

NATIONAL POLICIES FOR MILITARY UNMANNED SYSTEMS
THAT IMPLEMENT JOINT FIRES MISSIONS

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
Strategic Studies

by

GAUTAM R. KHARKAR, LCDR, U.S. NAVY
M.B.A., Massachusetts Institute of Technology, Cambridge, MA, 2009
M.L.A., The Johns Hopkins University, Baltimore, MD, 2001
M.S., Carnegie Mellon University, Pittsburgh, PA, 1998
B.S., Carnegie Mellon University, Pittsburgh, PA, 1997

Fort Leavenworth, Kansas
2015

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE			<i>Form Approved</i> <i>OMB No. 0704-0188</i>		
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 12-06-2015		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From - To) AUG 2014 – JUN 2015	
4. TITLE AND SUBTITLE National Policies for Military Unmanned Systems that Implement Joint Fires Missions			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) LCDR Gautam R. Kharkar, U.S. Navy			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301			8. PERFORMING ORG REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Since September 11, 2001, the United States has used unmanned systems extensively around the world. These were primarily unmanned aircraft systems, but in the same years the technologies for ground and maritime (both surface and sub-surface) systems also matured significantly. In the coming years, unmanned systems with tremendous capabilities will be readily available in all of these areas. Technological advances in unmanned systems have expanded existing military capabilities. Despite the adoption of these technologies for military applications, policy guidance for U.S. national decision-makers has lagged the introduction of new capabilities. This thesis examines the current national-level policy guidance that exists for military unmanned systems capable of implementing joint fires missions (both kinetic and non-kinetic), and identifies policy gaps based on the planned capabilities of unmanned systems. This thesis asserts that U.S. policies to constrain autonomy have been developed; however, there are limits to the guidance provided for responses to aggression against U.S. unmanned systems or the use of adversary unmanned systems. It further asserts that policies should be publicly declared to signal U.S. intent, and that this guidance should include ground and maritime unmanned systems, not just airborne, as they are just as likely to affect U.S. international affairs.					
15. SUBJECT TERMS Unmanned systems, Joint fires, Armed drones, National policies, International relations, Foreign relations					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. PHONE NUMBER (include area code)
(U)	(U)	(U)	(U)	106	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: LCDR Gautam R. Kharkar

Thesis Title: National Policies for Military Unmanned Systems that Implement Joint Fires Missions

Approved by:

_____, Thesis Committee Chair
Phillip G. Pattee, Ph.D.

_____, Member
Lt Col Patrick D. Sullivan, M.S.

_____, Member
Patrick C. Beatty, M.S.

Accepted this 12th day of June 2015 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

NATIONAL POLICIES FOR MILITARY UNMANNED SYSTEMS THAT IMPLEMENT JOINT FIRES MISSIONS, by LCDR Gautam R. Kharkar, 106 pages.

Since September 11, 2001, the United States has used unmanned systems extensively around the world. These were primarily unmanned aircraft systems, but in the same years the technologies for ground and maritime (both surface and sub-surface) systems also matured significantly. In the coming years, unmanned systems with tremendous capabilities will be readily available in all of these areas. Technological advances in unmanned systems have expanded existing military capabilities. Despite the adoption of these technologies for military applications, policy guidance for U.S. national decision-makers has lagged the introduction of new capabilities.

This thesis examines the current national-level policy guidance that exists for military unmanned systems capable of implementing joint fires missions (both kinetic and non-kinetic), and identifies policy gaps based on the planned capabilities of unmanned systems. This thesis asserts that U.S. policies to constrain autonomy have been developed; however, there are limits to the guidance provided for responses to aggression against U.S. unmanned systems or the use of adversary unmanned systems. It further asserts that policies should be publicly declared to signal U.S. intent, and that this guidance should include ground and maritime unmanned systems, not just airborne, as they are just as likely to affect U.S. international affairs.

ACKNOWLEDGMENTS

I would like to thank the members of my thesis committee at the U.S. Army Command and General Staff College (CGSC) for their guidance and support throughout the development of this thesis. Dr. Phillip Pattee's counsel helped me understand and frame the problem. Lt Col Patrick Sullivan's knowledge of unmanned systems helped ensure I was considering the right set of issues. Mr. Patrick Beatty's constant encouragement and experience helped steer me through the writing process. In addition, I would like to thank Mr. Nathaniel Stevenson for allowing me to take part in the Strategic Studies track at CGSC, and for helping me develop my topic.

I would also like to thank the instructors of Staff Group 20B at CGSC: Section Leader and Leadership Instructor Mr. Scott Porter, Staff Group Advisor and Tactics Instructor LTC John Dalbey, Joint Operations Instructor LTC Gene Richards, History Instructor Dr. Mark Gerges, and Sustainment Instructor Patrick Beatty. Their dedication helped prepare me for the Oral Comprehensive exam and my future Navy career.

I would further like to thank the leadership and staff of the CGSC U.S. Navy Element. CAPT Trenton Lennard and CDR Scott Richardson set the expectation for excellence, and Ms. Ann Chapman ensured my thesis adhered to those high standards.

I especially want to thank my loving family for their sacrifices during the writing of this thesis, and throughout my Navy career. This thesis would not have been possible without continuous encouragement from my wife Alissa, who as a dedicated teacher always understood my commitment to education. This thesis is dedicated to my daughter Leela in the hopes that she too never stops wanting to learn.

TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE	iii
ABSTRACT.....	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS.....	vi
ACRONYMS.....	viii
ILLUSTRATIONS	ix
CHAPTER 1 INTRODUCTION	1
Identifying the Problem	1
Recent History	3
Significance of the Problem.....	6
Research Questions.....	8
Assumptions.....	11
Definition of Terms	13
Scope.....	14
Limitations	14
Delimitations.....	16
Conclusion	17
CHAPTER 2 LITERATURE REVIEW	18
Significant Literature for Understanding Issues Related to Unmanned Systems.....	20
Media Commentary on Existing Policies for Unmanned Systems.....	24
Research Institutes and Academic Publications on Unmanned Systems Policies.....	27
Common Themes in Existing Literature.....	30
Significance of Thesis in Relation to Existing Literature.....	33
CHAPTER 3 RESEARCH METHODOLOGY	35
Phase 1: Identification of Capabilities that could Require Policy Guidance.....	35
Phase 2: Review of Existing, Publicly-Declared Unmanned Systems Policies	36
Phase 3: Comparison of Policy Requirements to Historical Analogies.....	37
The Three-phase Research Methodology Addresses the Research Questions	38
Further Considerations.....	40

CHAPTER 4 ANALYSIS	42
Phase 1-1: DOD Research Priorities as Indicators of Near-future Capabilities	43
Phase 1-2: Addressing New or Greatly Expanded Capabilities of Unmanned Systems.....	45
Phase 2-1: Analysis of Existing Policies on the Use of Military Unmanned Systems.....	50
Phase 2-2: Aspects of New Capabilities not Addressed by Policies	63
Phase 3: Historical Analogies that can Provide Insight on Unmanned Systems Issues	66
Results of Research Methodology	75
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS	76
Revisiting the Research Questions	76
Conclusions.....	82
Recommendations.....	84
Areas of Further Research	86
BIBLIOGRAPHY	88

ACRONYMS

CIA	Central Intelligence Agency
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
UCAV	Unmanned Combat Aerial Vehicle
U.S.	United States

ILLUSTRATIONS

	Page
Figure 1. Principle Source of Materials.....	19
Figure 2. Three-phase Research Methodology.....	38
Figure 3. Results of Three-phase Research Methodology	78

CHAPTER 1

INTRODUCTION

For the same progress that gives us the technology to strike half a world away also demands the discipline to constrain that power - or risk abusing it.

— Barack Obama,
“Remarks by the President at the National Defense University”

Identifying the Problem

Since September 11, 2001, the United States has used unmanned systems extensively on battlefields around the world. These were primarily unmanned aircraft systems, but in these same years the technologies for ground and maritime (both surface and sub-surface) systems also matured significantly. In the coming years, unmanned systems with tremendous capabilities will be readily available across the three unmanned operating domains: air, ground, and maritime.¹

Removing the human from the platform has obvious benefits. Unmanned systems are especially useful in dull, dirty, or dangerous (in terms of reduced risk to military personnel) missions.² There are also engineering savings in terms of physical space, weight, and complexity associated with removal of life-support requirements from platforms. As designs move beyond those that simply remove humans from current platforms, capabilities begin to expand beyond what existed today’s manned systems.

¹ Department of Defense, *Unmanned Systems Integrated Roadmap 2013-2038* (Washington, DC: Government Printing Office, 2013), 1, accessed May 19, 2015, <http://www.defense.gov/pubs/DOD-USRM-2013.pdf>.

² *Ibid.*, 20.

The media has characterized the use of armed, unmanned aircraft systems to target and eliminate threats as a drone policy. This is just one capability of unmanned systems, and even this capability has generated great debate over its use. As we move from remotely-guided to automated to truly autonomous platforms that are able to implement fires (“to use available weapons and other systems to create a specific lethal or nonlethal effect on a target”), the debates will intensify.³ Yet, the benefits of using new capabilities will be enticing for our national leadership. When describing these expanding capabilities of unmanned systems, President Obama said, “There’s a remoteness to it that makes it tempting to think that somehow we can, without any mess on our hands, solve vexing security problems.”⁴ The issue is technologies are advancing faster than the policies directing their use.

Technological advances in unmanned systems (air, ground, and maritime surface and subsurface) have expanded existing military capabilities. Despite the adoption of these technologies for military applications, policy guidance for U.S. national decision-makers has lagged the introduction of new capabilities. Strategic options created by unmanned systems for national decision-makers provide new ways to implement U.S. policies, but these options are being implemented without a thorough understanding of their potential consequences and implications.

