and 'back' or 'trap' doors." These targets and weapons

124. Black Jr., "Thinking Out Loud About Cyberspace," 2
125. ibid., 2-3

A Taxonomy for Information Warfare: Three Waves, Three Schools of Thought

WAVE	FIRST (AGRARIAN)	SECOND (INDUSTRIAL)	THIRD (INFORMATION)
PHYSICAL SECURITY PROVIDED BY	A Warrior Class, Mercenaries, Militia	Professional Citizens	Information Knowledgeable Leaders
DOMINANT SOCIAL, POLITICAL, ECONOMIC FORCE	Tribe, City, State	Nation-State	Global Conglomerates
ECONOMY DOMINATED BY	Trade	Money	Symbols
WAR CHARACTERIZED BY	Representational Conflict	Mass Armies	Information Attacks
ULTIMATE DESTRUCTIVE CAPABILITY	Gunpowder	Weapons of Mass Destruction	Critical Information Deletion
INFORMATION IN WARFARE	YES	YES	YES
INFORMATION TECHNOLOGY IN WARFARE	NO	YES	YES
INFORMATION WARFARE	NO	NO	YES

Figure 5.1: The NSA Interpretation of the Toffler's Theory from "IO, IO, it's Off to Work We Go"

therefore necessitate the centering of digital SIGINT techniques. Contra the information warfare doctrine of MOP 30, Black argued that warriors of the future "will understand that 'information operations' are more than 'operations' supported by intelligence and communications; rather, they will understand that all three function together synergistically."[126]

Another article reveals that the staff of this office were also inspired by the Toffler's *War and Anti-War*. In "IO, IO, it's Off to Work We Go" the author distinguishes between three different schools of thought on information warfare.[127] First, the "information in warfare" thinkers who argue that information manipulation is a long-standing practice. Second, the "information technology in warfare" (RMA) types who view "information warfare as a force multiplier to enhance existing combat capabilities." Third, the pure "information warfare group" who "recognizes that Information Operations will lose its battlefield context in the next millenium" because of "warfare in Cyberspace."[128] The author, unsurprisingly, subscribes to the latter school which holds that protect, exploitation and attack are becoming functionally the same as the global information infrastructure consolidates.[129]

126. Black Jr., "Thinking Out Loud About Cyberspace," 4
127. See figure above.
128. [Author Redacted], "IO, IO, It's Off to Work We Go," *Cryptolog* XXIII, no. 1 (Spring 1997): 8
129. ibid., 7

The remaining authors in this volume all fall into the latter camp as well. They articulate information warfare as a qualitatively different activity from Counter-C2 Warfare (MOP 30), instead information warfare makes "possible infinitely scalable, infinitely accurate strikes on infrastructure targets by means of cyber-attacks on the information infrastructure needed to operate it."[130] Outside of merely articulating that strategic action can happen in and through infrastructure, another article provided an analytical framework for developing strategic cyber-attacks. In "Thoughts on a Knowledge Base to Support Information Operations in the Next Millennium" the author goes through the requirements for both creating and executing strategic information attacks on critical information infrastructure.[131]

Altogether, the NSA Information Warfare staff present an imaginary of information warfare and Cyberspace that is far more recognizable than prior statements of doctrine or service journal articles.[132] The crucial difference is that "action at a distance" on and through the information systems that compose Cyberspace are the crucial feature of information warfare. Black, in particular, seems to implicitly criticize the focus on other capabilities articulated in MOP 30. Moreover, the influence of Minihan is clear—Black articulates the same tripartite (CNE, CND, CNA) structure that Hayden claims Minihan helped develop. Thus, in Information Age warfare, SIGINT is the most critical capability because it enables all three activities in and through Cyberspace thereby creating new forms of coercion. While the Air Force in *Cornerstones* noted that "information attacks" could support strategic action, the NSA analysts believed that cyberattacks could have independent strategic effects. The arrival of Minihan at NSA, therefore, enhanced and encouraged the development of an independent and distinctive war imaginary.[133] Thus, NSA authors articulated a fundamentally distinct vision of information warfare from the doctrinal statements and debates occurring in the armed services.

---

130. [Author Redacted], "The Role of Information Warfare in Strategic War," *Cryptolog* XXIII, no. 1 (Spring 1997): 25; See also: [Author Redacted], "The Infowar Revolution(s)," *Cryptolog* XXIII, no. 1 (Spring 1997): 11–19

131. [Author Redacted], "Thoughts on a Knowledge Base to Support Information Operations in the Next Millenium," *Cryptolog* XXIII, no. 1 (Spring 1997): 28–37

132. That being said, an article written by RAND analysts appeared in Parameters the preceding year that made many of the same claims as the NSA authors. Roger C. Molander, Andrew S. Riddile, and Peter A. Wilson, "Strategic Information Warfare: a New Face of War," *Parameters: US Army War College Quarterly* XXVI, no. 3 (Autumn 1996): 81–92

133. Previous Cryptolog articles present a very different view. See: [Author Redacted], "Information Warfare: A New Line of Business for NSA," *Cryptolog* XX, no. 2 (1994): 3–4; [Author Redacted], "Global Network Intelligence and Information Warfare: SIGINT and INFOSEC in Cyberspace"

IOTC: Developing CNA

While Black and his staff worked on the conceptual development of a cyberwarfare imaginary, the DoD issued an updated version of TS-3600.1. The overall changes to the directive were largely cosmetic: Information Warfare was renamed Information Operations. DoD historian Mark Warner suggests that this is a consequence of political pressure, the use of "information warfare" caused concerns over the militarization of the Internet.[134] However, it also contained a critical conceptual change, computer network attack was articulated as a capability in support of "Information Operations." CNA were defined as "operations to disrupt, deny, degrade, or destroy information resident in computers and computer networks, or the computers and networks themselves."[135] Furthermore, it directed the NSA to "provide Signals Intelligence and technology assessments in support of IO planning and operations."[136]

To implement this directive, Minihan decided to create the Information Operations Technologies Center (IOTC). Insofar as SIGINT or CNE in the Information Age was fundamentally the same as CND and CNA, Minihan sought to use this opportunity to consolidate the various SCE units that were working on CNO capabilities under the control of the NSA. Therefore, much like the JSSG and Joint Information Center, the IOTC would be a joint organization including the SCEs, Joint Staff, and other intelligence agencies. This center was meant to be a creative workshop, akin the Air Information Warfare Center created by Minihan in 1993, to develop CNO techniques. Moreover, Minihan wanted the center to both *operate* and develop the technology for computer network attacks thereby granting the NSA authority to use CNA as force.[137] However, the other intelligence agencies and service departments bristled at this consolidation of authority and the NSA bureaucracy put up significant resistance. It was only after the intercession of the Secretary of Defense, William Perry, and the Chairman of the Joint Chiefs of Staff as well as the removal of the proposed Title 10 Authority that the center was

134. Warner, "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014"; ASD (C3I), *Department of Defense Directive # S-3600.1, Subject: Information Operations*, Internet Archive, [Online; accessed June 4, 2017], 12-9-1996, 1, `https://ia601509.us.archive.org/15/items/DODD_S3600.1/14F0492_DOC_02_Directive_S-3600.1.pdf`. The Air Force Information Warfare Center was also renamed to Information Operations Center.

135. ibid., 1-1

136. ibid., 7

137. Inside Defense, "AFTER 40 YEARS AT NSA, BILL BLACK IS SIGINT WORLD'S AGENT FOR CHANGE"; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 124; Nolte, "Anticipating Cyberspace Security: NSA's Experience 1992-1997," 35

able to begin development.[138]

Critically, this support also came in the form of the direct devolution of authority for creating CNA capabilities as outlined in the newly updated 3600.1 directive. The memorandum read:

> The National Security Agency (NSA) is hereby authorized to develop computer network attack (CNA) as defined in DoDD 3600.1, exploitation, and related techniques, conduct analysis of foreign information infrastructure systems for CNA technology development, develop analytic modeling and simulation techniques to characteristic vulnerabilities of information systems and effectiveness of developed CNA techniques, and provide protect advice and/or techniques, as a appropriate.[139]

It also granted the NSA executive agent status for the CNA development, which consolidated NSA's authority over the agency and service elements that operated under the IOTC. Thus, the IOTC, with Bill Black at its helm, came to serve as a critical site for the development of offensive CNO techniques. Hayden, who assumed the NSA directorship shortly after the IOTC became active, described it as "the cyber-gathering place where cyber concepts could be defined, discussed, challenged, debated, and tested" the "center kept the doctrinal fire (and controversy) of cyber operations alive."[140] Black would go on to describe the impact of the IOTC in this way: "we have become, rather than the gatherers of the past, hunters in cyberspace."[141]

---

138. Wiener, "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation," 203. The removal of this authority also led to a lot of grousing from the service personnel assigned to it. "Jumper described his experience:... When you get to the info warrior, the info warrior says, 'I can take the target, but first I have to go back to Washington and get a finding.'" William M. Arkin, "A Mouse that Roars?," [Online; accessed June 26, 2017], *Washington Post*, 6-7-1999, `http://www.newsweek.com/were-middle-cyerwar-166196`

139. Perry, William A., *Memorandum for the Director, National Security Agency, Subject: Delegation of Authority and Creation of Executive Agent*, George Washington University National Security Archive, 3-3-1997, `http://nsarchive.gwu.edu/dc.html?doc=2778590-Document-02-William-A-Cohen-Memorandum-for-the`

140. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 139

141. Quoted in: Inside Defense, "AFTER 40 YEARS AT NSA, BILL BLACK IS SIGINT WORLD'S AGENT FOR CHANGE" Curiously, the IOTC seems to have also enhanced the de-spatialization of Information Warfare. The Secretary of Defense who followed William Perry, William Cohen, states in his annual report that "The new Information Operations Technology Center (IOTC) acknowledges a transition in viewing IO threats and targets as technology-centered rather than geography-centered." William S. Cohen, *Annual Report to the President and Congress: 1998* (Washington, District of Columbia: Government Printing Office, 1998). Furthermore, in 1998 3600.1 was superseded by CJCSI 3210.01A. While the document is not available to the public, an author who was able to discuss declassified portions noted that it added CNE alongside CNA. Daniel T. Kuehl, "Information Operations, Information Warfare, and Computer Network Attack Their Relationship to National Security in the Information Age," *International Law Studies* 76 (2002): 44

Assessing Minihan's Influence

One of my core claims in this chapter is that the cross-pollination of advocacy between the service SCEs and the NSA aided the conceptual development of cyberspace as a distinct domain. In the case of the NSA, it seems that this is likely. If we take Michael Hayden at his word that the triple structure of computer network attack, computer network defense, and computer network exploitation were developed by Minihan, then this cross-pollination seems likely.[142] Previous Air Force doctrine and debates within the Airpower Journal did not articulate this triple CNO structure, rather they saw information and cyber attacks as undifferentiated in their function. Bill Black's inclusion of this structure in his article "Thinking Out Loud About Cyberspace" indicates that Minihan brought this conceptualization with him. Moreover, the articles in the Cryptolog special issue go farther in specifying how strategic effects can be generated in cyberspace than previous doctrine and debates. Regardless of Minihan's specific influence, it is clear during this time that the contours of a distinct cyberwarfare imaginary had emerged at the NSA.

As to outside of the NSA, it is not clear why "computer network attack" was included in the updated 3600.1 directive. I was unable to find in DoD documents or service journals an earlier reference to that term so it may potentially be a consequence of Minihan's conceptual influence. It is apparent that Minihan and the Secretary of Defense at this time shared a close relationship, but there is no evidence of a close relationship between Minihan and the Assistant Secretary who wrote the updated directive. In either case, the updated directive gave the mandate for the creation of the IOTC. While the tools for offensive cyberwarfare were being developed at the IOTC, another joint organization was created in response to a series of hacks.

5.4.2 Joint Structures for CNA and CND

ELIGIBLE RECEIVER and SOLAR SUNRISE

The years 1997-1998 would see the creation of the Joint Task Force-Computer Network Defense in reaction to a simulated and then real cyberattack. The former was part of an annual exercise, ELLIGIBLE RECEIVER, held by the Pentagon to assess future trends in warfare. After assuming the NSA directorship, Minihan wanted to convince DoD leadership to take both computer network attack and defense seriously. Despite the profusion of information warfare

142. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 140

doctrine, the senior leadership of the service departments were not particularly interested in either activity. Thus, NSA's red team[143] was tasked with attacking the DoD network infrastructure to expose vulnerabilities.[144] The simulation was conducted without prior notification and involved simulated attacks on critical infrastructure in ten cities and actual attacks on the DoD telecommunication and C2 networks.[145]

The exercise commenced June 19, 1997 and was scheduled to last two weeks but the red team accomplished their objectives in just four days.[146] Apparently these attacks were so effective that a commander sent an email stating "I don't trust my command-control." But for many the attacks went unnoticed, and over the course of the four days only one person in the entire DoD attempted to mitigate them.[147] The speed and expansiveness of the red team's success shook the DoD leadership who immediately began a series of initiatives to remediate their computer systems.[148] However, while the results of the exercise were still being analyzed, another attack drove home the DoD's vulnerability.

Some seven months after ELIGIBLE RECEIVER, the Air Force Information Warfare Center detected an intrusion into Air Force systems. The attack would come to be known as SOLAR SUNRISE because it exploited a vulnerability in the Solaris operating system.[149] While there was no visible damage or attempts to modify Air Force systems, the psychological impact of ELIGIBLE RECEIVER meant that officers remained uncertain as to the true extent of the attack.[150] The attacks were initially believed to have originated in Iraq but within two

143. Team of CNO operators dedicated to finding flaws in networks.

144. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 65; Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 137-138; John J. Hamre, *DoD Speech to Fortune 500 Chief Information Officers Forum*, Federation of American Scientists, [Online; accessed June 12, 2017], 7-21-1998, `https://fas.org/sgp/crs/intel/RL30735.pdf`; Kenneth H. Bacon, *DoD News Briefing, Thursday April 16, 1998*, U.S. Department of Defense, [Online; accessed June 10, 2017], 4-16-1998, `http://archive.defense.gov/Transcripts/Transcript.aspx?TranscriptID=793`

145. With the exception of the Army who viewed the exercise as a waste of time. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 67; Global Security, *Eligible Receiver*, Global Security, [Online; accessed June 10, 2017], 5-7-2011, `http://www.globalsecurity.org/military/ops/eligible-receiver.htm`

146. ibid.

147. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 70

148. Bacon, *DoD News Briefing, Thursday April 16, 1998*; Hamre, *DoD Speech to Fortune 500 Chief Information Officers Forum*

149. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 74; James Adams, "Virtual Defense," *Foreign Affairs* 80, no. 3 (May 2001): 99-100

150. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 76. The founder of the Joint Task Force-Computer Network Defense recalls that "frankly, it scared the hell out of a lot of folks." Jason Healey and Mark Grindal, *Lessons from the First Cyber Commanders*, Atlantic Council, 3-14-2012, `http://www.atlanticcouncil.org/blogs/new-atlanticist/lessons-from-the-first-cyber-commanders`

days the actual perpetrators were discovered—two teenagers in California who were hacking for fun.[151]

Together, these attacks led the DoD to create the Joint Task Force-Computer Network Defense.[152] During a meeting shortly after the SOLAR SUNRISE attack an Assistant Secretary of Defense, consulting with top information warfare officers, demanded to know who had responsibility for DoD network defense. At that time DoD networks were defended individually by the service departments through a combination of information assurance units and IT departments meaning that no individual had formal authority over network defense. Eventually, the Joint Staff officer who was in charge of information warfare, John Campbell, claimed responsibility. The Assistant Secretary empowered Campbell to develop a defensive organization and Campbell drew up plans for an inter-service unit called Joint Task Force-Computer Network Defense (JTF-CND). [153] The creation of JTF-CND signaled the acceptance that CNO were increasingly a military issue that necessitated formal military preparation

The Joint Task Force would be based in Washington, DC to enable access to the various intelligence agencies and the Joint Staff. However, instead of reporting to a service or other agency, the Task Force would initially be under the control of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence. While the Air Force wanted control over the Task Force in order to complement the competencies of the AIA and Information Warfare Center, the other services were not interested in the "Air Force telling them what they could do in their nets."[154] Curiously then, the creation of the Task Force did not trigger rivalry: neither the Navy nor the Army were interested in controlling the Task Force, they only sought to ensure that the Air Force did not. Perhaps this is because "Cyberspace" at this point continued to be broadly understood as infrastructure and while there were foreign threats the Task Force

151. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 77; Adams, "Virtual Defense," 99-100

152. U.S. Strategic Command, *JTF-CND / JTF-CNO / JTF-GNO – A Legacy of Excellence*, George Washington University National Security Archive, 2010, 5, `http://nsarchive.gwu.edu/dc.html?doc=2849764-Document-05`