³ Joint Chiefs of Staff, Joint Publication 3-0, *Joint Operations* (Washington, DC: Government Printing Office, August 2011), xiv, accessed May 19, 2015, http://www.dtic.mil/doctrine/new_pubs/jp3_0.pdf.

⁴ Scott Shane, “Election Spurred a Move to Codify U.S. Drone Policy,” *The New York Times*, November 24, 2012.

Recent History

Advances in technology and the proliferation of unmanned systems have made their use ubiquitous in recent years. However, countries have sought unmanned systems for decades to provide an offensive capability that did not present risks to human operators. An early example is the Kettering Aerial Torpedo, developed in 1917 by the Dayton-Wright Airplane Company, which was essentially a pilotless airplane that used pre-set pneumatic and electrical controls to guide a 180-pound warhead to a predetermined target.⁵ Similarly, remotely piloted drones have been developed that provided kinetic strike capabilities (e.g., U.S. development of BGM-34 Firebee attack drones during the Vietnam War) or expendable decoy and jamming capability to support strike missions.⁶ Cruise missiles (such as the Tomahawk Land-Attack Missile) have been capable of making navigation decisions based on complex terrain recognition algorithms for conducting attacks without the need for humans.⁷

Recent U.S. counterterrorism efforts have highlighted the flexibility of options that unmanned systems can create for national leaders. The expansion of the use of unmanned aerial systems (e.g., MQ-1 Predator and MQ-9 Reaper) to locate, identify, and engage terrorist threats under the Obama Administration has been perhaps the most

⁵ National Museum of the Air Force, “Kettering Aerial Torpedo ‘Bug,’” U.S. Air Force, March 25, 2014, accessed April 27, 2015, <http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=320>.

⁶ Michael Hastings, “The Rise of the Killer Drones: How America Goes to War in Secret,” *Rolling Stone*, April 16, 2012, accessed April 4, 2015, <http://www.rollingstone.com/politics/news/the-rise-of-the-killer-drones-how-america-goes-to-war-in-secret-20120416>.

⁷ M. Shane Riza, *Killing Without Heart: Limits on Robotic Warfare in an Age of Persistent Conflict* (Washington, DC: Potomac Books, 2013), 19.

visible example, and certainly the one that has generated the most public discourse. There are thousands of unmanned platforms, from unmanned aerial systems in a wide range of sizes, small unmanned ground vehicles, and experimental surface and underwater unmanned vehicles, in the U.S. inventory today, including hundreds that are capable of kinetic strike operations.⁸ Leaders in the U.S. Government, including the President, have stressed the importance of having such capabilities as an option in an increasingly ambiguous global situation.⁹

Because unmanned systems vary so widely in sophistication, many countries have already fielded some version of unmanned system for military use. As with the proliferation of any type of weapon system, it is only a matter of time before countries with goals that are not aligned with the United States are able to operate unmanned systems with the capability to perform joint fires missions. Already, at least a dozen countries have acquired, built, or are developing armed unmanned systems.¹⁰ It is estimated that, due to the number of programs in development and the flexibility of the

⁸ Samuel J. Brannen, *Sustaining the U.S. Lead in Unmanned Systems: Military and Homeland Considerations through 2025* (Washington, DC: Center for Strategic and International Studies, 2014), 1, accessed April 4, 2015, http://csis.org/files/publication/140227_Brannen_UnmannedSystems_Web.pdf.

⁹ U.S. President, “Remarks by the President at the National Defense University,” The White House, Office of the Press Secretary, May 23, 2013, accessed April 9, 2015, <https://www.whitehouse.gov/the-press-office/2013/05/23/remarks-president-national-defense-university>.

¹⁰ International Security, “World of Drones,” *New America*, accessed April 9, 2015, <http://securitydata.newamerica.net/world-drones.html>.

global arms market, nearly every country in the world will have access to armed unmanned systems within a decade.¹¹

While only three countries (the United States, the United Kingdom, and Israel) had used armed unmanned systems in combat by 2015, other countries have indicated their preference to use these types of systems.¹² For example, press articles in 2013 revealed that China had considered using an armed unmanned aerial system to target an individual in Myanmar who was accused of killing Chinese sailors.¹³

Several advances in technology have made unmanned systems more capable, and thus more likely to provide capabilities that were previously unavailable or immature.¹⁴ First, progress in software, particularly for Artificial Intelligence, give unmanned systems greater ability to make independent decisions. This decision-making capability introduces the possibility for greater autonomy. Second, computing power has increased to the point where unmanned systems cannot only take in a large amount of sensor data, but they can also make sense of this data for situational awareness and to use in offensive actions. Third, miniaturization of electronics means that sensing and processing can be done on-board the unmanned platform itself, making it less reliant on outside information. Fourth,

¹¹ Patrick Tucker, "Every Country Will Have Armed Drones Within 10 Years," *Defense One*, May 6, 2014, accessed April 9, 2015, <http://www.defenseone.com/technology/2014/05/every-country-will-have-armed-drones-within-ten-years/83878/>.

¹² Peter Bergen and Emily Schneider, "The World Needs New Rules for Armed Drones," *Defense One*, February 24, 2015, accessed April 4, 2015, <http://www.defenseone.com/ideas/2015/02/world-needs-new-rules-armed-drones/105933/>.

¹³ *Ibid.*

¹⁴ Brannen, 5-7.

more efficient power generation and storage allows unmanned systems to operate for greater time over expanded distances. In addressing these advances in technology, the Department of Defense (DOD) has identified issues surrounding the improvement in unmanned system capabilities that further complicate the situation: competitors are catching up, data-intensive capabilities are evolving, and technology innovations are rapidly increasing.¹⁵

Significance of the Problem

Why does the use of unmanned systems pose a problem for the United States?

After all, the basic concept of unmanned systems has been in place for decades. In 1945, General Henry H. (Hap) Arnold stated:

We have just won a war with a lot of heroes flying around in planes. The next war may be fought with airplanes with no men in them at all. It certainly will be fought with planes so far superior to those we have now that there will be no basis for comparison. Take everything you've learned about aviation in war and throw it out of the window and let's go to work on tomorrow's aviation. It will be different from anything the world has ever seen.¹⁶

The answer lies in the effects these systems could have on interactions with other countries, and the ensuing impact on foreign relations. The current U.S. administration has publicly recognized the impact that the use of armed unmanned systems can have on relations with other countries, not just adversaries but also allies. With that understanding

¹⁵ Department of Defense, *Unmanned Systems Integrated Roadmap 2013-2038*, 10.

¹⁶ Jay M. Shafritz, *Words on War* (New York: Simon and Schuster, 1990), 104.

has come the initial attempts at restraint and a publicly stated policy on the use of these systems.¹⁷

These interactions come from two sides. The first is the U.S. use of unmanned systems to perform joint fires missions that would previously have required American service members to be placed in harm's way. This, along with other new or expanded capabilities provided by unmanned systems, provides national leaders with different options when using the military as an Instrument of National Power to project influence and achieve U.S. goals with respect to other countries. The second is the United States will now have to deal with unmanned hardware that is being employed by other countries, and develop responses that are appropriate for this new capability. The United States will face situations that are similar to events it has experienced in the past, but that are unique in terms of the systems being employed against it.

That weapons systems could drive foreign policy decisions is not a new phenomenon. The development of nuclear weapons drove the creation of new national strategies and shaped the way countries viewed each other for the past half century. Weapons such as land and naval mines have created immeasurable international discussion and treaty efforts as countries tried to contain the potential effects of these weapons without fully losing access to their capabilities. An approach to policies for unmanned systems will require similar responses as those exhibited for past weapon systems, and perhaps even new considerations given the expanded capabilities provided by unmanned systems.

¹⁷ U.S. President, "Remarks by the President at the National Defense University."

Research Questions

In order to help U.S. policymakers understand the issues involved in managing the capabilities, both for the United States and other countries, brought about by unmanned systems that are capable of implementing joint fires missions, this thesis seeks to answer the following primary research question, What national policies need to be developed to guide U.S. leaders in their use of military unmanned systems that implement joint fires?

To understand this question, it is important to examine its components. First, national policies can be broadly defined, and will necessarily be more narrowly defined within this thesis. Of primary interest are those national policies that examine the strategic intersection of national security and foreign relations, where incidents involving unmanned systems could and will impinge on both. As policies are developed as guidance for government officials to execute, the policies examined by this thesis will reflect those that provide appropriate response options for national-level leadership. This should include both the U.S. use of unmanned systems, and the U.S. response to the use of unmanned systems by other countries.

In examining these policies, or policy gaps, this thesis will not purport to identify the correct course of development for these policies. The purpose of the primary research question is to identify gaps, not recommend how to fill them. The development of these policies will need to take into account a variety of ever changing factors that extend beyond simple suggestions.

It is also important to note which unmanned systems are being considered in the primary research question. While the specifics will be expanded on in the section on

scope of the thesis, it should be summarily noted that the unmanned systems associated with these policies are those used by the military for the implementation of joint fires missions.

In order to build sufficient knowledge to attempt to answer the primary research question, this thesis will examine a series of secondary research questions. The first of these is, What capabilities do current and near-future unmanned systems have that have not been available to national leaders in the past? In order to understand what options a national leader will turn to in order to execute the military Instrument of National Power, it is important to understand what capabilities exist in military unmanned systems. In order to do so, this thesis will examine capabilities inherent in unmanned systems in the current U.S. military inventory, as well as capabilities that are being pursued by the DOD in the near term. Which capabilities are being pursued is based on a review of the types of research and development programs for unmanned systems that are being funded; despite assertions of importance, any capability that does not have sufficient funding is not likely to become a viable option for national leaders in the foreseeable future.

The second secondary research question is, What are the effects of unmanned systems capabilities on U.S. foreign policy efforts? The U.S. Government has a myriad assortment of policy efforts that support foreign relations positions at any given time. At the point where the capabilities of unmanned systems that implement joint fires have been identified, the next step is to examine how those capabilities could affect ongoing foreign relations efforts. While unmanned systems are only one of many factors that influence the development of foreign policy, it is important to understand if there are instances in which the emergence of unmanned systems is having an outsized effect on

diplomatic, commercial, or military nation-to-nation interaction. These foreign policy efforts might include not only the use of unmanned systems, but also their sale. Arms control and export policies of the United States and other countries will affect how the United States achieves its foreign policy objectives.¹⁸

The third secondary research question is, What publicly-stated national-level policies exist for the military use of unmanned systems? There are a few aspects of this question that need to be clarified. First, numerous policies exist at all levels of government that are either internal to the organization, or are restricted to specific individuals within the government (i.e., classified). While these policies are useful for the organization (whether the whole of government or an entity within) to formulate a response to a situation, because they have not been publicly announced they could have a limited impact on the actions of other nations. Because this thesis is focused on the implications of policies at the convergence of national security and foreign relations, policies that are only known to one party in the interaction will provide limited effect.

The fourth secondary research question is, What publicly-stated national policies exist as a result of other countries developing unmanned systems capable of performing fires missions? This question addresses the bidirectional nature of nation-to-nation interactions. Certainly the U.S. use of unmanned systems will (and already has) lead to responses from other countries around the world. As noted previously, the proliferation of increasingly capable unmanned systems will mean that the United States will find itself in a position where it will need to respond to the use of unmanned systems by others. The purpose of examining this question is to ensure that any national policies that are

¹⁸ Brannen, 2.

developed speak to the reciprocal nature of incidents involving unmanned systems. As with the previous question, these policies would need to be publicly stated in order for them to impact relations with other nations.

The fifth secondary research question is, What other historical weapon systems could serve as analogies for development of policies for new military capabilities? In order to help government policymakers understand what issues will need to be addressed when examining unmanned systems that implement joint fires, it would be helpful to review weapon systems that have had an impact on foreign relations. How the use, or another nation's use, of these weapon systems has been incorporated into formalized international relations could provide insight into how unmanned systems could be similarly incorporated into the international framework.

Assumptions

To deal with the topic of unmanned systems, particularly those that are armed and have a degree of autonomous function, certain assumptions must be made. The primary assumption in viewing policy requirements for unmanned systems is that new technologies will be adopted for military use as they become available. There are inherent biases at all levels that could delay the adoption of unmanned systems technologies, particularly autonomy. Whether it is a discomfort with having a machine in control of a function previously performed by a human (e.g., driving a vehicle with human passengers), or a mistrust of previously unavailable capabilities, there are reasons why the government could choose to delay the introduction of an unmanned system. There are also bureaucratic impediments that are inherent in the current military structure that are a

challenge for the rapid adoption of unmanned systems.¹⁹ This research assumes the benefit of unmanned systems will outweigh cultural aversions to their use so that policies necessarily must be developed in anticipation of that outcome. Regardless of the speed with which the U.S. military incorporates increasingly sophisticated unmanned systems into its inventory, the widespread availability of these systems means that the United States will likely have to deal with an incident involving such a system that is in use by another country.

The second major assumption is that public revelation of policy provides other countries with an insight into U.S. intent. While unilateral options for U.S. national leaders do not require that policy (or intent) be shared with other countries, the bilateral and multilateral interactions between the United States and countries that the U.S. Government wishes to influence will require public discourse and diplomacy. Because this thesis focuses on the impact of unmanned systems on the convergence of national security and foreign relations, it will address those policies that have been publicly disclosed or implied. The underlying assumption is that unilateral policies exist, but without disclosure, they have limited utility for this research. Several reasons exist for the potential secrecy of certain policies, including the desire to keep capabilities secret and the need to preclude other nations from gaming U.S. procedures.

¹⁹ Brannen, 8-9.

Definition of Terms

To ensure a consistent understanding, it is important to define key terms that will be used repeatedly in this thesis. These terms help clarify the scope of the thesis, and the information desired from the Primary and secondary research questions.

Autonomous: Operations of an unmanned system wherein the unmanned system receives its mission from the human and accomplishes that mission with or without further human-robot interaction.²⁰

Autonomy: An unmanned system's own ability of sensing, perceiving, analyzing, communicating, planning, decision-making, and acting, to achieve its goals as assigned by its human operator(s) through designed human-robot interaction.²¹

Fires: To use available weapons and other systems to create a specific lethal or nonlethal effect on a target. Fires typically produce destructive effects, but various nonlethal ways and means (such as electronic attack) can be employed with little or no associated physical destruction.²²

Joint Fires: Those [fires] delivered during the employment of forces from two or more components in coordinated action to produce desired results in support of a common objective.²³

²⁰ National Institute of Standards and Technology, NIST Special Publication 1011, *Autonomy Levels for Unmanned Systems (ALFUS) Framework, Volume I: Terminology, Version 1.1* (Gaithersburg, MD: National Institute of Standards and Technology, September 2004), 8.

²¹ Ibid.

²² Joint Chiefs of Staff, Joint Publication 3-0, xiv.

²³ Ibid.

Remotely-guided: An unmanned system requiring continuous input for mission performance.²⁴

Unattended System: Any unmanned, mobile/stationary, or active/passive system, with or without power that is designed to not be watched, or lacks accompaniment by a guard, escort, or caretaker.²⁵

Unmanned System: An electro-mechanical system, with no human operator aboard, that is able to exert its power to perform designed missions.²⁶

Scope

While the topic of unmanned systems is broad, the scope of this thesis is specifically centered on the strategic options created by unmanned systems' capabilities for implementing joint fires, and how those options affect the decision-making of U.S. national leaders. Described here are some of the limitations, or a description of what is included in the scope of the study, and the delimitations, or those aspects of the topic that are adjacent to the study but purposefully not included.

Limitations

The use of unmanned systems has been written on extensively, so to maintain focus certain aspects of the topic are considered outside the scope of this thesis. The primary focus of this thesis is the strategic implications of military unmanned systems

²⁴ National Institute of Standards and Technology, NIST Special Publication 1011, 16.

²⁵ Ibid., 20.

²⁶ Ibid.

that implement joint fires on national security and foreign policy. As such, the operational and tactical implementation of existing systems will not be considered except where the information provides background for the strategic context. Similarly, the specifics of technologies that make unmanned systems possible will not be discussed except to provide background on new or expanded capabilities that provide options for national leaders.

This thesis focuses on the use of unmanned systems that implement joint fires (e.g., kinetic strike, electronic attack), and not on the other joint warfighting functions. There are several potential uses for military unmanned systems in areas such as intelligence, surveillance, and reconnaissance, transportation, search and rescue, etc. Each of these could provide a venue for research in their own right.

This thesis will also only address reusable unmanned systems, except where expendable unmanned systems serve as historical examples or analogies. While several unmanned weapons (e.g., Tomahawk cruise missile) have characteristics of the unmanned systems discussed in this thesis, such expendable munitions have been available for decades and their policy implications have been thoroughly reviewed.

Finally, this thesis will primarily address unmanned systems capable of autonomous functions. While there are already operational military unmanned systems performing a multitude of roles that have autonomous functions, few unmanned systems designed to perform joint fires missions are primarily autonomous. This has the potential to change over time, both for the United States and other countries. Any examination of future policy requirements will need to address the use of autonomous systems and responses to them. Examples that will be used to build an understanding of context will

include current systems that have some automated capability (e.g., recovery in case of loss of guidance communications, collision avoidance during travel along preprogrammed routes), but still require a “man-in-the-loop” for critical functions.²⁷

Delimitations

Perhaps the most important delimitation for this thesis is that although moral, ethical, and legal validity will influence policy, they will not be examined. While any future policy will be informed by these topics, this thesis will separate what we can do from what we should do. For the purpose of this thesis, unmanned systems will be considered tools that can be used for policy implementation; the moral, ethical, and legal choices associated with using those tools will be left to future decision-makers.

This thesis is focused on military options for national leaders, so the implementation of unmanned systems for civilian uses will not be considered, even though some civilian issues (e.g., airspace management for unmanned aerial systems) will affect military use of the technologies. As civilian unmanned systems become more commonplace, technologies and procedures will naturally migrate between the civilian and military domains. Nonetheless, the implementation of joint fires missions by unmanned systems will largely remain the role of the military.

This thesis will also focus on unmanned systems that are designed to operate within the Earth’s atmosphere (for the purpose of this thesis, at less than 100,000 feet), on the surface, or under the surface of the ocean, and not systems designed to operate in space. These systems could be referred to as endo-atmospheric or terrestrial. While

²⁷ Department of Defense, *Unmanned Systems Integrated Roadmap 2013-2038*, 16.

space-based systems are typically unmanned, their capabilities and the accompanying strategic implications have been studied for over half a century. While there are areas of space policy that still need to be developed, the policies governing the use of weapons in space have been well documented.

Conclusion

The U.S. Government will need to establish policies that guide national-level decision-making on the use of current and future military unmanned systems used to implement joint fires. These systems will provide national leaders with options they did not have in the past, but will also stir debate as to how and when they should be used. By identifying which policies need to be developed (but not making a judgment on what the policy should be); this thesis will help policymakers establish a roadmap to guide the use (as opposed to only the development) of military unmanned systems.

CHAPTER 2

LITERATURE REVIEW

The purpose of this literature review is to provide an overview of the publicly available, unclassified sources that deal with the issue of policies for unmanned systems that are capable of implementing joint fires missions. The intent is to identify the current thinking on the topic in order to demonstrate how the analysis in this thesis contributes to the field. In order to do so, this literature review examines the secondary sources that provide commentary or analysis on U.S. Government public documents and statements made by national leaders. Analysis of those primary sources will take place in chapter 4 using the three-phased research methodology described in chapter 3.

The topic of unmanned systems has been popular in recent years, so there is no shortage of materials dealing with the issue. However, for the purpose of this thesis it is important to narrow the scope of materials significantly to focus on the issue of policy for the use of unmanned systems. Unfortunately, relatively few sources deal with the policy issue alone, so it is necessary to glean pieces of relevant information from documents that cover the topic of unmanned systems more generally.