153. Healey and Grindal, *Lessons from the First Cyber Commanders*; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 81; Bob Gourley, *JTF-CND to JTF-CNO to JTF-GNO to Cybercom*, CTOvision.com, [Online; accessed June 20, 2017], 9-8-2010, `https://ctovision.com/jtf-cnd-to-jtf-cno-to-jtf-gno-to-cybercom/`. The creation of JTF-CND to defend DoD networks signaled an important shift in the conceptualization of cyber-defense; a core tension of this time period was whether to understand these attacks as a military matter or law enforcement matter.Stephen A. Hildreth, *CRS Report for Congress: Cyberwarfare*, Federation of American Scientists, [Online; accessed June 12, 2017], 2001, 6, 8, `https://fas.org/sgp/crs/intel/RL30735.pdf`

154. Gourley, *JTF-CND to JTF-CNO to JTF-GNO to Cybercom*; See also: Healey, *A Fierce Domain: Conflict in Cyberspace 1986-2012*, 44-45; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 121

was, in a sense, a high-powered IT department. The Task Force became operational in late 1998 with John Campbell as the commander and Walter Rhoads (who had led the IWS) as the Chief of Staff.[155]

Operationalizing CNA

By this point the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence Art Money had become a true believer in the growing significance of cyberattacks. Money had been watching cyber developments for some time and was actively courted by NSA Director Hayden. By early 2000 Money sought to operationalize CNA capabilities within the services and proposed the creation of Joint Task Force-Computer Network Operations (JTF-CNO) to consolidate the defense (CND) and offensive (CNA) roles under a single command.[156] Again, owing to uneven interest within the services this would be a joint construct placed under the authority of US Space Command.[157]

However, while JTC-CNO had the same degree of autonomy as the IWS its mission was no longer information warfare as conceived in MOP 30, but rather strictly conducting CNA and CND operations.[158] According to the mission statement, the Task Force's purpose was to "coordinate and direct the defense of DoD computer systems and networks: coordinate and, when directed, conduct computer network operations (less CNE) in support of CINCs' [Command in Chief of Space Command] and national objectives."[159] Outside of conducting CNA and CND, JTF-CND was also tasked with deploying support teams to other joint commands in order to encourage the integration of CNO capabilities into their plans and operations.[160] The NSA also maintained a high degree of input into the operations of the Task Force, presumably

155. U.S. Strategic Command, *JTF-CND / JTF-CNO / JTF-GNO – A Legacy of Excellence*, 8

156. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 122; U.S. Strategic Command, *JTF-CND / JTF-CNO / JTF-GNO – A Legacy of Excellence*, 6. By this point the Air Force's 609th IWS was de-activated and much of its CNO activities were passed to the AIA. *609 IWS: A Brief History Oct 1995-Jun 1999*, 27

157. Apparently, US Space Command was the only command interested in housing the task force. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 122; Healey, *A Fierce Domain: Conflict in Cyberspace 1986-2012*, 46-47

158. The information warfare mission was given to the Joint Information Operations Center. United States Space Command, *USCINCSPACE Implementation Plan for Computer Network Operations*, George Washington University National Security Archive, 3-13-2001, 4-1, `http://nsarchive.gwu.edu/dc.html?doc=2805487-Document-03-The-White-House-Defending-America-s`

159. ibid., 1

160. ibid., 3-2

through the IOTC, by providing consultation on doctrine and developing target files for operations.[161] The Joint Task Force-Computer Network Operations represented the beginning of the full operationalization of CNO as an end in itself. Prior to this the authority and desire to conduct CNOs, outside of NSA, largely existed in service of information warfare broadly conceived. Thus, the creation of this task force in 1999-2000 represented the first operational unit *dedicated* to CNO as a distinct military activity.

The Second Coming of CNO Operationalization

Whereas the first operational unit for CNO, the 609th IWS, was tasked with developing CNO in service of an information warfare mission, the JTF-CNO was intended to conduct CNO as a distinct activity and capability. JTF-CNO emerged out of a chain of events initiated by the Director of the NSA, Minihan, that led to the defense of DoD networks becoming a priority. The structure of the successive Task Forces represented two features of CNO development. First, the advocacy for CND (and by extension CNO) as an operational activity primarily emerged from the NSA and service intelligence officers. This necessarily had a "joint flavor" because of the overlapping authorities that controlled the various intelligence activities, for example, the service SCEs were administered by the service departments but commanded by the NSA through the Central Security Services. Moreover, the Title 10 and Title 50 authority split meant that the intelligence organizations were unable to conduct CNOs as *force*, necessitating partnerships between the intelligence agencies/services and the service departments. Second, the defense task force had the mission of defending all DoD networks which had previously been separately defended and managed by the individual services. The sensitivities of centralizing the control of infrastructure were resolved through a joint structure, which was then preserved when JTF-CNO was developed.

Again, the structure of this unit is theoretically unexpected—I expect that these units should be directly formed out of and by a group of distinctive advocates. As I suggested before, this is a consequence of intelligence services being the first organizations interested in the non-infrastructural uses of CNOs. While the service departments developed and articulated CNOs

161. United States Space Command, *USCINCSPACE Implementation Plan for Computer Network Operations*, 2-1, 2-4. According to a 2004 indoctrination pamphlet the NSA's role in these operations were rather expansive: National Security Agency/Central Security Service and U.S. Strategic Command, Joint Functional Component Command - Network (JFCC-NW), *National Initiative Protection Program - Sentry Eagle*, George Washington University National Security Archive, 2004, 8, `http://nsarchive.gwu.edu/dc.html?doc=2838110-Document-03`

in the context of Information Warfare broadly conceived, the SCEs and the NSA continued to develop CNOs as an end in itself. The Title 10/Title 50 split meant that the bulk of advocates for this perspective, as was seen in the Cryptolog articles, were concentrated in the NSA and the service SCEs (specifically the AIA). Organizational expansions to realize the operational use of CNOs, because of the legal tensions inherent in intelligence activities versus the uses of force, thereby necessitated partnership. The creation of this unit and the IOTC represented the first steps in the NSA consolidating operational and developmental authority for CNOs as independent capabilities which would culminate in the creation of United States Cyber Command.

5.4.3 Joint Task Force-Computer Network Operations to Cyber Command

Several years later the Bush administration would begin the process of formalizing authority for militarily significant CNOs with NSPD-16. The previous Joint Task forces had been ad-hoc and hybrid structures, and by 2003 there was a desire within the Bush administration to more thoroughly define CNO authority and guidelines.[162] While the text of NSPD-16 is still classified and precisely why it was issued at this moment is unclear, an implementation document has been declassified that provides insight into what followed. Critically, these implementation documents began the process whereby the NSA began to take *direct* authority over CNOs as *force* through delegation of the CNA mission to United States Strategic Command.

The now declassified DoD *Information Operations Roadmap* issued in 2003 is likely the implementation document for NSPD-16.[163] The *Roadmap* retains the previous overarching articulation of CNOs as an element of information operations, which continue to be largely directed towards disruption of enemy command and control. The crucial inclusion that distinguishes the *Roadmap* from previous directives and doctrine is that it provides an extended conceptual discussion of CNA and formalizes operational CNA authority.[164] While the previous

162. Bradley Graham, "Bush Orders Guidelines for Cyber-Warfare," *The Washington Post*, February 7, 2003, A01; Clay Wilson, *Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues*, [Online; accessed March 11, 2017], 2007, 6, `http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB24/nsa22.pdf`

163. See commentary in Warner, "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014"

164. Department of Defense, *Information Operations Roadmap*, George Washington University National Security Archive, [Online; accessed June 12, 2017], 10-30-2003, 21, `http://nsarchive.gwu.edu/NSAEBB/NSAEBB177/info_ops_roadmap.pdf`; An updated version of 3600.1 articulates a similar framework. See:ASD (C3I), *Department of Defense Directive # S-3600.1, Subject: Information Operations*

3600.1 directive had briefly articulated a role for CNA, *Roadmap* included a broader commitment to developing and operationalizing CNA. For example, it argues that there is a need to "mature CNA into a reliable warfighting capability" and assigns the authority for conducting CNA to United States Strategic Command with consultation and support from the NSA IOTC.[165] The document acknowledges that "CNA can be executed at the tactical, theater or strategic levels" and in a redacted portion discusses the potential strategic uses of CNA.[166] Despite this richer conceptualization of CNA, there was still uncertainty as to when a CNA constitutes a use of force or an intelligence collection operation, and the document directs that a legal review be performed to study the issue.[167] This reflects the continuing tensions between Title 10 and Title 50 activities which would begin to be resolved by another organizational evolution.

The NSA Director Michael Hayden, who had become a cyber-advocate after his time at the AIA, seized on this delegation of authority in 2004 to give the NSA an offensive role. In his memoir, he recounts that he saw the delegation of CNA authority to United States Strategic Command as an opportunity to unify the CNA, CND, and CNE missions thereby creating a cyber-force patterned on the United States Air Force. This opportunity came because Hayden had cultivated a relationship with the head of United States Strategic Command, Jim Cartwright. Strategic Command had been given a "dog's breakfast" of missions after the United Space Command was closed in 2002, and Cartwright was having trouble managing all of them.[168] In order to lighten the load on Cartwright, Hayden suggested that he "devolve his authority and responsibility for cyber attack to Fort Meade and dual-hat me as his action arm under the unwieldy title of commander, Joint Functional Component Command-Network Warfare (JFCC-NW)." The IOTC would take a central role in the JFCC-NW. Hayden states that:

> We were essentially going to expand the IOTC, rebrand it, and give it operational authority through Cartwright's position as a combatant commander. The combined team at Fort Meade would access and conduct reconnaissance of a target based on my authorities as DIRNSA [Director NSA] and then, on order, could manipulate or destroy the target based on Cartwright's exercising his combat authority through me.[169]

165. Department of Defense, *Information Operations Roadmap*, 50, 57
166. The text reads: "At the strategic level, targets include [redacted] and sensitive targets (national, nuclear command and control, etc) that may have a high operational or intelligence value." ibid., 53
167. ibid., 52
168. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 142
169. ibid., 143

This organizational evolution necessitated buy-in from the service departments and the Joint Chiefs, but Hayden claims there was no opposition because they would not have to commit any resources.[170]

While the arrangement did not require congressional approval, Hayden and Cartwright also cultivated relationships with key congressional committee members as the dual Title 10/Title 50 structure might run afoul of committee jurisdictions. Hayden recounts that he persuaded the committees by bringing "the members into our confidence and our 'ask' was to give this unusual relationship of Title 10 (war making) and Title 50 (espionage) authorities a little space and time to mature."[171] Apparently this lobbying was effective and the various committees made no protest over the arrangement. Following a short initial set-up time the JFCC-NW was stood-up 2005.

For Hayden the creation of the JFCC-NW was the realization of his and Minihan's vision for a consolidated cyber force patterned on the Air Force. He states "we now had a structure to go along with our vision: a defensive center in the NSA Threat Operations Center (NTOC), an offensive arm in the Joint Functional component Command-Network Warfare (JFCC-NW), and an ongoing espionage enterprise in Tailored Access Operations (TAO)."[172] While Hayden viewed this arrangement as the realization of a vision he also saw it as provisional, a first step to creating Cyber Command. Moreover, the overall authority for conducting CNA was still vested in Cartwright, and the JFCC-NW worked to support Strategic Command's overall objectives. While the JFCC-NW cultivated greater authority and autonomy for CNA, it still lacked operational autonomy. Hayden would leave the directorship shortly after the JFCC-NW was activated, the next commander and NSA Director—Keith Alexander—would oversee the development of the first documented independent large-scale cyber-sabotage operation by the United States.[173]

The Stuxnet sabotage campaign against Iranian centrifuges at Natanz, initiated in 2006, was the brainchild of Cartwright and Alexander.[174] The former, perhaps as a result of his

170. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 143
171. ibid., 144
172. ibid., 144-145
173. Certainly CNO were utilized during the Iraq invasion but there is little explicit documentation of what was done. However, SIGINT fusion centers that brought CNE data to operational commanders were widely used in Iraq and Afghanistan after Alexander became director. See Kaplan, *Dark Territory: The Secret History of Cyberwar*, 145-163; Shane Harris, *@War: The Rise of the Military-Internet Complex* (New York, New York: First Mariner Books, 2015), 12-33
174. Though, it would not be detected until 2012. For the best account of the discovery and consequences of Stuxnet

contact with Hayden, had become attuned to the potentials of CNA. As to the latter, Alexander embraced Hayden's vision and pushed forward with developing the NSA as a one-stop shop for the full range of CNO activities.[175] These two came together when President Bush was contemplating military action against Iranian uranium enrichment plants as Bush, wishing to avoid another military entanglement, was casting about for another option.[176] By this point the NSA was conducting deep CNE operations against Iranian enrichment plants and discovered that the systems operating the enrichment plants were easily exploitable.[177] Cartwright and Alexander proposed using the NSA's resources to develop a CNA weapon that would disrupt the operation of these centrifuges and Bush agreed.[178] After eight months of development, the attack that they conceived represented a manifestation of the vision of Cyberwarfare that had been developing at the NSA and the SCEs for the last decade: Stuxnet would subtly influence the operation of uranium enrichment centrifuges causing them to fail while obfuscating cause of failure to the Iranian technicians.[179] It was an operation on an information system conducted *through* an information system. Stuxnet was released and by 2010 had damaged approximately a quarter of all Iranian centrifuges. While the material efficacy of the attack is questionable[180], Stuxnet was significant for what it represented. Hayden recalls that "it felt to me a little bit like August 1945. Mankind had unsheathed a new kind of weapon. Someone had crossed the rubicon."[181]

BUCKSHOT YANKEE and the rise of Cyber Command

In the same year that Stuxnet was approved the DoD issued the *National Strategy for Cyberspace Operations* which represented the first comprehensive strategic statement by the DoD. While previous directives and doctrine had used "information systems" or the "information environment," this is the first classified DoD document that fully embraces the domain status of cyberspace. While many of the relevant portions of the document are redacted, there are some aspects that are worth discussing. First, the acknowledgment that denoting Cyberspace

see: Kim Zetter, *Countdown to Zero Day* (New York, New York: Crown, 2014)

175. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 151

176. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 204; Zetter, *Countdown to Zero Day*, 184

177. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 20

178. Zetter, *Countdown to Zero Day*, 185

179. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 209

180. See, for example, Jon Lindsay's analysis. Jon R. Lindsay, "Stuxnet and the Limits of Cyber Warfare," *Security Studies* 22, no. 3 (2013): 365–404

181. Hayden, *Playing to the Edge: American Intelligence in the Age of Terror*, 152

as a domain is meaningful as it "establishes a foundation to define its place in military operations."[182] The definition that the document employs for Cyberspace bears many similarities to Black's characterization from 1997: "a domain characterized by the use of electronics and electromagnetic spectrum to store, modify, and exchange data via networked systems and associated physical infrastructures."[183] While the strategic framework unfurled in the document is redacted, it does list five capabilities to accomplish these goals: "network operations, information operations, kinetic actions, law enforcement, and counter-intelligence, and themes and messages."[184] While this list includes some non-CNO capabilities, the shift in priority from previous documents is telling. Whereas in the 2003 *Roadmap* CNO were listed after kinetic operations, in this document the first two capabilities are CNO based.[185] This indicates that by this point the conceptual separation of Cyberspace from the information environment was beginning to take hold.