The materials associated with the topic of this thesis can be viewed as a Venn diagram that graduate from the general to the specific, as shown in figure 1. First, there are materials on unmanned systems, or even more generally, robotics. These materials are important to review because of the introduction of useful terminology (e.g., levels of autonomy) and the development of enabling technologies. Second, there are materials that deal with military unmanned systems. These systems could support any of the Joint Warfighting Functions (i.e., command and control, intelligence, fires, movement and

maneuver, protection, and sustainment).²⁸ Because of the proliferation of civilian uses of unmanned systems, a great deal of information is being published with views on how the integration of unmanned systems into everyday life should proceed. In some cases, there is an overlap between civilian and military use of unmanned systems, such as the integration of unmanned systems into the National Airspace or the use of the same unmanned platform by military and civilian organizations (e.g., MQ-9 Predator B used by the U.S. Air Force and the U.S. Customs and Border Protection).²⁹

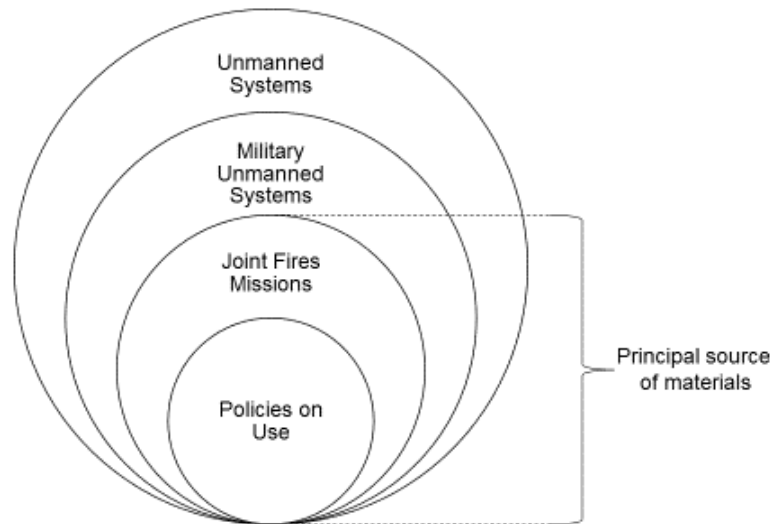


Figure 1. Principle Source of Materials

Source: Created by author.

²⁸ Joint Chiefs of Staff, Joint Publication 3-0, xiv.

²⁹ U.S. Customs and Border Protection, “Unmanned Aircraft System MQ-9 Predator B Fact Sheet,” U.S. Department of Homeland Security, February 6, 2014, accessed April 22, 2015, <http://www.cbp.gov/document/fact-sheets/unmanned-aircraft-system-mq-9-predator-b-fact-sheet>.

Third, there are military unmanned systems that are capable of implementing joint fires missions (typically those that are armed with kinetic munitions or have electronic warfare capabilities). Because these systems have become associated with the issue of targeting of high-value individuals in counter-terrorism operations, a great deal of commentary is available; in some cases, unmanned systems are only tangentially referenced. This is typically the first level at which policy for the use of unmanned systems is addressed, and is the principal source of materials for the literature used in this thesis. Fourth, a select few materials specifically examine the policy for use of unmanned systems that can implement joint fires missions. These are the most closely related to the analysis in this thesis, but as will be shown, there are limitations to the scope of the policies these materials consider.

This literature review examines the most influential resources used in the creation of this thesis from the final two levels of specificity described previously. First, it examines significant literature that has shaped the overall discussion on unmanned systems that implement joint fires missions. Next, it delves into some of the significant media critiques on existing unmanned systems policies. Finally, it examines significant pieces of analysis done by government research institutions and academia. While all of the materials that shaped the creation of this thesis are included in the bibliography, only a representative sample of the most influential is included in this literature review.

Significant Literature for Understanding Issues Related to Unmanned Systems

The first set of significant literature is the materials that enable a broad understanding of unmanned systems capable of performing joint fires missions. These

include materials from a variety of sources (e.g., books, periodicals, and reports) that attempt to give a background on the emergence of unmanned systems, important technologies that allowed for that emergence, and how unmanned systems have been employed. Because of the use of unmanned systems to enact effects on targets, this literature often also discusses the ethical and moral implications of the use of unmanned systems.

The first of these is Peter W. Singer's *Wired for War: The Robotics Revolution and Conflict in the 21st Century*.³⁰ Singer, a Senior Fellow at the New America Foundation and former Director of the Center for 21st Century Security and Intelligence at the Brookings Institution, examines the history of robotics that is leading to the "unmanning of warfare."³¹ He includes in this examination his views on the impact unmanned systems will have on the economics and ethics of war. These issues translate to laws, and the policies (such as those examined in this thesis) the U.S. Government must put in place to deal with the consequences. The book approaches these issues through the participants involved in the creation, development, fielding, and operational use of unmanned systems. Providing a broad overview of the topic, Singer introduces important concepts such as the "Three Ds: dull, dirty, or dangerous" (those roles in which unmanned systems are particularly attractive) that help provide the popular lexicon for describing unmanned systems.³² In the context of U.S. foreign relations, Singer notes the

³⁰ Peter W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (New York, NY: The Penguin Press, 2009).

³¹ Peter W. Singer, "Wired for War," accessed April 27, 2015, <http://wiredwar.pwsinger.com/>.

³² Singer, *Wired for War*, 63.

message the use of unmanned systems sends to other countries can be very different from the use of traditional manned systems; therefore, unmanned systems might not provide the same effect as the systems they were designed to replace.³³

Another important overview of issues related to the use of armed unmanned systems is M. Shane Riza's *Killing Without Heart: Limits on Robotic Warfare in an Age of Persistent Conflict*.³⁴ Written by a former fighter pilot, the book focuses on the ethical, moral, and legal sides of unmanned systems. While this thesis does not attempt to determine what ethical and moral implications should exist for policies on unmanned systems that implement joint fires missions, it is important to understand the debate and recognize that future policymakers will necessarily have to address these aspects of unmanned systems, and the politics that go with them. The author provides an overview of existing military unmanned systems, and examines the DOD's roadmap for unmanned systems development. Riza also addresses how theories such as *jus bellum iustum* (Just War) could apply to unmanned systems.³⁵ In particular, the idea of *jus in bello*, or the right conduct in war, is increasingly a consideration when unmanned systems can be used against an adversary without a similar capability, an idea that is brought up in many pieces of literature on the subject.

³³ Amy Goodman and Peter W. Singer, "Wired for War: The Robotics Revolution and Conflict in the 21st Century" (book discussion on *Wired for War*, C-SPAN, February 6, 2009), accessed April 27, 2015, http://www.democracynow.org/2009/2/6/wired_for_war_the_robotics_revolution.

³⁴ Riza.

³⁵ *Ibid.*, 126.

To understand what technologies and capabilities are coming available for unmanned systems, the DOD Defense Science Board's *Task Force Report: The Role of Autonomy in DOD Systems* examines "relevant technology, ongoing research, and the current autonomy-relevant plans of the Military Services."³⁶ This gives an indication of what technologies are being pursued, for what purpose, and what capabilities those technologies could ultimately provide to decision makers. The report also observes that defined levels of autonomy may not be helpful because they confuse the "allocation of cognitive functions and responsibilities between the human and computer" and that "these allocations may vary by mission phase as well as echelon."³⁷

An example of a report that provides an understanding, at least in one domain, of unmanned systems' missions, components, and DOD plans is the Congressional Budget Office's *A CBO Study: Policy Options for Unmanned Aircraft Systems*.³⁸ This report provides insight into how the U.S. Government views the different mission sets for unmanned systems, and the advantages and disadvantages of using unmanned platforms for these missions. It also gives a clear indication of which systems and technologies the U.S. military is investing in during the coming decade, which informs which capabilities will be available and which ones are desired. Similarly, the Congressional Research Service report *U.S. Unmanned Aerial Systems* includes unmanned systems missions,

³⁶ Department of Defense, Defense Science Board, *Task Force Report: The Role of Autonomy in DOD Systems* (Washington, DC: Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, July, 2012), 1.

³⁷ *Ibid.*, 23.

³⁸ U.S. Congress, Congressional Budget Office, *A CBO Study: Policy Options for Unmanned Aircraft Systems* (Washington, DC: Government Printing Office, June 2011).

development, management issues, and investment priorities.³⁹ It also discusses capabilities provided by unmanned systems that make them desirable for the military such as reduced risk to the warfighter and decreased reaction time for surgical strike.⁴⁰

Media Commentary on Existing Policies for Unmanned Systems

Having established a baseline level of understanding of unmanned systems capable of performing joint fires missions through literature such as those described previously, the next principal source of materials for this thesis is publicly available commentary on existing policies for unmanned systems. This set of materials includes examination by experts on unmanned systems, periodicals and web sites dedicated to defense issues, and national and international periodicals that generally cover issues open to national discourse.

Recently developed White House policies on unmanned systems are primarily focused on armed unmanned systems used to conduct counterterrorism strikes. This is just one capability of unmanned systems, but the one that draws the most immediate public scrutiny. These policies are indicators of how wider issues on the use of unmanned systems could be dealt with at the national level, and will likely be the basis for future policy development.

An example of a national publication attempting to address this issue is *The New York Times* article, “Election Spurred a Move to Codify U.S. Drone Policy,” which

³⁹ Jeremiah Gertler, Congressional Research Service Report for Congress R42136, *U.S. Unmanned Aerial Systems* (Washington, DC: Library of Congress, January 3, 2012).

⁴⁰ *Ibid.*, 3.

suggests that the Obama Administration set “explicit rules for the targeted killing of terrorists by unmanned drones, so that a new president would inherit clear standards and procedures.”⁴¹ The article also notes that this “drone policy” is “setting a legal and ethical precedent for other countries developing armed drones;” in other words, the policy is establishing behavior for other countries.⁴²

In “The Great Drone Debate,” George Washington University professor Amitai Etzioni describes the policy in place for the use of “drone strikes,” and the meticulous steps that are taken to ensure the correct target is being engaged and collateral damage is being minimized.⁴³ He also describes the carefully scripted methods for seeking approval for the use of unmanned systems implementing kinetic strikes, and the Congressional oversight that is required. The examples he provides are useful in understanding how a policy for unmanned systems that implement joint fires can be put in place that is independent of the ethical and moral considerations for using the system; if the decision is reached to use the system, then the policy guides how the system will be used.

Another recently released policy that has invited significant commentary is the Department of State’s “U.S. Export Policy for Military Unmanned Aerial Systems.”⁴⁴ For example, Micah Zenko’s “The Great Drone Contradiction” in *Foreign Policy* describes

⁴¹ Shane, 1.

⁴² *Ibid.*, 2.

⁴³ Amitai Etzioni, “The Great Drone Debate,” *Military Review* (March-April 2013): 2-12.

⁴⁴ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems,” February 17, 2015, accessed April 4, 2015, <http://www.state.gov/r/pa/prs/ps/2015/02/237541.htm>.

the disagreement between those who believe the Missile Technology Control Regime should be the framework for the export of armed unmanned aerial systems (primarily personnel from the Department of State), and those (primarily from the DOD) who want to use exports of these systems to build partner capacity.⁴⁵ While the new policy generally adheres to the Missile Technology Control Regime, it allows for exceptions. These exceptions are based on adherence to four principles the United States has elucidated for export justification; while Zenko does not delve into the implications of these principles, they will provide insight into the U.S. view of how other nations should use unmanned systems, which is discussed in chapter 4.

In “Every Country Will Have Armed Drones Within 10 Years” published in *Defense One*, Patrick Tucker discusses the same relative merits of armed unmanned system proliferation or denial.⁴⁶ As context, he provides background on the indigenous programs being undertaken around the world. He also takes the arguments a step further into the potential for proliferation of autonomous unmanned systems (rather than the automated or remotely-piloted systems being used today).

The DOD has developed and continues to revise its *Unmanned Systems Integrated Roadmap FY2013-2038* documents in an effort to coordinate the evolution of unmanned systems across the military services. Much of what the DOD has produced on the topic is meant to establish how these systems will be integrated into military doctrine, organizations, etc., but it also provides insight into current and future capabilities that will

⁴⁵ Micah Zenko, “The Great Drone Contradiction,” *Foreign Policy*, February 19, 2015, accessed April 4, 2015, <http://foreignpolicy.com/2015/02/19/the-great-drone-contradiction-unmanned-aircraft-systems/>.

⁴⁶ Tucker.

need to be dealt with from a national policy perspective. Several articles and reports include a cursory review of the DOD plans for unmanned systems, and provide critiques of the technologies, systems, and operating concepts being explored. One such article is George Galdorisi's "The Dark Side of Unmanned Systems Autonomy" published on the Defense Media Network.⁴⁷

Research Institutes and Academic Publications on Unmanned Systems Policies

Several government and private sector organizations have also provided perspectives on the integration of unmanned systems into the military. While articles on unmanned systems are widely produced by the media, the reports from research and academic institutions tend to consolidate these snapshots-in-time into coherent reviews of the topic. These institutions include government agencies with an interest in the acquisition and use of unmanned systems, such as the Congressional Budget Office and the Congressional Research Service. It also includes private sector think tanks such as the Brookings Institution and the Rand Corporation. Academics, including faculty and students at the Service Colleges, have also written on the influence unmanned systems will have on the military and on the policies of the U.S. Government. In addition, several defense-focused private organizations produce periodicals (e.g., IHS Jane's Unmanned Maritime Vehicles, Association of Unmanned Vehicle Systems International's *Unmanned Systems Magazine*) about the evolution of unmanned systems, including policies associated with them.

⁴⁷ George Galdorisi, "The Dark Side of Unmanned Systems Autonomy," *Defense Media Network*, November 21, 2013, accessed April 27, 2015, <http://www.defensemedianetwork.com/stories/the-dark-side-of-unmanned-systems-autonomy/>.

A think tank report that provides a broad review of unmanned systems, including potential policy implications, is Samuel Brannen's *Sustaining the U.S. Lead in Unmanned Systems: Military and Homeland Considerations through 2025*.⁴⁸ Published by the Center for Strategic and International Studies, a respected think tank that is generally considered centrist, the report examines how unmanned systems have been perceived in the public, key enabling technologies for the next decade, potential military operational applications for the next decade, ground and maritime use of unmanned systems, and export controls for unmanned systems.⁴⁹ This report is one of the few that highlights the potential for proliferation of armed unmanned systems to affect U.S. foreign policy because "Regardless of U.S. export policies, unmanned systems are . . . likely to further complicate the international security environment and U.S. interests worldwide across the spectrum of operations."⁵⁰ It also recommends priority intelligence collection on other countries' "development of new roles and missions, and concepts of operation for the technology" because of their desire to seek an asymmetric advantage over the United States.⁵¹

The article "CNAS: Key Questions Remain in Unmanned Systems Realm" published by the U.S. Naval Institute explores unanswered questions about unmanned

⁴⁸ Brannen.

⁴⁹ Danielle Kurtzleben, "Think Tank Employees Tend to Support Democrats," *U.S. News and World Report*, March 3, 2011, accessed April 27, 2015, <http://www.usnews.com/news/articles/2011/03/03/think-tank-employees-tend-to-support-democrats>.

⁵⁰ Brannen, 2.

⁵¹ *Ibid.*, 16.

systems that could be viewed as future policy issues to be addressed.⁵² Some of the questions brought up include an adversary's use of unmanned systems, the decision to employ in human-computer interaction, when it is cost effective to use manned versus unmanned systems, and the suitability of unmanned systems for various mission sets.

A Service College article that provides insight into some of the potential policy issues of unmanned combat aerial vehicles (UCAVs), a subset of the unmanned systems discussed in this thesis, is "UCAVs—Technological, Policy, and Operational Challenges" by Charles L. Barry and Elihu Zimet in *Defense Horizons*, which is published by the Center for Technology and National Security Policy at the National Defense University.⁵³ Although written in 2001, the issues they identify are still relevant, which shows the slow rate of policy adoption on this issue as a whole. Specifically, they address the issue of how to categorize UCAVs in arms control treaties, and the related policies for sharing unmanned systems technologies with allies.⁵⁴ In addition, they address the issue of levels of autonomy desirable for unmanned systems with the capability to perform kinetic strikes, and cultural biases that could inhibit a systematic adoption of unmanned systems capabilities.⁵⁵ While the majority of the article deals with UCAV technologies and operational concepts, addressing some of the potential policy challenges related to

⁵² John Grady, "CNAS: Key Questions Remain in Unmanned Systems Realm," *USNI News*, June 12, 2014, accessed April 27, 2015, <http://news.usni.org/2014/06/12/cnas-key-questions-remain-unmanned-systems-realm>.

⁵³ Charles L. Barry and Elihu Zimet, "UCAVs—Technological, Policy, and Operational Challenges," *Defense Horizons*, no. 3 (October 2001), accessed May 19, 2015, www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA422553.

⁵⁴ *Ibid.*, 6.

⁵⁵ *Ibid.*, 2.

UCAVs provides insight into policy issues associated with all unmanned systems capable of performing joint fires missions.

Common Themes in Existing Literature

In reviewing these materials, a few common themes emerge. The first is the conflation of unmanned systems capabilities with their intended uses. The second is current unmanned system capabilities represent an expansion of existing manned platform capabilities, not entirely new capabilities. The third is much of the discussion taking place today deals with the technology and capabilities of unmanned systems, and not the implications of their use. The fourth is although unmanned ground and naval platforms have made significant advances in recent years, most literature deals with unmanned aerial systems.

Many of the materials that discuss armed unmanned systems, especially in the popular media, combine the capabilities that are expanded by unmanned systems and the effects the U.S. Government seeks to achieve with them.⁵⁶ This conflation exists not only in the secondary sources that are examining U.S. Government documents, but even in the primary sources themselves. For example, H.R.466, which has been referred to both the House Armed Services and House Intelligence committees, seeks to “prohibit the Central Intelligence Agency from using an unmanned aerial vehicle to carry out a weapons strike or other deliberately lethal action.”⁵⁷ In this instance, Congress is attempting to eliminate

⁵⁶ Brannen, 4.

⁵⁷ U.S. Congress, House, Committee on Intelligence, “To prohibit the Central Intelligence Agency from using an unmanned aerial vehicle to carry out a weapons strike or other deliberately lethal action and to transfer the authority to conduct such strikes or

the potential for creating an effect; however, they are doing so by addressing only one system that is capable of producing that effect. For example, targeting of high-value individuals can be conducted by unmanned systems, but it could also be conducted by manned aircraft, special operations forces, etc. Much of the controversy surrounding the Obama Administration’s “drone policy” has little to do with unmanned systems; they are simply the tools that are being used to execute a policy.⁵⁸

One area where the discussion on military unmanned systems seems to lag civilian use is that current unmanned capabilities are represented as an expansion of existing manned platform capabilities, and not new capabilities.⁵⁹ In essence, the unmanned systems DOD is introducing are seen as replacements for manned missions, when the possibility exists for new missions altogether. While organizations such as the Defense Advanced Research Projects Agency (DARPA) are experimenting with innovative new ways to apply unmanned systems, DOD seems to be slower in moving such non-traditional programs beyond Milestone B (Program Initiation) in the Defense Acquisition System pipeline.⁶⁰ Recent changes, such as the Navy’s creation of a Deputy

lethal action to the Department of Defense,” 114th Cong., H.R. 466, January 22, 2015, accessed April 22, 2015, <http://thomas.loc.gov/cgi-bin/query/z?c114:H.R.466>.