This conceptual separation, which would culminate in the creation of Cyber Command, was accelerated in 2008 by a perceived CNA on DoD's classified networks: BUCKSHOT YANKEE. The Deputy Secretary of Defense at this time, William Lynn, states that this was the "most significant breach of US military computers ever, and it served as an important wake-up call."[186] The wake-up call was issued in the fall of 2008 when NSA CND teams noticed a digital beacon trying to reach the open Internet from within a classified DoD network. The NSA began an operation to backtrace the beacon and within several hours disabled its operation.[187] While the NSA was fast on their feet, the rest of the DoD was reeling just as they had been after ELIGIBLE RECEIVER and SOLAR SUNRISE.[188] The quick action of Alexander and the NSA contrasted with the reeling of the Joint Chiefs and other service leaders both impressed the Secretary of Defense Bob Gates and President Bush and deepened the perceived NSA ownership

182. Chairman of the Joint Chiefs of Staff, *The National Military Strategy for Cyberspace Operations*, George Washington University National Security Archive, [Online; accessed March 17, 2017], December 2006, 3, `http://nsarchive.gwu.edu/NSAEBB/NSAEBB424/docs/Cyber-023.pdf`

183. ibid., xi

184. ibid., 14

185. Department of Defense, *Information Operations Roadmap*, 21

186. Healey, *A Fierce Domain: Conflict in Cyberspace 1986-2012*, 205

187. ibid., 205-206; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 183-184

188. The virus that was sending the beacon, Agent.bz, was actually widely known in information security circles and existed on the open Internet. What this suggests for some information security researchers is that the virus was not in fact a directed attack by a nation-state. The banality of this attack was obfuscated by the fact that the NSA restricted outside forensics analysis of the attack. Harris, *@War: The Rise of the Military-Internet Complex*, 149; Healey, *A Fierce Domain: Conflict in Cyberspace 1986-2012*, 205-207

of the CNO mission. While materially the NSA was quick to act, this perception was also an extension of the intentional cultivation of actual and perceived expertise on CNOs begun by Minihan with the IOTC. This perception was further reinforced by the Director of National Intelligence (DNI), Mike McConnell, who had been part of the first efforts to experiment with CNO as *force* during the Gulf War and as a participant in the JSSG. McConnell had spent his time as the DNI slowly building a constituency within the administration that Cyber should be taken seriously.[189] Therefore, by the time of the BUCKSHOT YANKEE it was *obvious* that the NSA was the best equipped to respond and necessitated further empowerment.[190]

How the NSA should be empowered was a consequence of McConnell's internal lobbying, he had repeatedly pitched the idea of Cyber Command to Secretary of Defense Gates.[191] After BUCKSHOT YANKEE Gates and Bush agreed that the time had to come to create Cyber Command.[192] The JFCC-NW would form the nucleus around which Cyber Command would be formed and as such would remain subordinate to United States Strategic Command and the Director of the NSA would remain "dual-hatted." Moreover, as a unified subordinate combatant command it would be composed of elements drawn from all of the services—at the time of its creation: the Navy's 10th Fleet, 24th Air Force, and 2nd Army.[193] While the command would still be subordinate to the strategic direction of US Strategic Command, the consolidation and integration of all CNO forces and the delegation of doctrinal development granted it de-facto operational autonomy.[194]

---

189. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 171-172

190. Harris, *@War: The Rise of the Military-Internet Complex*, 150; Kaplan, *Dark Territory: The Secret History of Cyberwar*, 184

191. Apparently Alexander was not seeking this.

192. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 185

193. Gates, *Memorandum for Secretaries of the Military Departments, Chairmain of the Joint Chiefs of Staff, Under Secretaries of Defense, Deputy Chief Management Officer, Commanders of the Combatant Commands, Assistant Secretaries of Defense, General Counsel of the Department of Defense, Director Operational Test and Evaluation, Director Cost Assessment and Program Evaluation, Inspector General of the Department of Defense, Director Administration and Management, Director Net Assessment, Directors of the Defense Agencies, Directors of the DOD Field Activities; Subject: Establishment of a Subordinate Unified U.S. Cyber Command Under U.S. Strategic Command for Military Cyberspace Operations*; Nakashima, "Dual-leadership Role at NSA and Cyber Command Stirs Debate"

194. *passim* Gates, *Memorandum for Secretaries of the Military Departments, Chairmain of the Joint Chiefs of Staff, Under Secretaries of Defense, Deputy Chief Management Officer, Commanders of the Combatant Commands, Assistant Secretaries of Defense, General Counsel of the Department of Defense, Director Operational Test and Evaluation, Director Cost Assessment and Program Evaluation, Inspector General of the Department of Defense, Director Administration and Management, Director Net Assessment, Directors of the Defense Agencies, Directors of the DOD Field Activities; Subject: Establishment of a Subordinate Unified U.S. Cyber Command Under U.S. Strategic Command for Military Cyberspace Operations*

The memo that directed the creation of the command opened with the following declaration: "Cyberspace and its associated technologies offer unprecedented opportunities to the United States and are vital to our Nation's security and, by extension, to all aspects of military operations."[195] The basic premise of Cyber Command, therefore, is that Cyberspace has both a material and virtual manifestation. And that Cyberspace, as a discrete space, presents independent opportunities for the pursuit of national security. Attending the activation of Cyber Command, the Deputy Secretary of Defense William Lynn wrote an article entitled "Defending a New Domain" explaining to the public how and why Cyberspace must be treated as a military domain with its own force structure.[196] However, the status of Cyberspace as a domain continued to be under contestation: within several months another government official published a response. In a "A Civil Perspective on Cybersecurity," the Deputy Secretary of Homeland Security Jane Holl Lute and Senior Counselor Bruce McConnell issued a response to Lynn stating "We disagree. Cyberspace is not a war zone... cyberspace is fundamentally a civilian space—a neighborhood, a library, a marketplace, a school yard, a workshop... the vast majority of cyberspace is civilian space."[197] Whether Cyberspace will be viewed as a warzone or a civilian space is ultimately immaterial to the fact that in practice the United States and other nations prepare for and conduct military operations within it. These tensions will continue as Cyberspace approaches realization—strategic autonomy—and will likely remain for some time afterwards.

Diffuse Advocacy and the Rise of a New Domain

During the second stage of domain development, I expect that a coherent war imaginary should develop alongside organizational expansions that grant operational autonomy. The development of Cyber during this period exhibits one major theoretically unexpected features: the drive for operational autonomy and the development of a war imaginary occurred through an intelligence

195. Gates, *Memorandum for Secretaries of the Military Departments, Chairmain of the Joint Chiefs of Staff, Under Secretaries of Defense, Deputy Chief Management Officer, Commanders of the Combatant Commands, Assistant Secretaries of Defense, General Counsel of the Department of Defense, Director Operational Test and Evaluation, Director Cost Assessment and Program Evaluation, Inspector General of the Department of Defense, Director Administration and Management, Director Net Assessment, Directors of the Defense Agencies, Directors of the DOD Field Activities; Subject: Establishment of a Subordinate Unified U.S. Cyber Command Under U.S. Strategic Command for Military Cyberspace Operations*, 1

196. William J. Lynn III, "Defending a New Domain: The Pentagon's Cyberstrategy," *Foreign Affairs* 89, no. 5 (2010): 101

197. Jane Holl Lute and Bruce McConnell, "OP-ED: A CIVIL PERSPECTIVE ON CYBERSECURITY," [Online; accessed March 20, 2017], *Wired Magazine*, 2-14-2011, `https://www.wired.com/2011/02/dhs-op-ed/`

agency—the NSA. As I argued before, I posit that this is because advocacy cross pollinated between the SCEs and the NSA. The successive directors who controlled the NSA, developed or attempted to develop successive joint structures with Title 10 authority to use force. These hybrid structures were the outcome of the structure and statutory limits placed on the United States intelligence community.

Furthermore, the cross-pollination of advocacy between the AIA and the NSA meant that a documentable coherent war imaginary emerged at the NSA after Minihan took over the Directorship. This imaginary posited that Cyberspace was a discrete infrastructural medium through which strategic effects could be generated. The claims made by the NSA staff were far more focused and less hypothetical than the earlier debates in Airpower Journal. The success of this imaginary in articulating a vision can be seen in both the Stuxnet attack and the cultivation of organizational alliances leading to the creation of Cyber Command.

The intervening variables during this period are strikingly permissive: while the services indicated some degree of interest in Information Warfare during the 1990s they put up little opposition to the successive growth of the NSA's hybrid organizations. This had the consequence that neither senior leadership interest nor inter-service rivalry had any impact on either visioning or organizational growth. While the overall absence of opposition may be a function of the NSA directors driving these changes, that is challenged by both the brief opposition to the IOTC as well as an overall lack of service interest in control over the Joint Task Forces. Moreover, the one clear case of civilian intervention following BUCKSHOT YANKEE in 2008 went in favor of the NSA advocates. Thus, Cyberspace as a domain has entered the realization phase and continues to be so today.

5.5 Trends toward Realization

While much of what Cyber Command does is conducted in deep secrecy, there are signs CNO as a form of warfare is becoming increasingly normalized. Under the Obama Administration preparations for the delegation of authority to launch cyberattacks during moments of acute

198. In 2012 an individual used a botnet—functionally a computer virus—to map the usage of Internet Protocol addresses (IPv4) across the world. The result was used to generate this map which gives a glimpse into the publically accessible networked geography. Carna Botnet, *Internet Census 2012: Port scanning /0 using insecure embedded devices*, [Online; accessed May 20, 2015], 2012, `http://census2012.sourceforge.net`

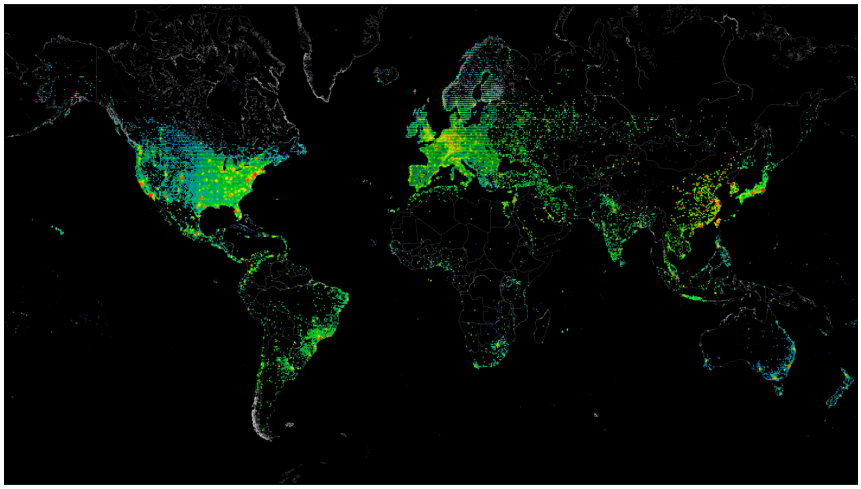

Figure 5.2: Cyberspace in 2012[198]

crisis were developed in PPD-20. Previously classified, PPD-20 was revealed in 2013 by Edward Snowden. While Cyber Command enjoys a high degree of autonomy, previous to PPD-20 consequential CNOs required presidential approval at all times. In PPD-20, the Secretary of Defense and other agency heads (unspecified) were delegated authority to conduct "emergency cyber actions." While the directive specifies that these must be limited in scope and effect, it signals a small expansion of autonomy.[199] Moreover, in 2016 Cyber Command formed Joint Task Force-Ares in order to wage cyberwarfare against ISIS.[200] The ability for Cyber Command to train, equip, and deploy an individual task force represents the increasing size and sophistication of its operations. Taken together these indicate that the institutionalization of Cyber as a domain of warfare continues apace. Whether and when Cyberspace will become a full strategic domain is uncertain, the realization of the air as a strategic domain occurred during the last great power war—World War II. Given the increasing sophistication and difficulty in attributing CNOs, it is possible that this could occur in what is nominally peacetime. As the deep secrecy that attends the conduct of CNOs by Cyber Command could very well mean that it independent strategic cyberwarfare could be realized without public debate or even knowledge.

199. The White House, *Presidential Policy Directive/PPD-20*, Federation of American Scientists, [Online; accessed June 20, 2017], 10/16/12x, 10-11, https://fas.org/irp/offdocs/ppd/ppd-20.pdf

200. USCYBERCOM, *USCYBERCOM to CDRUSACYBER, Subj: CYBERCOM FRAGORD 01 to TASKORD 16-0063 To Establish Joint Task Force (JTF)-ARES to Counter the Islamic State of Iraq and the Levant (ISIL) in Cyber Space, May 5, 2016.*, George Washington University National Security Archive, 2016, http://nsarchive.gwu.edu/dc.html?doc=3678213-Document-07-USCYBERCOM-to-CDRUSACYBER-Subj

However, if there is any conclusion about the alleged 2016 Russian intrusion into the American presidential campaign, it is that the debates over how think about Cyberspace—warzone or neighborhood—will continue.

5.6 Alternative Explanations

As to the potential alternative explanations—normative and structural isomorphism—outside of the suspected perpetrators of cyberattacks there seems to be little discussion of either foreign threats or foreign CNO doctrine the case evidence. For example, while SOLAR SUNRISE in 1998 was briefly suspected to be perpetrated by Iraq, the attack merely accelerated the changes initiated by the exercise ELIGIBLE RECEIVER. BUCKSHOT YANKEE, on the other hand, was perceived to be an attack by Russia and was the proximate cause for the creation of Cyber Command. However, the offensive CNO mission had already existed with the NSA prior to this under the JFCC-NW. That being said, BUCKSHOT YANKEE did inspire the consolidation of all CNO forces under a single command, something which Keith Alexander was not seeking. This suggests that the creation of Cyber Command, at the very least, was a response to structural pressure. As to potential foreign normative influences, there are no references to how and why other states might or were using CNOs in the key early doctrinal debates and literature. Much of these discussions were based on deriving what features of warfare had changed based on a new epoch, the "Information Age." There is a normative dimension in this thought—that an Information Age military must wage Information Age war—but there were no discussions of other states. However, by time of Cyber Command the "Information Age" as an epoch in military thought had passed. We are now, so it seems, in the Cyber Age and what that will mean for what warfare is has still yet to be fully realized.

5.7 Conclusion

The entry of cyber into the realization phase is the work of advocates, emerging from intelligence agencies, working through joint structures to realize offensive CNA capabilities. This path forged by the cyber-advocates is theoretically unexpected, however, as I expect that advocacy forms and develops through a service department. A core reason for this is the fact that early experimentation with CNOs—at the JSSG and Joint Intelligence Center—was conducted

by composite intelligence organizations. The conceptual framework of using CNOs to generate effects was then diffused to the AIA, and eventually the NSA. As intelligence organizations, they had limited authority to conduct activities that appeared to be force, and as such further hybrid structures were created. What this suggests is that the initial organizational entry of a technology into a military spurs organizational path dependency. The main offensive Israeli Cyber unit, Unit 8200, demonstrates this path dependency. Unit 8200 began as a strictly signals intelligence agency akin to the NSA, and they rapidly moved into CNOs. Unlike Cyber Command, 8200 is a unified organization rather than a composite. Moreover, 8200 considers Cyberspace to be a strategic domain, though there is little information on how 8200 came to articulate Cyberspace in this way.[201] The line of advocacy that extends from the JSSG to Cyber Command is composed almost entirely of career intelligence officers who moved between the services and the NSA. As I noted in the introduction, there is little known about the organizational dynamics of identity and allegiance within the intelligence community. While they certainly operate according to normal bureaucratic politics—the NSA career staff at several points opposed the development of CNOs—the movement of service intelligence officers between various organizations suggests a composite or hybrid identity. Per my theoretical claims, a new and distinctive identity centered around warfare through a new domain serves a key function—it binds advocates together in their drive to develop new organizations, ideas, and theories of warfare. The fact that the advocacy line largely remained within the intelligence community suggests that distinctive identity can develop through hybrid organizational forms. This would explain why, for example, JSSG advocates did not cross-pollinate their ideas into the Navy.

This is related to a second theoretical curiosity from this case—that Minihan and Hayden were able to impose top-down change in the character of the NSA. I expect that organizational expansions should flow from the work of distinctive "bottom-up" advocacy as a new domain signals a break from the dominant identity of a service. In this case, the development of specialized organizational forms for operationalizing CNOs was the product of successive NSA directors. Moreover, at multiple points existing NSA constituenices actively opposed or expressed displeasure at the movement towards CNOs and active SIGINT. While there are few accounts of the nature of intelligence community organizational identity, I suggest that there are three reasons why these NSA directors might have been able to drive revolutionary change.

201. Lior Tabansky and Isaac Ben Israel, "Striking with Bits? The IDF and Cyber-Warfare," in *Cybersecurity in Israel* (Cham: Springer International Publishing, 2015), 64-65

First, unlike service department senior leadership which stand at the top of a sharply delimited advancement pyramid, NSA directors are drawn from outside of the NSA bureaucracy. Directors are typically drawn from service department SCEs, which have a relationship to the NSA through the CSS, and possess a multivalent relationship to bureaucratic authority. While service department leadership is socialized through and owe their careers entirely to a single organizational entity, intelligence officers organizationally travel and owe fealty to multiple organizations. These socialization differences may grant intelligence agency directors a freer hand both organizationally and conceptually. Second, service departments are vastly larger than the NSA, possess a great number of veto points, have multiple public constituencies, and their identity is an aspect of broader American culture. Whereas the NSA is far smaller, possesses a highly secretive culture, and highly compartment or "stove-piped." This may lead the NSA organizational culture to not have the same 'esprit de corps' as the service departments. Moreover, the organizational complexity of service departments make them far harder to change. Finally, the hybrid nature of the Title 10 CNO organizations may have externalized the most distasteful aspects of these shifts, thereby diffusing potential resistance.

The final theoretically surprising dimension of this case is that CNOs were developed as an integrated capability by the Air Force and yet the Air Intelligence Agency served as a site of conceptual development and advocacy. I theoretically expect that the development of an integrated capability binds the operators and developers into the service conception of war, preventing distinctive advocacy from coalescing. Why this auxiliary outcome did not prevent the formation of distinctive advocacy is likely due to two factors: first, that the MOP 30 Information Warfare mission was explicitly a joint-mission. This jointness meant that the services did not seek to weave Information Warfare into their service identity in the same way that the Air Force wove guided missiles into their strategic bombing mission. And second, that service intelligence officers have a multivalent identity—they frequently participate in joint organizations, organizationally travel, and observe different organizational chains of authority. Together, these two factors meant that the socialization dynamics I expect to occur only generated weak bonds.

Chapter 6

Conclusion

In this dissertation, I have sought to demonstrate that the inauguration of new military domains is fundamentally a process of structured contingency. Over time domain enabling technologies stabilize as they become woven into military doctrine, procurement plans, service tradition and identities, and international legal regimes. The differential outcomes demonstrated by the air, orbital space, and cyber cases show that the development of new spaces and ways of warfare is at its core a process of social imagination and organizational struggle. In particular, the development of orbital space into a support domain and the repeated failures of attempts to revise that status demonstrates that the process by which a domain develops is neither linear nor assured. Technological change is not a deterministic force; it may spark the imagination of advocates but they must constantly tend the flame through lobbying, debates, and organizational maneuvering. The tending of this flame necessarily presents many challenges as the development of a new military domain is fundamentally a *revolutionary* change in the nature of warfare. These actions sustain, produce, and diffuse the organizational forms and social beliefs that surround distinct spaces and ways of warfare. An Air Force official reflecting on the rise of cyber in the late 1990s argued that "technology begets doctrine, and doctrine begets organization."[1] At a fundamental level, what this project has sought to explain is how this process of begetting, driven forward by advocates, succeeds or fails.