⁵⁸ Brannen, 4.

⁵⁹ Micah Zenko, “10 Things You Didn’t Know About Drones,” *Foreign Policy*, February 27, 2012, accessed April 27, 2015, <http://foreignpolicy.com/2012/02/27/10-things-you-didnt-know-about-drones/>.

⁶⁰ Defense Acquisition University, “Acquisition Framework,” *Defense Acquisition Guidebook (DAG)* (Fort Belvoir, VA: Defense Acquisition University, June 28, 2013), accessed April 24, 2015, <https://dag.dau.mil/Pages/acqframework.aspx>.

Assistant Secretary of the Navy for Unmanned Systems, may change this institutional inertia.⁶¹

In examining the emerging capabilities of unmanned systems, a majority of the literature is focused on the novel technologies being introduced, and not on the implications of their use. As an example, the recent successful demonstration of unmanned refueling by the X-47B program garnered headlines for the first time the integration of such technologies was demonstrated.⁶² Some literature went a step further to discuss the expanded on-station capabilities that could be made possible by such technologies. However, very few addressed the implications on options for decision-makers that the expanded on-station times provide.

The final trend observed in existing literature is the emphasis on unmanned aerial systems. This is understandable given aerial systems have been operationally employed in a wide variety of instances, and are highly visible to the public. However, many of the issues pertaining to unmanned systems apply across the air, surface, and subsurface domains. In some regards, because the use of unmanned aerial systems is well documented and has been open to public debate for many years, the policy implications of emerging areas such as unmanned ground, surface, or underwater systems could cause unforeseen foreign relations issues for the U.S. Government. While these systems

⁶¹ Sydney J. Freedberg, Jr., "Secretary Of Drones: Mabus Creates DASD For Unmanned," *Breaking Defense*, April 15, 2015, accessed April 22, 2015, <http://breakingdefense.com/2015/04/secretary-of-drones-secnav-mabus-creates-deputy-asst-sec-for-unmanned/>.

⁶² Naval Air Systems Command, "X-47B First to Complete Autonomous Aerial Refueling," U.S. Navy, April 22, 2015, accessed April 24, 2015, http://www.navy.mil/submit/display.asp?story_id=86710.

currently may not be as mature or sophisticated as some unmanned aerial systems, they are already being employed in greater numbers. For example, during the height of U.S. involvement in Iraq, there was approximately the same number of unmanned ground systems of various types in use by the military there as the number of tanks the British had at the end of World War I (another emerging technology of the time).⁶³ A Center for Strategic and International Studies International Security Program Report stated, “The most significant advances or changes to existing force structure involving substitution of unmanned systems in the near term will likely come on the ground, at sea, and undersea.”⁶⁴

Significance of Thesis in Relation to Existing Literature

Upon review of the existing literature on the topic, it becomes clear that this thesis adds to the body of knowledge in a few important ways. The first is the use of historical analogies to provide future policymakers with examples of issues that were encountered with other weapon systems that also influenced U.S. foreign relations, and how those issues were dealt with. The second is the incorporation of recent U.S. Government guidance on the export of armed unmanned aerial systems and the implications on how the U.S. Government views appropriate use of these systems by other countries.⁶⁵ The third is the incorporation of a dual-sided view of policies for the use of unmanned

⁶³ Singer, *Wired for War*, 210.

⁶⁴ Brannen, 11.

⁶⁵ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems.”

systems to determine whether they consider both use by the United States and U.S. views on (or response to) use by other countries.

CHAPTER 3

RESEARCH METHODOLOGY

Because the fundamental analysis being conducted in this thesis is interpretive, the approach being used is qualitative research.⁶⁶ As the policymaking process is an ongoing endeavor, the results for this thesis are being extrapolated from a snapshot in time. Therefore, there can be no objective truth to an analysis of the topic, but rather the thesis represents a careful reflection of what conclusions can realistically be drawn from the findings.

The approach to devising a research methodology for this thesis is to systematically address the secondary, and ultimately the primary, research questions described in chapter 1. In order to address these questions, the research methodology is divided into three phases: (1) identification of current and near-future unmanned systems capabilities that could require policy guidance; (2) review of existing unmanned systems policies; and (3) comparison of policy requirements to historical analogies. The three phases are qualitative in nature, but will rely on a systematic framework to ensure a collectively exhaustive review of the topic.

Phase 1: Identification of Capabilities that could Require Policy Guidance

The first phase in the research methodology consists of two steps. The first step is the identification of current and near-future unmanned systems capabilities that could

⁶⁶ Martin Davies and Nathan Hughes, *Doing a Successful Research Project: Using Qualitative or Quantitative Methods*, 2nd ed. (New York, New York: Palgrave Macmillan, 2014), 8.

require policy guidance. These capabilities are derived from the existing DOD *Unmanned Systems Integrated Roadmap* and other public sources that outline programs and technologies that have been funded. This phase of the thesis will not attempt to interpret what technologies could become available, but rather it will examine the technological capabilities in which the U.S. has stated it will invest. The difference is only those technologies that receive near-term funding will be viable in providing capabilities to national decision makers. While organizations such as the Defense Advanced Research Projects Agency and the Office of Naval Research have numerous unmanned systems-related projects in their portfolios, the transition from research and development to an operational capability is typically done through planned procurement by DOD. The capabilities identified in this first step are those capabilities that are either unique to unmanned systems, or greatly enhanced by unmanned platforms. Otherwise, the capabilities would not translate to new options for national decision makers.

The second step in the first phase is to identify policies that are needed based on capabilities identified in the first step. A new or enhanced capability could produce multiple questions that need to be addressed, though the answers to those questions could be amalgamated into a small number of policy documents. This step is addressed by analysis of the new or enhanced capabilities, and through iterative feedback from the historical analogies uncovered in Phase 3.

Phase 2: Review of Existing, Publicly-Declared Unmanned Systems Policies

The second phase in the research methodology also consists of two steps. The first step is a review of existing unmanned systems policies, which examines official U.S.

Government policies that have been published or publicly espoused. This includes released public documents and for-the-record comments by national leadership. Much of the public guidance that exists addresses multiple issues that were identified in the first phase of research. In many instances, the issues may not be directly addressed, but are alluded to. The U.S. Government organizations and individuals whose documents and comments are targeted for research are identified through a study of the responsibilities for establishing policies and guidance for the acquisition, sale, and operation of military unmanned systems that perform joint fires missions.

The second step in the second phase is to compare those areas that were identified in Phase 1 as needing to be addressed with the policies and guidance identified through research in Phase 2. The results are those policy areas that have yet to be developed (or are not easily identifiable to the public).

Phase 3: Comparison of Policy Requirements to Historical Analogies

The third phase in the research methodology uses historical analogies to provide insight into how unmanned systems policies could be developed. Technologies such as satellites and mines have already gone through a similar public discourse, and provide examples of what does and does not work with respect to technology policy development. The result of this research is also fed back into the analysis conducted in Phase 1 to ensure past lessons are incorporated.

Figure 2 provides a graphical representation of the three phases of the research methodology. The feedback of the potential issues encountered during research on historical analogies is depicted at the bottom of the diagram. The goal is to provide future

policymakers with a starting point when contemplating which issues need to be addressed in publicly-declared statements.



Figure 2. Three-phase Research Methodology

Source: Created by author.

The Three-phase Research Methodology
Addresses the Research Questions

The purpose of the three-phase research methodology is to provide answers to the secondary research questions that contribute to an understanding of the primary research question. Each phase of the research methodology has been designed to address one or more of the research questions.

The first secondary research question, What capabilities do current and near-future unmanned systems have that have not been available to national leaders in the past? is addressed by Phase 1, Step 1. In researching the capabilities (and associated

technologies) that the U.S. Government is investing in, it is possible to gain an understanding of whether the capability is being pursued because it is entirely new, an extension of an existing capability, or simply a replacement for an existing capability for reasons such as reduced costs. Capabilities in the first category, and significant cases of capabilities in the second category, are the most likely candidates for providing new options to national decision makers that were not available before.

The second secondary research question, What are the effects of unmanned systems capabilities on U.S. foreign policy efforts? is addressed by Phase 1, Step 2. By examining the implications of new capabilities, it is possible to gain insight into how those implications affect U.S. interactions with other nations. New military capabilities available to U.S. decision makers can change the stance of either side when it comes to agreements between countries.

The third secondary research question, What publicly-stated national-level policies exist for the military use of unmanned systems? is directly addressed by Phase 2, Step 1. By systematically understanding which U.S. Government organizations have the authority to provide guidance on the acquisition, sale, and operations of military unmanned systems capable of conducting joint fires missions, it is possible to review the public documents and the texts of speeches from leadership of those organizations.

The fourth secondary research question, What publicly-stated national policies exist as a result of other countries developing unmanned systems capable of performing joint fires missions? is also addressed by Phase 2, Step 1. The fundamental capabilities that the United States is developing for unmanned systems will likely be mirrored by other nations. By understanding the implications of unmanned systems capabilities, it is

possible to project how the United States might have to deal with those same capabilities in the hands of another country, whether ally or adversary. While researching where the U.S. Government has publicly addressed a certain unmanned systems capability, it is possible to determine whether the public statement applies only to U.S. actions or implies how the United States wants other nations to act.

The fifth secondary research question, What other historical weapon systems could serve as analogies for development of policies for new military capabilities? is directly addressed by Phase 3. Using case examples of systems, such as mines and nuclear weapons, that have had an impact on U.S. relations with other countries (e.g., have prompted the development of agreements or treaties) helps ensure a more robust assessment of the implications of new unmanned systems capabilities.

The primary research question, What national policies need to be developed to guide U.S. leaders in their use of military unmanned systems that implement joint fires? is addressed by Phase 2, Step 2, and supported by Phase 3. Examining the gap between guidance that should exist and guidance that does exist provides the basis for recommending where policy needs to be developed. Providing historical case examples of other systems can provide insight into what issues will need to be addressed as the policy is developed.

Further Considerations

One important note on research for this thesis is that only unclassified sources are considered. There are two reasons for this limitation on sources. First, as described in chapter 1, the public statement of guidance and policy allows the information to be readily available to all countries with which the United States might have dealings. In

doing so, policy on a military capability (i.e., military unmanned systems capable of performing joint fires missions) becomes a tool for foreign relations. While some countries will certainly gain access to even classified U.S. policies, it must be assumed that only unclassified, publicly released documents are intended to serve as a signal of intent from the U.S. Government. Second, it is to ensure that the thesis can be widely shared for review and dissemination. Given the volume of unclassified research materials available, this should not limit the insights gained from the thesis.

There is a fundamental hypothesis in this thesis that policy gaps for military unmanned systems that implement joint fires missions exist, and that these gaps will need to be addressed with publicly stated guidance. When addressing this hypothesis, this thesis strives to consider all data to ensure a confirmation bias does not exist.⁶⁷ The qualitative process of testing ultimately cannot positively confirm the existence of gaps, but can confirm the existence of guidance to match anticipated needs. Where gaps are suspected to exist, the best evidence that can be provided is the absence of publicly-stated guidance from readily available channels. A clear message of intent from the U.S. Government as to how it expects to act (or expects others to act) should not be difficult to discern or to find.

⁶⁷ William Hakes and Jennifer Priestley, “Problem Solving and Psychological Traps,” in *Smart Choices. A Practical Guide to Making Better Decisions*, eds. John S. Hammond, Ralph L. Keeney, and Howard Raiffa (Cambridge, MA: Harvard University Press, 1999), 3, accessed May 19, 2015, <https://analytics.kennesaw.edu/~jpriestl/PubPapers/Problem%20Solving%20and%20Psychological%20Traps.pdf>.

CHAPTER 4

ANALYSIS

Having established a baseline understanding of the technologies, operations, moral, ethical, and legal issues, and policies surrounding military unmanned systems that are capable of implementing joint fires missions through a thorough literature review of those secondary sources that provide commentary and analysis on the subject, it is now time to implement the three-phase research methodology described in chapter 3 to seek potential answers to the primary and secondary research questions. To do so, it is necessary to identify and review the primary sources, both documented and verbal policy positions, which constitute the U.S. Government's stance on unmanned systems. As issues are identified, reviewing the history of weapons systems that also had an influence on U.S. foreign relations provides additional insights for future policymakers that are addressing unmanned systems.

This chapter is organized using the three-phase research methodology, and begins with a review of documents that identify DOD's funded research priorities as indicators of desired capabilities. Having identified new or greatly expanded capabilities of unmanned systems that could provide national decision-makers with additional options, it will then examine the primary policy sources and subsequently describe how they address the capabilities of unmanned systems; where gaps exist, these are also identified. Finally, this analysis considers several case examples of weapons systems, and issues those systems faced that are similar to issues faced by unmanned systems today. Where available, insights are drawn from the approach used to integrate those historical weapons systems into the U.S. inventory.

Phase 1-1: DOD Research Priorities as Indicators
of Near-future Capabilities

DOD has numerous organizations developing technologies and concepts for unmanned systems. In order to attempt to organize these efforts into a coherent approach, DOD produced and continues to revise an *Unmanned Systems Integrated Roadmap*, the latest covering 2013-2038.⁶⁸ A few of the sections in the latest version of the document are instrumental in providing an understanding of capabilities of unmanned systems that are being sought by DOD. Included among these are the sections on Strategic Planning and Policy, which describes the “structure, direction, and established guidance from DOD leadership toward planning and developing unmanned systems;” Capability Needs, which outlines the desire to “achieve improved efficiency, effectiveness, and survivability and to reduce the burden on manpower;” Technologies, which describes some of the key enabling technologies associated with capabilities; and International Cooperation, which “reflects DOD’s efforts to include cooperative research, development, test and evaluation, and regulatory/standard agreements of defense technologies and systems with foreign partners” (which gives an indication of expected behavior for other nations participating in DOD-sponsored unmanned programs).⁶⁹

Within DOD, there are funded research initiatives that go beyond some of the evolutionary development concepts outlined in the *Unmanned Systems Integrated Roadmap*. For example, DARPA, in the maritime domain is developing “an unmanned maritime surface vessel optimized to continuously and overtly trail threat submarines;

⁶⁸ Department of Defense, *Unmanned Systems Integrated Roadmap: FY2013-2038*.

⁶⁹ *Ibid.*, vi-vii.

unmanned undersea platforms for scalable operations; and novel technologies to enable take-off and landing of long-endurance un-manned aerial vehicles aboard smaller ships.”⁷⁰ However, funding for many of these initiatives will likely be terminated before they become a Milestone B program. Paul Scharre, director of the 20YY Warfare Initiative at the Center for a New American Security, stated, “there’s great stuff going on at places like the Office of Naval Research and DARPA, [but] crossing the valley of death into a program of record is pretty challenging.”⁷¹ Even some of the more promising technologies associated with unmanned systems are treated as interesting science fair projects and may not have a clearly defined path to becoming a production program. For example, the U.S. Navy recently announced its decision to decommission the two X-47B prototypes that have demonstrated the ability to launch and recover from an aircraft carrier and to perform air-to-air refueling, despite having already spent \$1.5 billion on the Unmanned Combat Air System Demonstration program and the prototypes still having eighty percent of the flight hours available on their airframes; the follow-on Unmanned Carrier-Launched Airborne Surveillance and Strike technology demonstrator program is not expected to have a flying aircraft prior to fiscal year 2020.⁷²

⁷⁰ Defense Advanced Research Projects Agency, *Breakthrough Technologies for National Security* (Arlington, VA: Defense Advanced Research Projects Agency, March 2015), 5-6, accessed April 9, 2015, <http://go.usa.gov/3rut4>.

⁷¹ Sydney J. Freedberg, Jr., “China’s (Not So Scary) Drone Army,” *Breaking Defense*, May 11, 2015, accessed May 12, 2015, <http://breakingdefense.com/2015/05/chinas-not-so-scary-drone-army/>.

⁷² Robert Martinage and Shawn Brimley, “The Navy’s New Museum Drone and Strategic Malpractice,” *War on the Rocks*, April 28, 2015, accessed April 29, 2015, <http://warontherocks.com/2015/04/the-navys-new-museum-drone-and-strategic-malpractice/?singlepage=1>.

Phase 1-2: Addressing New or Greatly Expanded Capabilities of Unmanned Systems

While the various documents outlining DOD's efforts to synchronize the development, production, and operations of unmanned systems provide numerous capabilities of unmanned systems, only a few are new or greatly expanded capabilities that provide options to national decision-makers. Many of the capabilities sought by DOD have more to do with operational and cost efficiencies than expanding the capabilities available to perform missions. However, four capabilities that provide options to decision-makers are consistently referenced in the DOD primary sources. These are the ability to execute joint fires missions while greatly limiting the exposure of humans to hostile fire, the ability to provide pre-defined autonomous engagement criteria, greatly expanding (to potentially indefinite) on-station times, and the ability to provide highly precise targeting of effects, both kinetic and non-kinetic.

The first capability that is greatly expanded by unmanned systems is the ability to execute a joint fires mission while limiting the exposure of humans to hostile fire. This includes the ability to not only limit the exposure of personnel directly involved in conducting the effect (e.g., a kinetic strike), but also the supporting personnel that might be required to be in the combat zone (search and rescue, spotting/targeting, etc.). National decision makers have long sought the ability to limit exposure of U.S. personnel, and have had limited means of doing so.

For example, President Clinton's decision in 1998 to use cruise missiles launched from the Red Sea and the Arabian Sea to strike targets in The Sudan and Afghanistan in retaliation for the bombings of the U.S. embassies in Kenya and Tanzania was made because it would allow the administration to achieve a specific effect without engaging

U.S. forces in areas of the world where there was little U.S. presence.⁷³ Unmanned systems of increasing sophistication expand this ability of national decision makers to engage in areas of the world where threats to U.S. personnel are deemed too great, or the U.S. Government does not want to embroil itself in an unpopular ground conflict.

Removing the human from the system may also reduce the repercussions to international relations, though it does not eliminate them completely. For example, in December 2011, the Iranian government displayed a U.S. RQ-170 Sentinel Unmanned Aerial System which they claimed had violated Iranian airspace and that they had brought down intact.⁷⁴ While Iran filed a complaint with the United Nations and threatened retaliation, the limited extent of this international incident is in stark contrast to the global reaction to the 1960 downing of a manned U-2 reconnaissance aircraft over the Soviet Union.⁷⁵

Several policy issues that could affect U.S. foreign relations have been identified by government and non-governmental organizations that have to do with the reduced threat to personnel from the use of unmanned systems. The first is an increased propensity (or perception thereof) to become engaged in situations around the world because the risk of casualties and prolonged troop involvement decreases. The second is a question of the willingness of the United States to recover unmanned systems that are lost

⁷³ Jamie McIntyre and Reuters, "U.S. Missiles Pound Targets in Afghanistan, Sudan," *CNN*, August 20, 1998, accessed May 4, 2015, <http://www.cnn.com/US/9808/20/us.strikes.01/>.

⁷⁴ Hastings.

⁷⁵ Richard P. Schwing, "Unmanned Aerial Vehicles—Revolutionary Tools in War and Peace" (Strategy Research Project, U.S. Army War College, Carlisle Barracks, PA, March 30, 2007), 5.

in hostile territory, and the associated assets and personnel that would be required to do so. The third is how the United States views attacks on its unmanned systems that are operating in contested areas (i.e., is attacking an unmanned system the same as attacking a manned U.S. asset?). Associated with this is a fourth issue of where the combat zone ends for unmanned systems that could be operated from the other side of the globe. The fifth is U.S. rules of engagement with regard to unmanned systems used by other countries (and the perception of an imminent threat from armed unmanned systems).