The revolutionary change represented by the development of a new strategic domain, therefore, is not merely the product of the creation of new technology or suite of technologies. Rather, it is the outcome of the conscious work of advocacy mediated by the organizational

1. Robinson JR., "Information Operations Center Provides Attack Thwarting Tools"

dynamics of militaries. The contingent nature of this social process exposes how micro-social processes of imagination can drive macro and meso changes in the international security environment. Cyber, for the United States, could have remained an adjunct of a broader conception of Information Warfare. Likewise, Air Forces could have been developed primarily with a focus on tactical and operational support and not strategic bombing campaigns. The rise of these domains is not the consequence of a rational assessment of technology nor purely a move to innovate against threats in the security environment. Instead, it was an outcome of advocacy working within and against organizational prerogatives and entrenched interests. The power of organizational mediation to de-rail advocacy is clearly demonstrated in the case of orbital space. Advocacy failed to coalesce because space enabling technologies were woven into existing concepts of war (guided missiles), preventing the development of advocacy and opening the path for an alternative vision. The effects of these outcomes are not trivial as they define who or what is considered a legitimate target in warfare, what threats exist in the security environment and how they are interpreted, and more fundamentally the nature and dynamics of internationally shared spaces.

In this conclusion I will outline two sets of implications of this project: first, what theoretical and conceptual lessons can be drawn for theorizing military innovation and change. I argue that this study both complements and challenges existing theories of military innovation. In particular, it demonstrates that large-scale military change can be driven by "unintentional" incubators and that innovation is not always a directed process or the side-effect of organization struggle. Further, it complements the literature by expanding the scale of innovation explained. Much of the extant literature focuses on individual weapons systems or doctrinal shifts. My theory of domain development shows how suites of weapons, bodies of doctrine, and organizational forms arise. I will also briefly discuss contributions to the burgeoning scholarship on cyber and international relations and potential insights into the sociology of military bureaucracy that were unearthed within the cases. Finally, I discusses avenues for further research. In the final section of this chapter I discuss the substantive implications for international political life of the development of domains. After outlining three substantive implications I conclude with a brief discussion of what, if anything, is unique about Cyberspace.

6.1 Implications for Theory

The development of a new strategic domain represents a type of large-scale military innovation as it involves the development of new capabilities, doctrine, organizational forms, legal regimes, and conceptions of warfare. This project contributes to existing explanations of innovation by expanding both the scope of innovation explained and providing a theoretical account that explains military change across large time scales. I will expand on these contributions in the following order: first, structural accounts; second, organizational explanations; and third, ideational/constitutive explanations. I also discuss what implications this project has for the burgeoning literature on Cyber and the sociology of military institutions. I conclude this section with a discussion of avenues for future research.

6.1.1 Theories of Military Innovation

Structural accounts of military change such as those presented by Barry Posen and Deborah Avant argue that one of the primary motors for military change is civilian policymakers assessing changes in the security environment.[2] This project both challenges and complements these studies by exposing the work of advocacy in generating the terms of military change. Posen argues that one of the mechanisms of change is the promotion of 'maverick' officers by civilian policymakers. By highlighting the role of slow-developing distinctive advocacy, this project explains how maverick advocacy develops and is sustained. It also demonstrates how the organizational environment of the military can prevent the development and promotion of viable maverick advocacy. The course of the development of Orbital Space, in particular, highlights the critical role of these organizational variables. Sputnik I & II were viewed as a clear demonstration of Soviet military prowess by the democratic leaders of the United States Senate, but they did not seek to align themselves with maverick elements in the services, such as Bernard Schriever who was an Air Force space advocate. Contra Posen I argue that this failure of politicians to align with service advocates was a function of inter-service rivalry that preceded Sputnik. While Avant would argue that this failure was a function of the tensions between the republican White House and democratic Senate this fails to account for why a consensus was

2. Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars*; Avant, "The Institutional Sources of Military Doctrine: Hegemons in Peripheral Wars"

formed around a civilian-surveillance articulation of Orbital Space. Therefore, this project clarifies when and how maverick advocacy forms and under what conditions this advocacy will be viable for civilian driven intervention for innovation.

Next, this project challenges and clarifies several aspects of organizational accounts of military innovation. First, it demonstrates how inter-service rivalry can limit large-scale military innovation. Scholars such as Harvey Sapolsky argue that this rivalry generates powerful organizational incentives for innovation.[3] Against this view, I have argued that rivalry stymies large-scale *revolutionary* innovation by generating incentives for senior leaders to domesticate or tame fundamentally new ways of warfare. The development of space-launch technologies for guided missiles (integrated capability) demonstrates this dynamic most clearly. Furthermore, inter-service rivalry relies on a "pull" dynamic for innovation: the creation of a new mission area and funding line generates the dynamics for innovation. The rise of strategic bombing and Computer Network Operations as *force* demonstrate that a "push" dynamic can drive innovation. Both of these highlight how new mission areas are developed through the work of advocacy under specified organizational conditions. Advocates push for the development of new mission(s) and therefore do not purely react to organizational incentives. Thus, while inter-service rivalry can generate narrow innovation in service of a new mission area, this study indicates that it cannot explain fundamentally *revolutionary* innovation of new missions areas.

Next, Rosen's account of intra-service rivalry provides an account of how the political dynamics of military identity and bureaucracy can provide the push for new mission areas.[4] However, intra-service rivalry can only explain how large-scale *evolutionary* changes occur within a military organization. The development of a strategic domain necessitates a series of *revolutionary* changes in organization, identity, and theories of victory. This study demonstrates that the drive for revolutionary change occurs through successive drives for substantial autonomy and not merely through internal alliance building. The failed attempts to promote the Aerospace Domain concept by the Air Force senior leadership demonstrates the limits of revolutionary innovation internal to a service department. Exceeding the mere evolutionary redefinition of a service, the development of a strategic domain necessitates the envisioning of a theory of victory or war imaginary that supplants and breaks with the core identity of a service.

3. Sapolsky, *The Polaris System Development: Bureaucratic and Programmatic Success in Government*
4. Rosen, "New Ways of War: Understanding Military Innovation"

The rise of the Army Air Forces and Cyber Command were the function of advocacy seeking fundamentally new organizational forms paired with a fully distinct imaginary of war. This project has demonstrated the ways in which large-scale innovation arises from the struggles to realize a fundamentally distinct way of warfare premised on a space of military activity.

For some, such as Benjamin Jensen, military bureaucracies can function as intentional innovators by promoting the creation of organizational incubators to develop new theories of victory.[5] This study suggests that bureaucracies can unintentionally create incubators for the development of a distinct war imaginary and theory of victory. A lack of senior leadership interest or inter-service rivalry after the initial acquisition of the technology can create the conditions that enable the incubation of innovative concepts and ideas. The work of the first Army Aviators and the Joint Special Studies Group both demonstrate how unintentional incubators are formed. This contributes to bottom-up studies of military innovation by showing how the work of self-forming innovative advocates, over time, produces fundamentally new ways of warfare.

The theory of domain development and preceding discussion has articulated the development of a war imaginary as a core process in the development of a strategic domain. War imaginaries are the sets of beliefs about how a domain enabling technology is revolutionizing warfare and society. To a large extent, existing ideational and constitutive studies of military innovation such as those posed by Farrell, Avant, and Kier externalizes the formation of new or distinct beliefs about warfare.[6] This study contributes to this scholarship by demonstrating how organizational environments and processes enable the formation and operationalization of these beliefs. Whereas Farrell focuses on the diffusion of normative military thought across and between militaries, the preceding case analysis suggests that a crucial normative dimension is the perception of world-historical time or epochs. In each of the cases military officers demonstrated extensive normative thinking but this thought was dominated by epochal thinking: the airplane and the Industrial Age, the rocket ship and the Technological Age, and Cyberspace and the Information Age. Technological change, therefore, inspired strains of normative thought which articulated new conceptions of warfare against the backdrop of an epoch. Avant makes a similar claim that broader beliefs about the nature of society and warfare can take hold following a defeat and the breakdown of political consensus. However, the development of strategic

5. Jensen, *Forging the Sword: Doctrinal Change in the U.S. Army*

6. Avant, "From Mercenary to Citizen Armies: Explaining Change in the Practice of War"; Farrell, *The Norms of War: Cultural Beliefs and Modern Conflict*; Farrell, *The Norms of War: Cultural Beliefs and Modern Conflict*; Kier, *Imagining War: French and British Military Doctrine between the Wars*

domains suggests that the mobilization of these beliefs can occur under conditions that are not defined by a wide-scale civilian political and military crisis. The rise of strategic air warfare in the United States necessitated viewing civilian industry and infrastructure on the far interior of states as being legitimate targets of warfare. Strategic air warfare represented more than a new tool of war, it also necessitated a re-conceptualization of the relationship between states, societies, and military activity. The mobilization of this set of beliefs occurred in the absence of political crisis and defeat. Finally, Kier highlights the role that broader beliefs about state-society relations play in the development of military doctrine. This study contributes to Kier's argument by showing how these beliefs are developed, mobilized, and encoded into the organizational culture of military bureaucracy.

This project and the theory of domain development makes four over-arching contributions to theoretical accounts of military innovation. First, by explaining the role that technological change plays in the development of innovative doctrine and capabilities. Rather than treating technology as a concrete deterministic force, I center the influence that technological changes has in inspiring the envisioning of new ways of warfare. Strategic bombing, cyber-warfare, and the non-weaponization of Orbital Space were not fated. Each are outcomes of the vicissitudes of advocacy inspired by technological change. Second, demonstrating the core role of advocacy in pushing for the development of new missions and ways of warfare. The drive for realizing a war imaginary by advocates is not a mere reaction to civilian intervention, organizational incentives, top-down direction, or ideational diffusion. Instead, this drive is born out of the advocacy birthed under specific organizational conditions. Third, a demonstration of how fundamentally *revolutionary* innovation and change occurs outside of moments of disjunctural crisis. Finally, by providing a theoretical account that captures the core dynamics of innovation across multi-decade periods and explains large-scale innovations.

6.1.2 Cyber and International Relations

This study also contributes to the burgeoning literature on cyber and international relations by placing the development of CNOs as a capability in a comparative context. This complements existing empirical scholarship on cyber, such as Valeriano and Maness's work on understanding the historical dynamics of cyber conflict between states[7] or assessments of the efficacy and

7. Valeriano and Maness, *Cyber War versus Cyber Realities: Cyber Conflict in the International System*

effect of cyber capabilities.[8] This study has shown that to a large extent, the development of Cyberspace as a domain has followed many of the same dynamics as previous domains. The key difference is that the development of cyber as a domain was driven by advocates drawn from intelligence units and agencies. While this challenges some aspects of the theory of domain development, it also demonstrates many of the core dynamics such as the organizational conditions under which distinctive advocacy forms, the development of a war imaginary, and the "bottom-up" struggle for organizational development.

6.1.3 Military Sociology

This study also suggests several conceptual conclusions for the sociology of military institutions. First, by demonstrating how conservative military officers tend to engage in metaphorical extension of existing concepts when confronted with new technologies. The airplane and the space launch technologies were received in some parts of the Army as a new type of artillery. Likewise, computer network operations were articulated as providing complementary or similar capabilities to aircraft in early Air Force information warfare doctrine. The use of these metaphors are not trivial for the development of a new domain—for example the Secretary of War following World War I argued against expanded aviation autonomy by analogizing it to granting greater autonomy to artillery forces. Similarly, in the landmark Smuts Report that led to the creation of the Royal Air Force, the author saw a need to explicitly counter similar understandings. Metaphorical conceptual extension also led the Air Force to initially pursue guided missiles instead of satellites when faced with space-enabling technologies.

Second, militaries are highly resistant to fundamental shifts in their core identity. By core identity, I mean what basic activities of warfare define how service members act, live, and die. The failure of the Air Force senior leadership to successfully promote Aerospace after the Sputniks Crisis demonstrates the resistance of these core aspects of service identity. Air Force rank and file needed constant re-assurance that the space age would not supplant their traditional core activity—flying aircraft. Weapons systems in Orbital Space heralded the displacement of both human direction and aircraft in the activity of warfare.

8. Ronald J. Deibert, Rafal Rohozinski, and Masashi Crete-Nishihata, "Cyclones in cyberspace: Information shaping and denial in the 2008 Russia-Georgia war," *Security Dialogue* 43, no. 1 (2012): 3–24; Lindsay, "Stuxnet and the Limits of Cyber Warfare"; Gartzke, "The myth of cyberwar"

Third, in the modern United States military service identity does seem to be more extensible for service members involved in and with intelligence activities. Service cryptologic elements and joint intelligence organizations played a crucial role in the development of beliefs about cyber as force. I suggest in the cyber case study this might be a consequence of two features of military intelligence bureaucracy: first, the core activities of service intelligence units possess a greater functional similarity across service departments. The work of signals intelligence is far less context dependent that servicing a ship or airplane. Second, following the post-World War II defense unification and the creation of the Joint Intelligence Directorate in the Goldwater-Nichols act (1986) many intelligence operations were conducted as joint projects between the services and intelligence agencies. That these linkages generate unique dynamics is drawn into contrast by failure of the Air Force space community to unify following the creation of Space Command. The unique organizational cultures of the various Air Force space organizations in the 1980s (existing within distinct Air Force commands) prevented the rapid consolidation of Air Force space systems and the development of new doctrine or missions. There is no observable evidence that the same conflicts effected the development of Cyber Command or the various joint organizations that preceded it.

6.1.4 Avenues for Further Research

This study suggests four avenues for future research. First, the relationship between perceptions of world-historical time and military doctrine. While cross-national normative thinking was surprisingly absent in the cases, there was a large degree of epochal normative thinking. Officers frequently utilized the argument that ways of warfare must match their age, e.g.: Air Warfare and the Industrial Age. In this project I have directly highlighted a few of these connections, such as the influence of the Toeffler's wave theory on Information Warfare, but this discussion has been limited due to the scope of the argument and space constraints. The frequent use of epochal language and world-historical context in debates over military doctrine suggests that this may be an important input into the development of military doctrine and capabilities. Future ideational studies of military innovation should trace how normative beliefs about epochal change enter into and influence the milieu of military thought.

Second, how beliefs about the nature and status of domains come to be part of the normative infrastructure of international politics. While it is clear that these beliefs come to under-gird internationally shared understandings of spaces of peace and conflict the scope of

this study did not extend to what pathways the diffusion of these beliefs take. Identifying and specifying these pathways would contribute both to our understanding of military domains but also how clusters of norms form alongside new ways of warfare.

Third, further research should be conducted on the failure of other domains to develop. For example, the development of diesel submarines and accurate torpedoes at the turn of the twentieth century was heralded by some as the end of surface Naval warfare. Later, the Electromagnetic Spectrum was briefly defined as a domain along with 'Information.' Understanding why these domains would fail to develop contributes to a broader understanding of the relationship between military activity and technological change. In future versions of this project I will discuss both of these cases.

Finally, further research is necessary to understand the relationship between intelligence agencies and service departments. The rise of Cyberspace and CNOs as force is a case of intelligence unit and agency driven military innovation. The organizational font of Cyber was theoretically unexpected, but it did possess many theoretically expected features. To that end, a clearer understanding of these relationships would be useful as Cyber Command is led by the NSA Director but also composed of service elements. There are two features that necessitate further study: first, the relationship to service identity that service intelligence officers possess. The Cyberspace case indicates that this relationship has neither been explored or captured effectively.[9] Second, how and if innovations diffuse between intelligence agencies and service departments. It is not clear why, for example, the Navy did not pursue CNOs as force despite the fact that it grew out of a study conducted primarily by Naval intelligence officers.

6.2 Substantive Implications

The first broad implication that can be drawn from this study is that the dynamics of the development of military domains are consequential for how new technologies become articulated as capabilities and in military doctrine. In particular, the history and formation of sets of beliefs about how technologies change warfare are effected by the organizational environment of the military. The contrast between the Army Air Forces and the Luftwaffe demonstrate that the interventions of the senior leadership of a service can stem revolutionary and independent

9. For example, the actions of the officers seem to contradict Huntington's classic understanding of service identity.

conceptions of warfare. Whereas the Luftwaffe developed as an operational air force due to the influence of Wehrmacht leadership, the Army Air Forces developed theories, capabilities, and organizations in pursuit of strategic air warfare. Moreover, the latter was not the product of a rationally calculating civilian leadership or the direction of War Department senior leadership. If Roosevelt wanted to develop an air capability that directly countered the Luftwaffe he would have directed the development of fighter aircraft or anti-aircraft technologies which would directly challenge the power of the Luftwaffe rather than allowing the Army aviators to pursue long-range strategic bombers that targeted infrastructure. Similarly, the War Department senior staff and Secretary of War during this period, while admitting that aircraft were important, preferred the development of medium bomber airframes. The war imaginary that undergirded Army Air Force strategic bombing plans and campaigns had developed out of a thirty-year process of distinctive advocacy. Similarly, the conceptual and organizational foundations of Stuxnet were developed out of the advocacy of Minihan and Hayden. The core organizational predecessor of Cyber Command—Joint Task Force-Computer Network Defense—was the direct outcome of advocacy by Keith Minihan and not civilian or service department intervention. While not theoretically expected, the influence of the RAND researchers on the development of Orbital Space also highlights the role of ideas in stemming the creation of new capabilities. The dual civilian-surveillance space policy adopted by the United States was the outcome of RAND analysts debating and exploring the political (technological prestige) and military (surveillance as an end in itself) dimensions of space systems. Both of these lines of thought temporally preceded Eisenhower's 1955 Open Skies Proposal[10] and Kennedy's 1962 articulation of lunar exploration as a dimension of national prestige. Theoretical accounts that seek to explain the development of new capabilities and ways of warfare must pay attention to how ideas and beliefs are formed within militaries.

What this indicates, I argue, is that the uses to which potential military technologies are directed are not a natural outcome of technological development. The paths that the development and utilization of technology takes are a function of the specific sets of beliefs of a given place and time. That space technologies were utilized for prestige and surveillance is not the outcome of cost and orbital dynamics—they were articulated through global prestige prior to the first space launch. Developing the first satellite as overtly civilian-scientific was a choice influenced by political considerations and visions of what the satellite would *mean*.

10. Which depended on surveillance.

Likewise, the idea that a computer network attack constituted *force* was a function of beliefs and not an obvious feature of the technology. For example, Thomas Rid's book *Cyber War Will Not Place* argues that by definition computer network attacks cannot rise to the level of warfare as they are merely variations of espionage, sabotage, and subversion.[11] While ultimately a definitional exercise, that this book and argument exists exposes the extent to which cyberwarfare is a matter of interpretation. Creating the JTF-CND as opposed to an administrative DoD IT department demonstrates that conceptual shifts were necessary to even view computer network attacks as a use of *force.* Thus, we must be attentive to the ways in which beliefs about warfare and technology drive forward these changes.

Second, that large-scale shifts in the security environment can be driven by bottom-up processes. The creation of a new strategic domain is more than just the creation of a new suite of capabilities or new organizational forms, it fundamentally alters the nature and structure of the security environment. Air, as a strategic domain, necessitated the creation of security architectures that anticipated attacks through the air by, for example, creating automated radar networks and placing aircraft on 24 hour alert. These structures were a reaction to the new form of vulnerability that aircraft engendered. Or, as the Army Chief Signal Officer perceptively remarked in 1910 the airplane "extended the vulnerable area of a country to every acre of its territory."[12] At a deeper level, they also underwrite symbolic displays of power such as the use of bomber flights for 'sabre-rattling' and the very belief that bombing campaigns can "shock and awe" a population or regime. Likewise, the rise of cyber has necessitated understanding the maintenance of military information infrastructure not as an administrative or law enforcement task, but rather a military activity. Furthermore, it also meant the acceptance that the offensive manipulation of information infrastructure by militaries is an expected aspect of inter-state competition and warfare. The use of the Stuxnet and Flame viruses to affect Iranian and North Korean nuclear development demonstrates how computer network attacks have become another instrument of foreign policy. Likewise, the targeting of Sheldon Adelson's businesses by Iran following belligerent remarks he made demonstrates how cyber as an instrument of foreign policy has allowed for the direct targeting of individuals.[13] In contrast, the non-weaponized nature of orbital space, while increasingly strained, has held for the last sixty years against multiple

11. Thomas Rid, *Cyber War Will Not Take Place* (New York, New York: Oxford University Press, 2013)
12. Allen, "Report of the Chief Signal Officer," 651
13. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 230

challenges. The consequence of this is that states do not have observable extensive preparations for kinetic warfare in orbital space. The codification of these beliefs in popular culture and international law enabled trans-national cooperation in space. That orbital space is widely believed to be an internationally shared space and an element of peaceful prestige struggles was and is a *choice*. Therefore, domains define who and what is vulnerable and how, who and what should be targeted and why, and in what spaces and ways threats should be anticipated.

Third, the set of beliefs surrounding integrated capabilities as well as support and strategic domains are sticky and define the "rules of the road" for the international system. Strategic air warfare conducted through strategic bombing continues to under-gird the core of Air Force identity. The maintenance of the set of beliefs surrounding strategic bombing has had the effect that the United States relies on bombing as a core tool of coercive foreign policy. For example, the use of bombing campaigns against ISIS, in Syria, and Libya. The continued belief in the independent strategic potential can also be seen in the "Shock and Awe" bombing campaign that opened the 2003 invasion of Iraq. The non-weaponized nature of orbital space has been preserved in international legal regimes such as the 1967 Outer Space Treaty[14] and the 1972 USA-USSR treaty on the limitation of Anti-Ballistic Missile Systems.[15] The opposition to the SDI and the failure of Aerospace also show the extent to which domain conceptions become encoded into broader social beliefs, much of the civilian opposition to the SDI was driven by the belief that orbital space should not be weaponized.[16]

The fundamental debates of "warzone" or "sanctuary" are being replayed with the rise of Cyberspace as a domain. The dueling articles by a Deputy Secretary of Defense[17] (warzone) and Deputy Secretary of Homeland Security[18] (sanctuary) that followed the creation of Cyber Command and the ongoing controversy over how to interpret the 2016 Russian interference in the United States Presidential Election demonstrates the ongoing negotiation of social beliefs and governmental policy surrounding the nature and status of Cyberspace. However, unlike the

14. UN General Assembly, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)*

15. USA-USSR, *TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYSTEMS*

16. Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 200-202; Reiss, *The Strategic Defense Initiative*, 88-89; Sheehan, *The International Politics of Space*, 103-105

17. Lynn III, "Defending a New Domain: The Pentagon's Cyberstrategy"

18. Lute and McConnell, "OP-ED: A CIVIL PERSPECTIVE ON CYBERSECURITY"

earlier cases where the core debates attending to their nature and status happened in public,[19] the substantive debates about the militarization of Cyberspace have occurred largely in private. Many of the documents used in the Cyber case are only available due to leaks or FOIA requests.

The consequences of the full realization of Cyberspace are immense: the spread of Internet technologies have brought with them the rapid consolidation of social, cultural, financial, military, and governmental infrastructures into a single meta-infrastructure, Cyberspace. The rise of the "Internet of Things" also means that the objects of everyday intimate civilian life—refrigerators, stoves, light bulbs, cars—are increasingly becoming integrated into this domain.[20] The realization of this domain would signal the full acceptance of targeting and weaponizing some of the most fundamental objects of everyday life. While targeting infrastructure is not a fundamentally new activity, the gathering of all infrastructure under Cyberspace represents a difference in kind and not scale. Arsenals of cyber weapons depend on the conscious cultivation of insecurity for these infrastructures by withholding public discussion or knowledge of flaws and vulnerabilities in hardware and software.[21] This insecurity is agnostic, while the very existence of nuclear weapons poses a similar generalized threat they also exist as discrete physical objects over which control can be exerted. The utilization of tools and techniques from the NSA arsenal for widespread ransomware attacks in the summer of 2017 demonstrates that this insecurity is exploitable by anyone with the skills and patience.[22] If there is anything revolutionary about Cyberspace, it is this generalization of insecurity. What is not revolutionary about cyber is how it is developing; Air and Orbital Space demonstrated that the process of domain development is fundamentally one of structured contingency and Cyberspace has followed many of these same dynamics. While the envelope is ever narrowing, the future nature and status of Cyberspace is still open.

---

19. For example, the Johnson Hearings following Sputnik were publicly accessible as with many of the congressional hearings about aircraft.

20. Approximately 6 billion things were connected to the Internet in 2016. A number that is forecast to rise exponentially in the coming years. Gartner Research, *Gartner Says 8.4 Billion Connected "Things" Will Be in Use in 2017, Up 31 Percent From 2016*, Gartner, [Online; accessed July 23, 2017], 2-7-2017, `https://www.gartner.com/newsroom/id/3598917`

21. This is a long-standing feature of signals intelligence and computer network operations. Kaplan, *Dark Territory: The Secret History of Cyberwar*, 15

22. Eric Geller, *NSA-linked tools help power second global ransomware outbreak*, Politico, [Online; accessed July 23, 2017], 6-27-2017, `http://www.politico.com/story/2017/06/27/ransomware-virus-nsa-petya-hacking-tools-240008`; Nicole Perlroth and David Sanger, *Hacks Raise Fear Over N.S.A. s Hold on Cyberweapons*, New York Times, [Online; accessed July 23, 2017], 6-28-2017, `https://www.nytimes.com/2017/06/28/technology/ransomware-nsa-hacking-tools.html`

Bibliography

[Author Redacted]. "Best Location for Computer Applications." *Cryptolog* 3, no. 4 (April 1976): 6–9.

———. "Computer Operating System Vulnerabilities." *Cryptolog* 6, no. 3 (March 1979): 13–15.

———. "Data Security and Human Errors." *Cryptologc* V, no. 10 (October 1978): 1–4.

———. "Future Powerful Personal Computers: an Overview of the Technology." *Cryptolog* IX, no. 11 (November 1981): 1–8.

———. "Global Network Intelligence and Information Warfare: SIGINT and INFOSEC in Cyberspace." *Cryptolog* XXI, no. 1 (1995): 29–37.

———. "Information Warfare: A New Line of Business for NSA." *Cryptolog* XX, no. 2 (1994): 3–4.

———. "IO, IO, It's Off to Work We Go." *Cryptolog* XXIII, no. 1 (Spring 1997): 5–9.

———. "The Infowar Revolution(s)." *Cryptolog* XXIII, no. 1 (Spring 1997): 11–19.

———. "The Personal Computer: A Current Cryptanalysis Support Tool." *Cryptolog* IX, no. 3 (March 1982): 1–3.

———. "The Role of Information Warfare in Strategic War." *Cryptolog* XXIII, no. 1 (Spring 1997): 20–27.

———. "Thoughts on a Knowledge Base to Support Information Operations in the Next Millenium." *Cryptolog* XXIII, no. 1 (Spring 1997): 28–37.

609 IWS: A Brief History Oct 1995-Jun 1999, 1999. `https://securitycritics.org/wp-content/uploads/2006/03/hist-609.pdf`.

Abbate, Jane. *Inventing the Internet*. Cambridge, Massachussetts: MIT Press, 1999.

Adams, James. "Virtual Defense." *Foreign Affairs* 80, no. 3 (May 2001): 98–112.

Air Force Doctrine Working Group. *Strategic Attack: Air Force Doctrine Document 3-70*. Secretary of the Air Force, 2007.

Air Force ISR Agency. *Air Force Instruction 14-128*. Secretary of the Air Force, 2011.

Air Force Office of the Chief of Staff. *Cornerstones of Information Warfare*. http://www.c4i.org. [Online; accessed May 25, 2017], 1995. http://www.c4i.org/cornerstones.html.

Allen, Brig. Gen. James. "Report of the Chief Signal Officer." In *Annual Report of the Secretary of War*, II:179–215. Washington, District of Columbia: Government Printing Office, 1908.

———. "Report of the Chief Signal Officer." In *Annual report of the Secretary of War Volume I*, I:629–654. Washington, District of Columbia: Government Printing Office, 1910.

———. "Report of the Chief Signal Officer." In *Annual report of the Secretary of War*, I:700–742. Washington, District of Columbia: Government Printing Office, 1911.

———. "Report of the Chief Signal Officer." In *Annual Report of the Secretary of War*, I:743–813. Washington, District of Columbia: Government Printing Office, 1913.

Anderson, James P. *Computer Security Technology Planning Study*. Technical report. Electronic Systems Division, Air Force Systems Command, 1972.

Arkin, William M. "A Mouse that Roars?" [Online; accessed June 26, 2017], *Washington Post*, 6-7-1999. http://www.newsweek.com/were-middle-cyerwar-166196.

Armacost, Michael H. *The Politics of Weapons Innovation: The Thor-Jupiter Controversy*. New York, New York: Columbia University Press, 1969.

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

Arnold, Henry Harley. *Global Mission*. New York, New York: Harper & Brothers, 1949.

Arquilla, John, and David Ronfeldt. "Cyberwar is Coming!" *Comparative Strategy* 12, no. 2 (Spring 1993): 141–165.

ASD (C3I). *Department of Defense Directive # S-3600.1, Subject: Information Operations*. Internet Archive. [Online; accessed June 4, 2017], 12-9-1996. https://ia601509.us.archive.org/15/items/DODD_S3600.1/14F0492_DOC_02_Directive_S-3600.1.pdf.

Atkinson, Dr. J.L. Boone. "Italian Influece on the Origins of the American Concept of Strategic Bombardment." *Airpower Historian* IV, no. 3 (1957): 141–149.

Atwood, Donald J. *Department of Defense Direction Number TS 3600.1*. DOD FOIA Online Reading Room, 12-21-1992. http://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/14-F-0492_doc_01_Directive_TS-3600-1.pdf.

Avant, Deborah D. "From Mercenary to Citizen Armies: Explaining Change in the Practice of War." *International Organization* 54, no. 1 (2000): 41–72.

———. "The Institutional Sources of Military Doctrine: Hegemons in Peripheral Wars." *International Studies Quarterly* 37, no. 4 (1993): 409–430.

Bacon, Kenneth H. *DoD News Briefing, Thursday April 16, 1998*. U.S. Department of Defense. [Online; accessed June 10, 2017], 4-16-1998. http://archive.defense.gov/Transcripts/Transcript.aspx?TranscriptID=793.

Bainbridge, William Sims. *The Spaceflight / Revolution*. New York, New York: Wiley Interscience, 1976.

Bamford, James. *Body of Secrets: Anatomy of the Ultra-Secret National Security Agency*. New York, New York: Anchor, 2002.

———. *The Puzzle Palace: Inside the National Security Agency, America's Most Secret Intelligence Organization*. New York, New York: Penguin, 1983.

Barlow, John Perry. *A Declaration of the Independence of Cyberspace*, 1996. Accessed October 15, 2016. https://projects.eff.org/%7B~%7Dbarlow/Declaration-Final.html.

Barry, William P. "Foreword." In *Cold War Space Sleuths: The Untold Secrets of the Soviet Space Program*, edited by Dominic Phelan, xiii–xiv. New York, New York: Springer-Praxis, 2013.

Baucom, Donald R. *Origins of the Strategic Defense Initiative: Ballistic Missile Defense, 1944-1983*. Technical report. Strategic Defense Initiative Organization, December 1989.

Beard, Edmund. *Developing the ICBM: A Study in Bureaucratic Politics*. New York, New York: Columbia University Press, 1976.

Ben-Yehuda, Nachman. *Atrocity, Deviance, and Submarine Warfare*. Ann Arbor, Michigan: University of Michigan Press, 2013.

Berger, Carl. *History of the Manned Orbiting Laboratory Program (MOL)*. Technical report. MOL Program Office, 1970.

Berkowitz, Bruce D. *The New Face of War: How War Will Be Fought in the 21st Century*. New York, New York: Free Press, 2003.

Betts, Richard. *Soldiers, Statesman, and Cold War Crises*. Cambridge, Massachussetts: Harvard University Press, 1977.

Betz, David, and Tim Stevens. *Cyberspace and the State: Towards a Strategy for Cyber-Power*. Abingdon, United Kingdom: Routledge, 2011.

Biddle, Tami Davis. *Rhetoric and Reality in Air Warfare*. Princeton: Princeton University Press, 2002.

Black Jr., William B. "Thinking Out Loud About Cyberspace." *Cryptolog* XXIII, no. 1 (Spring 1997): 1–4.

Blair, Edison T. "This is Dyna-Soar." *The Airman*, October 1960, 10–12.

———. "Why Wings in Space." *The Airman*, November 1962, 7–8.

Board, National Security Council Planning. *NSC 5520*. May 1955.

Bodnar, John W. "The Military Technical Revolution: From Hardware to Information." *Naval War College Review* XLVI, no. 3 (Summer 1993): 7–21.

Boot, Max. "Was Russia election hack an act of war?: Max Boot." [Online; accessed June 20, 2017], *USA Today*, 4-6-2017. `https://www.usatoday.com/story/opinion/2017/04/06/russia-election-hack-act-of-war-max-boot-column/100030944/`.

Bormann, Natalie. "Introduction." In *Securing Outer Space: International Relations Theory and the Politics of Space*, edited by Natalie Bormann and Michael Sheehan, 8–23. London, United Kingdom: Routledge, 2009.

Bowie, Robert R. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships." Chap. II-2: Robert R. Bowie, Policy Planning Staff, Department of State, "Memorandum for Mr. Phleger," March 28, 1955. Edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 273–274. Washington, D.C.: NASA History Office, 1996.

———. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships." Chap. II-3: Robert R. Bowie, Policy Planning Staff, Department of State, to Secretary of State, "Recommendations in the Report to the President by the Technological Capabilites Panel of the Science Advisory Committee, ODM (Killian Committee): Item 2–NSC Agenda 10/4/56," October 2, 1956. Edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 274–275. Washington, D.C.: NASA History Office, 1996.

Braun, Wehrner von. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration." Chap. II-7: Wehrner von Braun, "A Minimum Satellite Vehicle: Based on Components available from missile developments of the Army Ordnance Corps," September 15, 1954. Edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 274–281. Washington, D.C.: NASA History Office, 1995.

———. "Survey of Development of Liquid Rockets in Germany and their Future Prospects." *Journal of the British Interplanetary Society* 10, no. 2 (1951): 75–80.

Brenner, Joel. *Glass Houses: Privacy, Secrecy, and Cyber Insecurity in a Transparent World*. New York, New York: Penguin, 2013.

Brune, Lester. *The Origins of American National Security Policy — Sea Power, Air Power, and Foreign Policy*. Manhattan, Kansas: MA/AH Publishing, 1981.

Budlansky, Stephen. *Code Warriors: NSA's Codebreakers and the Secret Intelligence War Against the Soviet Union*. New York, New York: Knopf, 2016.

Builder, Carl H. *The Masks of War: American Military Styles in Strategy and Analysis*. Baltimore, Maryland: Johns Hopkins University Press, 1989.

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

Campbell-Kelly, Martin, William Aspray, Nathan Ensmenger, and Jeffrey R. Yost. *Computer: A History of the Information Machine*. Boulder, Colorado: Westview Press, 2014.

Campen, Alan D. *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War*. Fairfax, Virginia: AFCEA, 1992.

Carna Botnet. *Internet Census 2012: Port scanning /0 using insecure embedded devices*. [Online; accessed May 20, 2015], 2012. http://census2012.sourceforge.net.

Casciano, John P. *Los Angeles - October 18, 1996*. Air Force Association National Symposia, 10-18-1996. http://secure.afa.org/aef/pub/la9.asp.

Cebrowski, Arthur K., and J. J. Garstka. "Network-centric warfare: its origin and future." *Proceedings*, January 1998.

Chairman of the Joint Chiefs of Staff. *The National Military Strategy for Cyberspace Operations*. George Washington University National Security Archive. [Online; accessed March 17, 2017], December 2006. http://nsarchive.gwu.edu/NSAEBB/NSAEBB424/docs/Cyber-023.pdf.

Chalfant, Morgan. "Democrats step up calls that Russian hack was act of war." [Online; accessed June 20, 2017], *The Hill*, 3-27-2017. http://thehill.com/policy/cybersecurity/325606-democrats-step-up-calls-that-russian-hack-was-act-of-war.

Chalfant, Morgan346. "Former CIA director: Don't call Russian election hacking 'act of war'." [Online; accessed June 20, 2017], *The Hill*, 4-11-2017. http://thehill.com/policy/cybersecurity/328344-former-cia-director-dont-call-russian-election-hacking-act-of-war.

Chandler, Charles, and Frank Lahm. *How Our Army Grew Wings: Airmen and Aircraft Before 1914*. New York, New York: The Ronald Press Company, 1943.

Chapman, Bert. *Space Warfare and Defense: a Historical Encyclopedia and Research Guide*. Santa Barbara, California: ABC-CLIO, 2008.

Checkel, Jeffrey T. "Process Tracing." In *Qualitative Methods*, edited by Audie Klotz and Deepa Prakash, 114–130. New York, New York: Palgrave MacMillan, 2008.

Chesney, Robert. "Military-Intelligence Convergence and the Law of the Title 10/Title 50 Debate." *Journal of National Security Law and Policy* 5, no. 2 (2012): 539–629.

Choucri, Nazli. *Cyberpolitics in International Relations*. 320. Cambridge, Massachusetts: MIT Press, 2012.

Clarke, David. "Scareships over Britain: The Airship Wave of 1909." *Fortean Studies* 6 (1999): 39–63.

Clarke, Richard A., and Robert Knake. *Cyber War: The Next Threat to National Security and What to Do About It*. New York, New York: Ecco, 2011.

Clausewitz, Carl von. *On War*. Princeton, New Jersey: Princeton University Press, 1989.

Clive, Keith P. *NSA's Central Security Service*. Federation of American Scientists. [Online; accessed March 11, 2017], 2002. `https://fas.org/irp/eprint/css.htm`.

Clodfelter, Mark. *Beneficial Bombing: The Progressive Foundations of American Air Power, 1917-1945*. Lincoln, Nebraska: University of Nebraska Press, 2011.

Clodfelter, Mark, and John M. Fawcett. "The RMA and Air Force Roles, Missions and Doctrine." *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 22–29.

Coble, Donald W. "The World's First Space Trainer." *The Airman*, October 1964, 8.

Cohen, William S. *Annual Report to the President and Congress: 1998*. Washington, District of Columbia: Government Printing Office, 1998.

Corera, Gordon. *Cyberspies - the secret history of surveillance, hacking, and digital espionage*. New York, New York: Pegasus Books, 2015.

Corum, James S. *The Luftwaffe: Creating the Operational Air War 1918-1940*. Lawrence, Kansas: University of Kansas Press, 1991.

Cote, Owen. "The Politics of Innovative Military Doctrine: The U.S. Navy and Fleet Ballistic Missiles." PhD diss., Massachusetts Institute of Technology, 2005.

Crane, Conrad C. *Bombs, Cities, and Civilians: American Airpower Strategy in World War II*. Lawrence, Kansas: University Press of Kansas, 1993.

Creveld, Martin Van. *Technology and War: From 2000 B.C. to the Present*. New York, New York: Free Press, 1991.

Crouch, Tom D. *The Bishop's Boys: A life of Wilbur and Orville Wright*. New York, 2003.

Davies, Meron E., and William R. Harris. *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*. Santa Monica, California: Rand Corporation, 1988.

Day, Dwayne. "Invitation to Struggle: The History of Civilian-Military Relations in Space." In *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships*, edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 233–270. Washington, D.C.: NASA History Office, 1996.

———. "Reconsidering Sputnik: Forty Years since the Soviet Satellite." Chap. Cover Stories and Hidden Agendas: Early American Space and National Security Policy, edited by Roger Launius, John Logsdon, and Robert Smith, 161–190. London, United Kingdom: Routledge, 2000.

Defense Advanced Research Projects Agency. *A History of the ARPANET: The First Decade*. George Washington University National Security Archive, 4-1-1981. http://nsarchive.gwu.edu/dc.html?doc=3678207-Document-01-Defense-Advanced-Research-Projects.

Deibert, Ronald J. *Black Code: Surveillance, Privacy, and the Dark Side of the Internet*. New york, New York: Penguin, 2013.

Deibert, Ronald J., Rafal Rohozinski, and Masashi Crete-Nishihata. "Cyclones in cyberspace: Information shaping and denial in the 2008 Russia-Georgia war." *Security Dialogue* 43, no. 1 (2012): 3–24.

Delbert Jr, Terrill. *The Air Force Role in Developing International Outer Space Law*. Maxwell Air Force Base: Air University Press, 1999.

Department of Defense. *DOD Directive 5100.20: National Security Agency/Central Security Service (NSA/CSS)*. [Online; accessed June 12, 2017], 2010. http://www.dtic.mil/whs/directives/corres/pdf/510020p.pdf..

———. *Information Operations Roadmap*. George Washington University National Security Archive. [Online; accessed June 12, 2017], 10-30-2003. http://nsarchive.gwu.edu/NSAEBB/NSAEBB177/info_ops_roadmap.pdf.

Department of Defense Historical Office. *Department of Defense Key Officials*. Office of the Secretary of Defense, 2004.

DeVorkin, David H. *Science with a Vengeance: How the U.S. Military Created the US Space Sciences after World War II*. New York, New York: Springer-Verlag, 1992.

DiNardo, R. L., and Daniel J. Hughes. "Some Cautionary Thoughts on Information Warfare." *Airpower Journal* IX, no. 4 (Winter 1995): 69–79.

Divine, Robert A. *The Sputnik Challenge*. New York, New York: Oxford University Press, 1993.

Echevarria, Antulio J., and John M. Shaw. "The New Military Revolution: Post-Industrial Change." *Parameters: US Army War College Quarterly* XXII, no. 4 (Winter 1992): 70–79.

Eisenhower, Dwight D. *Radio and Television Address to the American People on Science in National Security*. [Online; accessed 6-Feb-2017], November 7, 1957. http://www.presidency.ucsb.edu/ws/?pid=10946.

Elliot, George Fielding. "Aerial Blackmail at Munich." In *The Impact of Air Power: National Security and World Politics*, edited by Eugene M. Emme, 64–67. Princeton, New Jersey: D. Van Norstand Company Inc., 1959.

Farrell, Theo. *The Norms of War: Cultural Beliefs and Modern Conflict*. Boulder, Colorado: Lynne Reinner, 2005.

———. *The Norms of War: Cultural Beliefs and Modern Conflict*. Boulder: Lynne Rienner Publishers, 2005.

Fastabend, David A. "Checking the Doctrinal Map: Can We Get There from Here with FM 100-5." *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 37–46.

Finney, Robert T. *History of the Air Corps Tactical School*. Washington, District of Columbia: Air Force History / Museum Program, 1998.

FitzSimonds, James R. "The Coming Military Revolution: Opportunities and Risks." *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 30–36.

Fortin, Edmond. "Don't Be Afraid of Computers." *The Airman*, June 1964, 12–15.

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

Freedman, Lawrence. *The Evolution of Nuclear Strategy*. Vol. Third. New York, New York: Palgrave Macmillan, 2003.

Futrell, Robert Frank. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960*. Maxwell Air Force Base, Alabama: Air University Press, 1989.

Galeotti, Mark. *Putin is Waging Information Warfare. Here's How to Fight Back*, 2016. Accessed December 14, 2016. http://www.nytimes.com/2016/12/14/opinion/putin-is-waging-information-warfare-heres-how-to-fight-back.html.

Gallagher, Sean. "What the government should've learned about backdoors from the Clipper Chip." *Ars Technica*, December 14, 2015. https://arstechnica.com/information-technology/2015/12/what-the-government-shouldve-learned-about-backdoors-from-the-clipper-chip/.

Gartner Research. *Gartner Says 8.4 Billion Connected "Things" Will Be in Use in 2017, Up 31 Percent From 2016*. Gartner. [Online; accessed July 23, 2017], 2-7-2017. https://www.gartner.com/newsroom/id/3598917.

Gartzke, Erik. "The Myth of Cyberwar: Bringing War in Cyberspace Back Down to Earth." *International Security* 38, no. 2 (2013): 41–73.

Gat, Azar. *Fascist and Liberal Visions of War: Fuller, Liddell Hart, Douhet, and Other Modernists*. Oxford, UK: Clarendon Press, 1998.

Gates, Robert M. *Memorandum for Secretaries of the Military Departments, Chairmain of the Joint Chiefs of Staff, Under Secretaries of Defense, Deputy Chief Management Officer, Commanders of the Combatant Commands, Assistant Secretaries of Defense, General Counsel of the Department of Defense, Director Operational Test and Evaluation, Director Cost Assessment and Program Evaluation, Inspector General of the Department of Defense, Director Administration and Management, Director Net Assessment, Directors of the Defense Agencies, Directors of the DOD Field Activities; Subject: Establishment of a Subordinate Unified U.S. Cyber Command Under U.S. Strategic Command for Military Cyberspace Operations*. George Washington University National Security Archive. [Online; accessed June 13, 2017], 6-23-2009. http://nsarchive.gwu.edu/NSAEBB/NSAEBB424/docs/Cyber-029.pdf.

Geller, Eric. *NSA-linked tools help power second global ransomware outbreak*. Politico. [Online; accessed July 23, 2017], 6-27-2017. http://www.politico.com/story/2017/06/27/ransomware-virus-nsa-petya-hacking-tools-240008.

George, Alexander Lawrence, and Andrew Bennett. *Case studies and Theory Development in the Social Sciences*. 331. Cambridge, MA: MIT Press, 2005.

Gibson, William. *Neuromancer*. New York, New York: Berkley Publishing Group, 1989.

Gizmodo Staff. "The 2016 Presidential Candidates' Views on Cyber Warfare." [Online; accessed March 2, 2016], *Gizmodo*, 3-1-2016. https://gizmodo.com/the-2016-presidential-candidates-views-on-cyber-warfare-1760899365.

Global Security. *Eligible Receiver*. Global Security. [Online; accessed June 10, 2017], 5-7-2011. http://www.globalsecurity.org/military/ops/eligible-receiver.htm.

Gorrell, Edgar. “29. Gorrell: Strategical Bombardment 28 November 1917.” In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:141. Washington, District of Columbia: U.S. Government Printing Office, 1978.

———. “54. Notes of the Characteristics, Limitations, and Employment of the Air Service 1919.” In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:303. Washington, District of Columbia: U.S. Government Printing Office, 1978.

Gourley, Bob. *JTF-CND to JTF-CNO to JTF-GNO to Cybercom*. CTOvision.com. [Online; accessed June 20, 2017], 9-8-2010. `https://ctovision.com/jtf-cnd-to-jtf-cno-to-jtf-gno-to-cybercom/`.

Graham, Bradley. “Bush Orders Guidelines for Cyber-Warfare.” *The Washington Post*, February 7, 2003, A01.

Graham, Daniel O. *High Frontier: a New National Strategy*. Washington, District of Columbia: High Frontier Inc., 1982.

Graham, Ret. Lieutenant General Daniel O. “Toward a New U.S. Strategy: Bold Strokes Rather than Increments.” *Strategic Review* 9 (Spring 1981): 9–16.

Gray, Colin S. “The Changing Nature of Warfare?” *Naval War College Review* XLIX, no. 2 (Spring 1996): 23–32.

Greer, Thomas H. *The Development of Air Doctrine in the Army Air Arm, 1917 to 1941*. Washington, District of Columbia: Office of Air Force History, 1985.

Griggs, D. “SM-11827 Preliminary Design of an Experimental World-Circling Spaceship.” Chap. Introduction, 1–8. Santa Monica, California: Project Rand, 1946.

Grissom, Adam. “The future of Military Innovation Studies.” *Journal of Strategic Studies* 29, no. 5 (2006): 905–934.

Grosse, Aristide V. “Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration.” Chap. II-5: A.V. Grosse, The Research Institute of Temple University, to Donald A. Quarles, Assistant Secretary of Defense for Research and Development, ”Report on the Present Status of the Satellite Problem,” August 25, 1953, pp. 2-7, edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 266–269. Washington, D.C.: NASA History Office, 1995.

Gruntman, Michael. *Blazing The Trail: The Early History Of Spacecraft And Rocketry*. Reston, Virginia: American Institute of Aeronautics / Astronautics, 2004.

Haley, Andrew G. *Space Law and Government*. New York, New York: Meredith Publishing Company, 1963.

Hall, R. Cargill. "Early U.S. Satellite Proposals." *Technology and Culture* 4, no. 4 (1963): 410–434.

———. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration." Chap. Origins of U.S. Space Policy, edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 213–229. Washington, D.C.: NASA History Office, 1995.

Hamre, John J. *DoD Speech to Fortune 500 Chief Information Officers Forum*. Federation of American Scientists. [Online; accessed June 12, 2017], 7-21-1998. https://fas.org/sgp/crs/intel/RL30735.pdf.

Hanyok, Robert J. "Some Reflections on the Reality of Computer Security." *Cryptolog* IX, nos. 6-7 (June 1982): 23–24.

Harley, Jeffrey A. "Information, Technology, and the Center of Gravity." *Naval War College Review* L, no. 1 (Summer 1997): 66–87.

Harris, Shane. *@War: The Rise of the Military-Internet Complex*. New York, New York: First Mariner Books, 2015.

Hayden, Michael V. *Playing to the Edge: American Intelligence in the Age of Terror*. New York, New York: Penguin, 2016.

———. "The Future of Things "Cyber"." *Strategic Studies Quarterly*, 2011, 3–7.

Healey, Jason. *A Fierce Domain: Conflict in Cyberspace 1986-2012*. Baltimore, Maryland: The Atlantic Council, 2013.

Healey, Jason, and Mark Grindal. *Lessons from the First Cyber Commanders*. Atlantic Council, 3-14-2012. http://www.atlanticcouncil.org/blogs/new-atlanticist/lessons-from-the-first-cyber-commanders.

Hennessy, Juliette A. *The United States Army Air Arm, April 1861 to April 1917*. 268. Washington, DC: Office of Air Force History, 1985.

Henry, Ryan, and Edward C. Peartree. "Military Theory and Information Warfare." *Parameters: US Army War College Quarterly* XXVIII, no. 3 (Autumn 1998): 121–135.

Hildreth, Stephen A. *CRS Report for Congress: Cyberwarfare*. Federation of American Scientists. [Online; accessed June 12, 2017], 2001. https://fas.org/sgp/crs/intel/RL30735.pdf.

Hobbes, Thomas. *Leviathan*. Edited by C.B. MacPherson. New York, New York: Penguin, 1982.

Horowitz, Michael C. *The Diffusion of Military Power: Causes and Consequences for International Politics*. Princeton, New Jersey: Princeton University Press, 2010.

Houchin III, Roy F. "The Dyna-Soar Program: Why the Air Force Proposed the Dyna-Soar X-20 Program." *Quest: The History of Spaceflight Magazine* 3 (Winter 1994): 10–15.

———. "Why the Air Force Proposed the Dyna-Soar X-20 Program." *Quest* 3, no. 4 (Winter 1994): 5–11.

Howe, George F. *The Early History of NSA*. George Washington University National Security Archive. [Online; accessed June 21, 2017], http://nsarchive.gwu.edu/NSAEBB/NSAEBB278/13.PDF.

HQ TRADOC. *Field Manual 100-6*. Federation of American Scientists. [Online; accessed June 12, 2017], 1999. https://fas.org/irp/doddir/army/fm100-6/.

Hunley, J.D. "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue." Chap. A Question of Antecedents: Peenemunde, JPL, and the Launching of U.S. Rocketry, edited by Roger D. Launius, 1–32. San Diego, California: American Astronautical Society, 1995.

Hunter III, Maxwell. *Strategic Dynamics and Space-Laser Weaponry*. Technical report. Sunnyvale, California: Lockheed Missiles & Space Company, 1977.

Huntington, Samuel P. "Interservice Competition and the Roles of the Armed Services." *American Political Science Review* 55, no. 1 (1961): 40–52.

———. *The Common Defense: Strategic Programs in National Politics*. New York, New York: Columbia University Press, 1961.

Hurley, Alfred. *Billy Mitchell: Crusader for Air Power*. Indianapolis, Indiana: Indiana University Press, 1975.

Inside Defense. "AFTER 40 YEARS AT NSA, BILL BLACK IS SIGINT WORLD'S AGENT FOR CHANGE." *Inside Defense*, 7-4-2002. https://insidedefense.com/inside-pentagon/after-40-years-nsa-bill-black-sigint-worlds-agent-change.

Jennings, Frank W. "Doctrinal Conflict over the Word Aerospace." *Airpower Journal* IV, no. 3 (1990): 46–58.

Jensen, Benjamin. *Forging the Sword: Doctrinal Change in the U.S. Army*. Stanford, California: Stanford Security Studies, 2016.

Jensen, Owen. "Information Warfare: Principles of the Third-Wave War." *Airpower Journal* VIII, no. 4 (Winter 1994): 35–44.

Joint Chiefs of Staff. *Joint Publication 3-12, Cyberspace Operations*. Defense Technical Information Center. [Online; accessed March 11, 2017], 2-5-2013. http://www.dtic.mil/doctrine/new_pubs/jp3_12R.pdf.

Jones, Neville. *The Origins of Strategic Bombing*. London, United Kingdom: William Kimber, 1973.

Kant, Immanuel. "Perpetual Peace: A Philosophical Sketch." In *Kant: Political Writings*, edited by H.S. Reiss, 93–130. New York, New York: Cambridge University Press, 1991.

Kaplan, Fred. *Dark Territory: The Secret History of Cyberwar*. New York, New York: Simon / Schuster, 2016.

Kecskemeti, Paul. *RM-567 The Satellite Rocket Vehicle: Political and Psychological Problems*. Santa Monica, California: RAND Corporation, 1950.

Kello, Lucas. "The Shape of Cyber Danger." *International Security*, 2014.

Kier, Elizabeth. *Imagining War: French and British Military Doctrine between the Wars*. Princeton, New Jersey: Princeton University Press, 1997.

Kinney, William. "The Challenge of Tradition." *The Airman*, June 1966, 44–48.

Koppel, Ted. *Lights Out: A Cyberattack, A Nation Unprepared, Surviving the Aftermath*. New York, New York: Crown, 2015.

Krepinevich, Andrew F. "Calvary to Computer: The Pattern of Military Revolutions." *The National Interest*, Fall 1994, 3042.

Kuehl, Daniel T. "Information Operations, Information Warfare, and Computer Network Attack Their Relationship to National Security in the Information Age." *International Law Studies* 76 (2002): 35–58.

La Vone, Michelle. *Kessler Syndrome: 10 Interesting and Disturbing Facts*. Space Safety Magazine. [Online; accessed August 3, 2017], n.d. `http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/`.

Lambeth, Benjamin. *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space*. Santa Monica, California: RAND Corporation, 2003.

Launius, Roger D. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration." Chap. Prelude to the Space Age, edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 1–21. Washington, D.C.: NASA History Office, 1995.

———. "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue." Chap. Early U.S. Civil Space Policy, NASA, and the Aspiration of Space Exploration, edited by Roger D. Launius, 63–86. San Diego, California: American Astronautical Society, 1995.

Layman, R.D. *To Ascend from a Floating Base: Shipboard Aeronautics and Aviation, 1783-1914*. Rutherford, New Jersey: Fairleigh Dickinson University Press, 1979.

Leiner, Barry M, Vincent G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Larry G. Roberts, and Stephen P. Wolff. *Brief History of the Internet*. Internet Society. [Online; accessed June 20, 2015], 1997. http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet.

Lemay, Curtis. "Men Will Always be Leading the Way." *The Airman*, January 1964, 2.

———. "The Future of Piloted Aircraft and Aerospacecraft." *The Airman*, May 1963, 1.

———. "The Hour of Decision." *The Airman*, October 1962, 2–8.

———. "Youth on the Space Frontier." *The Airman*, February 1962, 15–17.

Libicki, Martin. "Cyberspace is a not a Warfighting Domain." *I/S: A Journal of Law and Policy for the Information Society* 8, no. 1 (2012): 321–336.

———. "Why Cyber War Will Not and Should Not Have Its Grand Strategist." *Strategic Studies Quarterly* 14, no. 1 (Spring 2014): 23–39.

Licklider, Joseph C. R. *Man-Computer Symbiosis*. [Online; Accessed June 10, 2017], 1960. https://groups.csail.mit.edu/medg/people/psz/Licklider.html.

Liddell-Hart, Basil. *Paris, Or: The Future of War*. London, United Kingdom: Dutton, 1925.

Lijphart, Arend. "The Comparable-Cases Strategy in Comparative Research." *Comparative Political Studies* 2, no. 8 (1975): 158–177.

Lindsay, Jon R. "Introduction: China and Cybersecurity: Controvery and Context." In *China and Cybersecurity: Espionage, Strategy, and Politics in the Digital Domain*, edited by Derek Reveron, Tai Ming Cheung, and Jon R. Lindsay, 1–20. Oxford, United Kingdom: Oxford University Press, 2015.

———. "Stuxnet and the Limits of Cyber Warfare." *Security Studies* 22, no. 3 (2013): 365–404.

———. "Stuxnet and the Limits of Cyber Warfare." *Security Studies* 22, no. 3 (2013): 365–404.

Lipp, James E. "RA-15032 Reference Papers Relating to a Satellite Study." Chap. The Time Factor in the Satellite Program, edited by James E. Lipp, 41–49. Santa Monica, California: Project Rand, 1947.

Logsdon, John, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, eds. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration." Chap. II-17: "National Aeronautics and Space Act of 1958," Public Law 85568, 72 Stat., 426. Signed by the president on July 29,1958. 334–360. Washington, D.C.: NASA History Office, 1995.

Lucas, William A, and Raymond H. Dawson. *The Organizational Politics of Defense*. Pittsburgh, Pennsylvania: International Studies Association, 1974.

Lukasik, S. "Why the Arpanet Was Built." *IEEE Annals of the History of Computing* 33, no. 3 (March 2011): 4–21.

Lute, Jane Holl, and Bruce McConnell. "OP-ED: A CIVIL PERSPECTIVE ON CYBERSECURITY." [Online; accessed March 20, 2017], *Wired Magazine*, 2-14-2011. https://www.wired.com/2011/02/dhs-op-ed/.

Lutwiniak, William, and Robert E. Rich. "SIGINT IN THE 80s: Two Views." *Cryptolog* VIII, nos. 1-3 (April 1981): 1–6.

Lynn III, William J. "Defending a New Domain: The Pentagon's Cyberstrategy." *Foreign Affairs* 89, no. 5 (2010): 97–108.

Macgregor, Douglas A. "Future Battle: The Merging Levels of War." *Parameters: US Army War College Quarterly* XXII, no. 4 (Winter 1992): 33–47.

Mann, Edward. "Desert Storm: The First Information War?" *Airpower Journal* VIII, no. 4 (Winter 1994): 15–25.

Marchio, James D. "The Evolution and Relevance of Joint Intelligence Centers." [Online; accessed June 30, 2017], *Studies in Intelligence* 49, no. 1 (2006). https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol49no1/html_files/the_evolution_6.html.

McClendon, R. Earl. *Autonomy of the Air Arm*. Washington, District of Columbia: Air Force History / Museums Program, 1996.

McDougall, Walter A. *...the Heavens and the Earth*. Baltimore, Maryland: Johns Hopkins University Press, 1985.

Mcfarland, Stephen. *America's Pursuit of Precision Bombing*. Washington, District of Columbia: Smithsonian Institute Press, 1995.

McKenzie, Kenneth F. "Beyond Luddites and Magicians: Examining the MTR." *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 15–21.

McLaughlin, Lt Col J. Kevin. *Military Space Culture*. [Online; accessed 10-May-2017], n.d. https://fas.org/spp/eprint/article02.html#iiia1.

Meyer, Joseph. "SIGINT 1990." *Cryptolog* IX (September 1982): 13–28.

Miller, Donald. *Masters of the Air: America's Bomber Boys Who Fought the Air War Against Nazi Germany*. New York, NY: Simon / Schuster, 2006.

Mitchell, Billy. *Winged Defense: The Development and Possibilities of Air Power—Economic and Military*. Tuscaloosa, Albama: University of Alabama Press, 2010.

Mitchell, William. "17. Mitchell: Air Policy, 13 June 1917." In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:107–110. Washington, District of Columbia: U.S. Government Printing Office, 1978.

———. "18. Mitchell: Aeronautical Organization, 13 June 1917." In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:111–112. Washington, District of Columbia: U.S. Government Printing Office, 1978.

———. "53. Mitchell: Provisional Manual of Operations 23 December 1918." In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:267–301. Washington, District of Columbia: U.S. Government Printing Office, 1978.

Molander, Roger C., Andrew S. Riddile, and Peter A. Wilson. "Strategic Information Warfare: a New Face of War." *Parameters: US Army War College Quarterly* XXVI, no. 3 (Autumn 1996): 81–92.

Moltz, James Clay. *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*. Stanford, California: Stanford University Press, 2011.

Morris, Lt. Col. Craig F. "The Origins of American Strategic Bombing Theory: Transforming Technology into Military Doctrine." PhD diss., Auburn University, 2015.

Morrow Board. *Report of the President's Aircraft Board*. Washington, District of Columbia: Government Printing Office, 1925.

Morrow, John Howard. *The Great War in the Air: Military Aviation from 1909-1921*. Washington, District of Columbia: Smithsonian Institution Press, 1993.

n.a. "Plan to use U.S. for Air Training Base." *Sun*, June 16, 1917, 3.

Nakashima, Ellen. "Dual-leadership Role at NSA and Cyber Command Stirs Debate." [Online; accessed March 11, 2017], *Washington Post*, October 6,2013. https://www.washingtonpost.com/world/national-security/dual-leadership-role-at-nsa-and-cyber-command-stirs-debate/2013/10/06/ffb2ac40-2c59-11e3-97a3-ff2758228523_story.html.

National Security Agency. *Biography — 15th Director*. [Online; accessed June 26, 2017], 5-3-2016. https://www.nsa.gov/about/leadership/former-directors/bio-hayden.shtml.

———. *Former Directors, NSA*. [Online; accessed June 26, 2017], 5-3-2016. https://www.nsa.gov/about/leadership/former-directors/.

National Security Agency/Central Security Service and U.S. Strategic Command, Joint Functional Component Command - Network (JFCC-NW). *National Initiative Protection Program - Sentry Eagle*. George Washington University National Security Archive, 2004. http://nsarchive.gwu.edu/dc.html?doc=2838110-Document-03.

National Security Council. “Memorandum of Discussion at the 339th Meeting of the National Security Council, Washington, October 10, 1957.” In *Foreign Relations of the United States, 1955-1957*, edited by Lisle A. Rose, XI:757–764. Washington, D.C.: Government Printing Office, 1988.

Nolte, William M. “Anticipating Cyberspace Security: NSA’s Experience 1992-1997.” *Cryptologic Quarterly*, 2012.

Nye Jr, Joseph S. “Nuclear Lessons for Cyber Security?” *Strategic Studies Quarterly* 5, no. 4 (2011): 18–38.

O’Doherty, John. “How big is Aeropsace?” *The Airman*, December 1965, 12–14.

Overy, R.J. “From ’uralbomber’ to ’amerikabomber’: The Luftwaffe and Strategic Bombing.” *Journal of Strategic Studies* I, no. 2 (1978): 154–178.

———. *The Air War 1939-1945*. New York, New York: Stein / Day, 1980.

Parent, Joseph M., and Sebastian Rosato. “Balancing in Neorealism.” *International Security* 40, no. 2 (2015): 51–86.

Parker, Frank. “22. Parker: The Role of Aviation.” In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:119–121. Washington, District of Columbia: U.S. Government Printing Office, 1978.

Patton, James H. “The New ”RMA”: It’s Only Just Begun.” *Naval War College Review* XLIX, no. 2 (Spring 1996): 7–22.

Peebles, Curtis. *High Frontier: the U.S. Air Force and the Military Space Program*. Washington, District of Columbia: Air Force History / Museums Program, 1997.

Perlroth, Nicole, and David Sanger. *Hacks Raise Fear Over N.S.A. s Hold on Cyberweapons*. New York Times. [Online; accessed July 23, 2017], 6-28-2017. https://www.nytimes.com/2017/06/28/technology/ransomware-nsa-hacking-tools.html.

Perry, William A. *Memorandum for the Director, National Security Agency, Subject: Delegation of Authority and Creation of Executive Agent*. George Washington University National Security Archive, 3-3-1997. http://nsarchive.gwu.edu/dc.html?doc=2778590-Document-02-William-A-Cohen-Memorandum-for-the.

Perry, Robert L. *Origins of the USAF Space Program 1945-1961*. Technical report. Air Force Systems Command, 1961.

Peters, Ralph. “After the Revolution.” *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 7–14.

Philips, Kristine. "Cheney Delivers a statement on Russian meddling: It's an 'act of war'." [Online; accessed June 20, 2017], *Washington Post*, 3-28-2017. https://www.washingtonpost.com/news/the-fix/wp/2017/03/28/cheney-is-the-latest-republican-to-call-russias-alleged-meddling-in-u-s-elections-an-act-of-war/?utm_term=.53f6a38fe487.

Phillips, Cecil. "Central Computer Complex in 1970s-1980s." *Cryptolog* IV, no. 3 (March 1977): 5–14.

Poindexter, Dennis F. *The New Cyberwar: Technology and the Redefinition of Warfare*. New York, New York: McFarland, 2015.

Pollpeter, Kevin. "Space, the New Domain: Space Operations and Chinese Military Reforms." *Journal of Strategic Studies* 39, nos. 5-6 (2016): 709–727.

Posen, Barry. *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars*. Ithaca, New York: Cornell University Press, 1986.

Posey, Carl. "A Sudden Loss of Altitude." *Smithsonian Air & Space Magazine*, July 1998.

Powell, Colin. *Chairman of the Joint Chiefs of Staff Memorandum of Policy No. 30 (CMOP); Command and Control Warfare*. Defense Technical Information Center. [Online; accessed June 11, 2017], 3-8-2013. http://www.dtic.mil/docs/citations/ADA389344.

Prelinger, Megan. *Inside the Machine: Art and Invention in the Electronic Age*. New York, New York: Norton, 2015.

Puckett, Robert H. "American Space Policy: Civilian/Military Dichotomy." *The Air University Review* 16, no. 3 (1965): 45–50.

———. *The Military Role in Space — A Summary of Official, Public Justifications*. Technical report. RAND Corporation, 1962.

Reagan, Ronald. *Address to the Nation on Defense and National Security*. [Online; accessed 10-May-2017], March 23, 1983. https://reaganlibrary.archives.gov/archives/speeches/1983/32383d.htm.

Reiss, Edward. *The Strategic Defense Initiative*. New York, New York: Cambridge University Press, 1992.

Resende-Santos, João. *Neorealism, States, and the Modern Mass Army*. New York, New York: Cambridge University Press.

Rice, Rondall R. *The Politics of Air Power: From Confrontation to Cooperation in Army Aviation Civil-Military Relations*. Lincoln, Nebraska: University of Nebraska Press, 2004.

Richelson, Jeffrey T. *The U.S. Intelligence Community*. 7th ed. Boulder, Colorado: Westview Press, 2015.

Rid, Thomas. *Cyber War Will Not Take Place*. New York, New York: Oxford University Press, 2013.

———. *Cyber War Will Not Take Place*. New York, New York: Oxford University Press, 2013.

———. *Rise of the Machines: A Cybernetic History*. Boulder, Colorado: Westview Press, 2014.

Robinson JR., Clarence A. "Information Operations Center Provides Attack Thwarting Tools." *Signal Magazine* 52, no. 11 (1998).

Rona, Thomas P. *Weapon Systems and Information War*. Technical report. Seattle, Washington: Boeing Aerospace Company, July 1976.

Roosevelt, Franklin D. *The Public Papers and Addresses of Franklin D. Roosevelt: 1939*. New York, New York: MacMillan, 1941.

Rosen, Stephen Peter. "New Ways of War: Understanding Military Innovation." *International Security* 13, no. 1 (1988): 134–168.

———. "The impact of the office of net assessment on the American military in the matter of the revolution in military affairs." *Journal of Strategic Studies* 33, no. 4 (2010): 469–482.

———. *Winning the Next War: Innovation and the Modern Military*. Ithaca, New York: Cornell University Press, 1994.

Rothstein, Stephen M. "Ideas as Institutions: Explaining the Air Force's Struggle with its Aerospace Concept." PhD diss., The Fletcher School of Law and Diplomacy, 2006.

Rousseau, Jean-Jacues. "The State of War." In *The Basic Political Writings*, 2nd, edited by Donald A. Cress, 253–255. Indianapolis, Indiana: Hackett, 2011.

Salvaneschi, Nino. *Let us Kill the War: Let us Aim at the Heart of the Enemy!* Art Edition. Milan: Bianco e Nero, 1917.

Sapolsky, Harvey. "On the Theory of Military Innovation." *Breakthroughs* IX, no. 1 (2000): 37–41.

———. *The Polaris System Development: Bureaucratic and Programmatic Success in Government*. Cambridge, Massachusetts: Harvard University Press, 1972.

Schell, Roger R. "Computer Security: the Achilles' heel of the electronic Air Force?" Originally published 1979 27, no. 1 (January 2012): 158–192.

Schmitt, Michael N., ed. *Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations*. New York, New York: Cambridge University Press, 2017.

Schriever, Bernard. “I-2: Major General Bernard A. Schriever, Commander, Western Devel opment Division Headquarters, Air Research and Development Command, ”ICBM - A STEP TOWARD SPACE CONQUEST,” Address to the First Annual Air Force Office of Scientific Research Astronautics Symposium, San Diego, California, 19 February 1957.” In *Orbital Futures: Selected Documents in Air Force Space History*, edited by David N. Spires, II:20–26. Peterson Air Force Base, Colorado: Air Force Space Command, 2004.

———. “The Shape of Things to Come.” *The Airman*, October 1959, 18–28.

———. “The U.S. Air Force in Space: 1945 to the 21st Century.” Chap. Military Space Activites Recollections and Observations, edited by R. Cargill Hall and Jacob Neufeld, 11–19. Washington, D.C.: USAF History / Museums Program, 1998.

Scriven, George. “Report of the Chief Signal Officer.” In *Annual report of the Secretary of War*, I:503–556. Washington, District of Columbia: Government Printing Office, 1913.

Secretary of the Air Force Public Affairs. *Air Force Stands Up New Headquarters Space Directorate*. [Online; accessed June 16, 2017], 2017. `http://www.afspc.af.mil/News/Article-Display/Article/1217866/air-force-stands-up-new-headquarters-space-directorate/`.

Segal, Adam. *The Hacked World Order*. New York, New York: PublicAffairs, 2016.

Senate Committee on Armed Services. *Inquiry into Satellite and Missile Programs: Hearings before Preparedness Investigating Subcommittee of the Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, November 25, 26, 27, December 13, 14, 16, and 17, 1957*. Washington, DC: Government Printing Office, 1958.

Sheehan, Michael. *The International Politics of Space*. London, United Kingdom: Routledge, 2007.

Sherman, William. “55. Sherman: Tentative Manual for the Employment of Air Service 1919.” In *The U.S. Air Service in World War I: Early Concepts of Military Aviation*, edited by Maurer Maurer, II:313. Washington, District of Columbia: U.S. Government Printing Office, 1978.

Sherry, Michael. *The Rise of American Air Power: The Creation of Armageddon*. Princeton, New Jersey: Yale University Press, 1987.

Siddiqi, Asif. *Challenge to Apollo: The Sovet Union and the Space 1945-1974*. Washington, District of Columbia: NASA History Office, 2000.

Singer, P.W., and Allan Friedman. *Cybersecurity and Cyberwar: What Everyone Needs to Know*. New York, New York: Oxford University Press, 2014.

Skocpol, Theda, and Margaret Somers. “The Uses of Comparative History in Macrosocial Inquiry.” *Comparative Studies in History and Society* 22, no. 2 (1980): 174–197.

"SM-11827 Preliminary Design of an Experimental World-Circling Spaceship." Chap. Abstract, i–viii. Santa Monica, California: Project Rand, 1946.

Smuts Committee. ""Magna Carta" of British Air Power." In *The Impact of Air Power: National Security and World Politics*, edited by Eugene M. Emme, 33–37. Princeton, New Jersey: D. Van Norstand Company Inc., 1959.

Spaatz, Carl. "Strategic Air Power: Fulfillment of a Concept." *Foreign Affairs* 24, no. 1 (1945): 385.

Space Planning, Directorate of, and Analysis. "Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program Volume II: External Relationships." Chap. II-15: "Military Lunar Base Program or S.R.183 Lunar Observatory Study," Study Summary and Program Plan, Air Research and Development Command, Project No. 7987, Task No. 19769, Directorate of Space Planning and Analysis, Air Force Balliitic Missile Division, April 1960, pp. 1-9. Edited by John Logsdon, Linda J. Lear, Jannelle Warren-Findley, Ray A. Williamson, and Dwayne A. Day, 304–311. Washington, D.C.: NASA History Office, 1996.

Spires, David N. *Beyond Horizons: a Half Century of Air Force Space Leadership*. Peterson Air Force Base, Colorado: Air Force Space Command, 2011.

Stech, Frank J. "Sociopolitical Stresses and the RMA." *Parameters: US Army War College Quarterly* XXV, no. 2 (Summer 1995): 47–54.

Stein, George J. "Information Warfare." *Airpower Journal* IX, no. 1 (Spring 1995): 30–55.

Stiennon, Richard. "A Short History of Cyberwar." In *Cyber Warfare: A Multidisciplinary Analysis*, edited by James A. Green, 253–255. New York, New York: Routledge, 2015.

Stirone, Shannon. *Our Next World War Might Be Fought in Outer Space*. [Online; accessed 20-May-2017], 2017. `https://newrepublic.com/article/142365/next-world-war-might-fought-outer-space-trump-reagan`.

Stoll, Cliff. *The Cuckoo's Egg*. New York, New York: Pocket Books, 1990.

Stone, John. "Cyber War Take Place!" *Journal of Strategic Studies*, 2012, 1–8.

Strother, Dean. "Man in Aerospace." *The Airman*, December 1961, 15–17.

Sturdevant, Rick. "Organizing for the Use of Space: Historical Perspectives on a Persistent Issue." Chap. Early U.S. Civil Space Policy, NASA, and the Aspiration of Space Exploration, edited by Roger D. Launius, 63–86. San Diego, California: American Astronautical Society, 1995.

Szafranski, Richard. "A Theory of Information Warfare: Preparing for 2020." *Airpower Journal* IX, no. 1 (Spring 1995): 56–65.

Tabansky, Lior, and Isaac Ben Israel. "Striking with Bits? The IDF and Cyber-Warfare." In *Cybersecurity in Israel*, 63–69. Cham: Springer International Publishing, 2015.

"Military Man in Space." *The Airman*, August 1964, 6–10.

"Our Space Age Flying Professors." *The Airman*, October 1964, 29.

"Out into the Wild Blue Yonder." *The Airman*, September 1967, 12–14.

"Slants on Space." *The Airman* III, no. 2 (1959): 48.

"Slated For Space." *The Airman*, January 1963, 50.

The Secretary of War. *Annual Report of the Secretary of War*. Vol. I. Washington, District of Columbia: Government Printing Office, 1908.

———. *Annual Report of the Secretary of War*. Vol. I. Washington, District of Columbia: Government Printing Office, 1913. ISBN: 3210105073.

———. *Annual Report of the Secretary of War*. Washington, District of Columbia: Government Printing Office, 1919.

The White House. *National Security Decision Directive Number 145: National Policy on Telecommunications and Automated Information Systems Security*. Federation of American Scientists. [Online; accessed June 12, 2017], 9-17-1984. https://fas.org/irp/offdocs/nsdd145.htm.

———. *Presidential Policy Directive/PPD-20*. Federation of American Scientists. [Online; accessed June 20, 2017], 10/16/12x. https://fas.org/irp/offdocs/ppd/ppd-20.pdf.

Thucydides. *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War*. Edited by Robert B. Strassler. New York, New York: Touchstone, 1998.

Toffler, Alvin, and Heidi Toffler. *War and Anti-War*. New York, New York: Grand Central Publishing, 1995.

Turnbull, Archibald, and Clifford Lord. *History of United States Naval Aviation*. New Haven, Connecticut: Yale University Press, 1943.

Turner, Fred. *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. Chicago, Illinois: The University of Chicago Press, 2008.

TWENTY-FIFTH AIR FORCE: BRIEF HISTORY. [Online; accessed June 12, 2017]. http://www.25af.af.mil/Portals/100/Documents/AFD-150520-021.pdf?ver=2016-02-11-123439-690.

U.S. Department of State. “Memorandum of a Conference, President’s Office, White House, Washington, October 8, 1957, 8:30 a.m.” In *Foreign Relations of the United States, 1955-1957*, edited by Lisle A. Rose, XI:755–756. Washington, D.C.: Government Printing Office, 1988.

U.S. Strategic Command. *JTF-CND / JTF-CNO / JTF-GNO – A Legacy of Excellence*. George Washington University National Security Archive, 2010. http://nsarchive.gwu.edu/dc.html?doc=2849764-Document-05.

UN General Assembly. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)*. [Online; accessed 7-May-2017], 1967. http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html.

Underwood, Jeffrey S. *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration 1933-1941*. College Station, Texas: Texas A&M University Press, 1991.

United States Air Force. *Brigadier General Gover E. Jackson, Biography*. Official United States Air Force Website. [Online; accessed July 5, 2017], 8-1-1991. http://www.af.mil/About-Us/Biographies/Display/Article/106658/brigadier-general-grover-e-jackson/.

———. *Lieutenant General Kenneth A. Minihan, Biography*. Official United States Air Force Website. [Online; accessed July 5, 2017], 10-1998. http://www.af.mil/About-Us/Biographies/Display/Article/106229/lieutenant-general-kenneth-a-minihan/.

United States House of Representatives. *Aeronautics in the Army. Hearings before the Committee on Military Affairs, House of Representatives, Sixty-third Congress, first session, in connection with H. R. 5304, May 16, 1913, entitled ”An act to increase the efficiency of the aviation service of the army, and for other purposes.” August 12, 14, 15, and 16, 1913.* Washington, District of Columbia: Government Printing Office, 1918.

———. *Hearings before the Committee on Military Affairs, House of Representatives, Sixty-sixth Congress, second session, United Air Service: General Discussion*. Washington, District of Columbia: Government Printing Office, 1919.

———. *Inquiry into the Operations of the United States Air Service, Select Committee of Inquiry into Operations of the United States Air Service, House of Representatives, Sixty-Eighth Congress, On Matters Relating to the Operations of the United States Air Service, PT II*. Washington, District of Columbia: Government Printing Office, 1925.

———. *The computer and invasion of privacy. Hearings, Eighty-ninth Congress. July 26, 27, and 28, 1966.* Washington, District of Columbia: Government Printing Office, 1966.

United States Space Command. *USCINCSPACE Implementation Plan for Computer Network Operations*. George Washington University National Security Archive, 3-13-2001. http://nsarchive.gwu.edu/dc.html?doc=2805487-Document-03-The-White-House-Defending-America-s.

USA-USSR. *TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYSTEMS*. [Online; accessed 7-May-2017], 1972. https://www.state.gov/www/global/arms/treaties/abm/abm2.html.

USCYBERCOM. *USCYBERCOM to CDRUSACYBER, Subj: CYBERCOM FRAGORD 01 to TASKORD 16-0063 To Establish Joint Task Force (JTF)-ARES to Counter the Islamic State of Iraq and the Levant (ISIL) in Cyber Space, May 5, 2016.* George Washington University National Security Archive, 2016. http://nsarchive.gwu.edu/dc.html?doc=3678213-Document-07-USCYBERCOM-to-CDRUSACYBER-Subj.

Valeriano, Brandon, and Ryan C Maness. *Cyber War versus Cyber Realities: Cyber Conflict in the International System*. New York, New York: Oxford University Press, 2015.

Vandenberg, Hoyt S. "I-1: Major General S. Craigie, Director of Research and Development Office, Deputy Chief of Staff, Materiel, to Brigadier General Alden R. Crawford, Air Materiel Command, Wright Field, Dayton, Ohio, "Satellite Vehicles", 16 January 1948, with attached: Memorandum for the Vice Chief of Staff, "Earth Satellite Vehicles," 12 January 1948, and General Hoyt S. Vandenberg, Vice Chief of Staff, United States Air Force, "Statement of Policy for a Satellite Vehicle"." In *Orbital Futures: Selected Documents in Air Force Space History*, edited by David N. Spires, vol. II. Peterson Air Force Base, Colorado: Air Force Space Command, 2004.

Wall, Andru E. "Demystifying the Title 10-Title 50 Debate: Distinguishing Military Operations, Intelligence Activities, and Covert Action." *Harvard National Security Journal* 3, no. 1 (2011): 85–142.

Waller, Douglas, and Mark Thompson. "Onward cyber soldiers." *Time Magazine* 146, no. 8 (8-21-1995): 38–45.

Wallop, Malcolm. "Opportunities and Imperatives of Ballistic Missile Defense." *Strategic Review* 7, no. 4 (1979): 13–21.

Waltz, Kenneth M. *Theory of International Politics*. New York, New York: McGraw-Hill, 1979.

War Department Office of the Chief of Staff. *Field Service Regulations: United States Army*. Washington, DC: Government Printing Office, 1910.

———. *Field Service Regulations: United States Army*. Washington, DC: Government Printing Office, 1913.

War Department Office of the Chief of Staff. *Field Service Regulations: United States Army 1923*. Washington, DC: Government Printing Office, 1923.

Ware, Willis H. *P-3544 Security and Privacy in Computer Systems*. Santa Monica, California: RAND Corporation, April 1967.

Warner, Michael. "Cybersecurity: A Pre-history." *Intelligence and National Security* 27, no. 5 (2012): 781–799.

———. "Notes on Military Doctrine for Cyberspace Operations in the United States, 1992-2014." *Cyber Defense Review*, 8-27-2015. http://cyberdefensereview.army.mil/The-Journal/Article-Display/Article/1136012/notes-on-military-doctrine-for-cyberspace-operations-in-the-united-states-1992/.

———. "Notes on the Evolution of Computer Security Policy in the US Government 1965-2003." *IEEE Annals of the History of Computing* 37, no. 2 (April 2015).

———. "Reflections on Technology and Intelligence Systems." *Intelligence and National Security* 27, no. 1 (2012): 133–153.

Watson, Mark Skinner. *Chief of Staff: Prewar Plans and Preparations*. Washington, Disctrict of Columbia: Department of the Army Historical Division, 1950.

Weimann, Gabriel. *Terrorism in Cyberspace: The Next Generation*. Washington, District of Columbia: Woodrow Wilson Center Press, 2015.

Widnall, Sheila. "State of the Air Force." *Airpower Journal* IX, no. 1 (Spring 1995): 4–14.

Wiener, Craig J. "Penetrate, Exploit, Disrupt, Destroy: The Rise of Computer Network Operations as a Major Military Innovation." PhD diss., George Mason University, 2016.

Wiener, Norbert. *Cybernetics: or, Control and Communication in the Animal and the Machine*. Cambridge, Massachussetts: MIT Press, 1948.

Williams, George K. "' The Shank of the Drill ': Americans and Strategical Aviation in the Great War." *Journal of Strategic Studies* 19, no. 3 (1996): 381–431.

Wilson, Clay. *Information Operations, Electronic Warfare, and Cyberwar: Capabilities and Related Policy Issues*. [Online; accessed March 11, 2017], 2007. http://www2.gwu.edu/~nsarchiv/NSAEBB/NSAEBB24/nsa22.pdf.

Wilson, Donald. "Origin of a Theory for Air Strategy." *Aerospace Historian* 18, no. 3 (1971): 19–25.

Wilson, H. J. A. "The Luftwaffe as a Political Instrument." In *The Impact of Air Power: National Security and World Politics*, edited by Eugene M. Emme, 58–63. Princeton, New Jersey: D. Van Norstand Company Inc., 1959.

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

Wolk, Herman S. *Toward Independence: The Emergence of the U.S. Air Force*. Washington, District of Columbia: Air Force History / Museum Program, 1996.

Zetter, Kim. *Countdown to Zero Day*. New York, New York: Crown, 2014.

Archives Consulted

The following archives were consulted in the process of writing this dissertation:

United States National Archives and Records Administration Online Catalog

Air Force Historical Research Association, Maxwell Air Force Base

NASA History Office, Washington, DC

Library of Congress Manuscripts Division, Washington, DC