The second capability that provides options for national decision makers is the increasing ability of unmanned systems to have autonomous functions. What makes this capability powerful, and therefore subject to intense scrutiny, is that the unmanned system is being treated as an “agent” that has the ability to “react to changes in its environment, proactively shape the environment, and socially interact with other agents.”⁷⁶ In the case of military unmanned systems that implement joint fires missions, shaping the environment is achieving specified effects on the adversary. Future unmanned systems will have the ability to execute dull, dirty, and dangerous missions over a long period of time without the need for continuous human interaction or support. These could include missions such as enforcement of no-fly zones or the blockading of ports, which could require an understanding of the environment, the ability to make decisions on how to interact with actors and adversaries in the environment, and execute actions to achieve specific effects. The question will be how willing are U.S. national

⁷⁶ Adam Elkus, “Secret Agent Man: How to Think about Autonomy,” War on the Rocks, May 4, 2015, accessed May 4, 2015, <http://warontherocks.com/2015/05/secret-agent-man-how-to-think-about-autonomy/>.

decision makers to trust a robotic agent to make decisions that include creating effects on an adversary (or in the vicinity of other actors).

An important guiding body for DOD use of autonomous capabilities is the Defense Science Board. Their views on the capabilities generated by autonomy and the operational benefits of incorporating autonomy into unmanned systems of all domains permeate DOD's unmanned systems approach.⁷⁷ Because of these efforts to integrate the science of autonomy with the acquisition process, U.S. public efforts to address autonomy in military systems is ahead of public discourse in most countries.

The primary foreign policy issues associated with autonomy have to do with the culpability of a nation when a weapons system executing an autonomous function violates an international law. This issue applies to U.S. systems, systems developed and used by other countries, or U.S. systems that are used by allied nations. These violations may occur in the course of generating an effect, or during other aspects of the mission profile (e.g., the unmanned system decides that violating the territorial integrity of another nation during peacetime is an efficient course of action in navigating its mission).

The third capability that expands the availability of options for national decision makers is the extended on-station times possible with future unmanned systems. There are inherent limitations on manned systems because of physical human requirements as well as the onset of exhaustion and accompanying lack of concentration. With the development of refueling on-the-move, renewables sources (e.g., solar, wind), or simply long-lasting sources (e.g., electrochemical, radioactive decay), unmanned systems could

⁷⁷ Department of Defense, Defense Science Board, *Task Force Report: The Role of Autonomy in DOD Systems*.

have the ability to remain on mission without pause. This changes the options available when traditional methods would include forward deployment and continual rotation of manned platforms and their associated personnel. It also changes the options for location of deployment of forces; while U.S. forces are currently considered forward deployed to a region if they are within the same area of responsibility, an unmanned system could operate indefinitely just outside of internationally recognized territorial limits.

The primary foreign policy issue with having the ability to leave an unmanned system on-station indefinitely is the opportunity to violate the territorial integrity of another nation or pose a continuous threat to another nation. For example, an unmanned system capable of projecting effects into another country while still remaining outside internationally recognized borders and territorial limits could be considered an imminent threat and hostile act by the country that is threatened. How willing is the United States to station armed unmanned systems in close proximity to a foreign country indefinitely, and conversely, what is the U.S. view on other countries operating armed unmanned systems near the United States or its interests?

The fourth capability that is potentially enhanced by unmanned systems and provides additional options to U.S. decision makers is the ability of unmanned systems to precisely target effects, both kinetic and non-kinetic. Without humans onboard, unmanned systems have reduced restrictions in terms of shape, size, and (as mentioned previously) endurance; these characteristics give unmanned systems the potential for decreased observability that could enable them to enter into close proximity of their intended targets and give them the ability to more precisely target effects. For example, the U.S. Army has been experimenting with integrating the Networked Electronic

Warfare Remotely Operated system on the Gray Eagle Unmanned Aerial System, and is also experimenting with smaller unmanned aerial vehicle jammers.⁷⁸ An unmanned system that is capable of approaching a target more closely can use an electronic attack system that does not require the same amount of power output to achieve the same effect; this in turn means unintended effects (such as collateral damage in the electromagnetic spectrum) associated with those actions could be reduced.

The impact on U.S. foreign relations from the potential for increased precision of effects generated by unmanned systems is, again, the potential increased willingness to use these systems if the perceived risk of collateral damage is decreased. This brings into question the proportionality of military response, both if the unmanned system is being operated by the United States and if the United States is the recipient of an attack by unmanned systems.

Phase 2-1: Analysis of Existing Policies on the Use of Military Unmanned Systems

Having already reviewed the DOD positions on the development, production, and operations of unmanned systems to understand what new or greatly expanded capabilities exist (or will exist in the near-future) for unmanned systems capable of implementing joint fires missions, the next step is to examine the primary sources from the executive and legislative branches of the U.S. Government that provide guidance on how those capabilities should be used, or how the United States should respond when other nations use unmanned systems. In examining the available, unclassified, publicly declared

⁷⁸ Adrienne Moudy, “Army Tests Putting NERO Electronic Warfare Jammer on UAVs,” U.S. Army, July 10, 2014, accessed May 4, 2015, http://www.army.mil/article/129608/Army_tests_putting_NERO_electronic_warfare_jammer_on_UAVs/.

sources from those U.S. Government organizations with the authority to issue guidance on unmanned systems, there are three segments of the U.S. Government that provide guidance that is particularly relevant. The first is the public statements and documents issued by the White House that address the use of unmanned systems in the context of their influence on foreign relations. The second, also within the executive branch, is the Department of State's policy guidance on the export of armed unmanned systems, which includes the implied U.S. Government views on their appropriate use by other countries. The third source is the Congressional hearings that have taken place on armed unmanned systems, and the accompanying proposed legislation that has been written to limit the effects Congress is willing to have unmanned systems produce.

The first set of guidance is the documents and public statements associated with the Obama Administration's drone policy. While details of the policy itself are classified, the White House has released documents and statements that explain the U.S. position on the subject because of continued public scrutiny. As noted in chapter 2, there is conflation in this policy between the use of unmanned systems for targeted kinetic strikes and the legal authorizations required for strikes, especially in cases such as strikes against U.S. citizens abroad. The first issue is at the heart of the research for this thesis; the second falls into the moral, ethical, and legal decisions that must be made before the use of a specific weapon system can be employed.

A primary document that supports the implementation of the drone policy is the "U.S. Policy Standards and Procedures for the Use of Force in Counterterrorism Operations Outside the United States and Areas of Active Hostilities" released by the

White House in 2013.⁷⁹ While it does not mention unmanned systems specifically as a means of implementation, it attempts to address the legal justification for the use of force, which has largely been carried out through the use of armed unmanned aerial systems. Another example of a document associated with the “drone policy” is the White Paper released in 2013 by the U.S. Department of Justice justifying kinetic strikes against U.S. citizens.⁸⁰ Issues such as these, along with the use of armed unmanned aerial systems to perform kinetic “signature strikes” based on suspicious activity, are putting enhanced scrutiny on the way unmanned systems are being used.⁸¹

Perhaps the most clear public declaration of the “drone policy” was President Obama’s 2013 speech at the National Defense University in which he described not only the justification for targeted strikes, but also the benefits of using unmanned systems to conduct those strikes.⁸² The policy the President described was pieced together over several years. *The New York Times* notes that in the run-up to the 2012 Presidential election, the administration accelerated work on the policy “so that a new president

⁷⁹ U.S. President, “U.S. Policy Standards and Procedures for the Use of Force in Counterterrorism Operations Outside the United States and Areas of Active Hostilities,” The White House, Office of the Press Secretary, May 23, 2013, accessed April 29, 2015, https://www.whitehouse.gov/sites/default/files/uploads/2013.05.23_fact_sheet_on_ppg.pdf.

⁸⁰ Alexa Koenig, “Department of Justice ‘White Paper’ Full of Contradictions,” *U.S. News and World Report*, February 6, 2013, accessed May 5, 2015, <http://www.usnews.com/debate-club/has-obama-gone-too-far-with-his-drone-policies/departments-of-justice-white-paper-full-of-contradictions>.

⁸¹ Steve Coll, “The Unblinking Stare,” *New Yorker Magazine*, November 24, 2014, accessed May 5, 2015, <http://www.newyorker.com/magazine/2014/11/24/unblinking-stare>.

⁸² U.S. President, “Remarks by the President at the National Defense University.”

would inherit clear standards and procedures.”⁸³ The importance of this effort for the research in this thesis is not the rules established to justify lethal action, but rather the guidance on the procedures for how to use unmanned systems once the decision to achieve a specific effect (lethal or non-lethal) has been determined. This includes institutionalizing the procedures for the approval of targets and authorization to engage targets.

The next set of documents that provide primary sources on the use of unmanned systems, especially U.S. expectations for the use of armed unmanned aerial systems by other countries, is the Department of State’s “U.S. Export Policy for Military Unmanned Aerial Systems.”⁸⁴ Because of the recognized importance of unmanned systems, this policy was released more than a year after the “U.S. Conventional Arms Transfer Policy” (Presidential Policy Directive 27).⁸⁵ This distinction marks the beginning of an international discourse on the appropriate use of unmanned systems capable of implementing joint fires missions.

The policy sends clear signals as to how the U.S. views the use of armed unmanned aerial systems by other countries. It states “the United States has a responsibility to ensure that sales, transfers, and subsequent use of all U.S.-origin UAS are responsible and consistent with U.S. national security and foreign policy interests,

⁸³ Shane.

⁸⁴ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems.”

⁸⁵ Zenko, “The Great Drone Contradiction.”

including economic security, as well as with U.S. values and international standards.”⁸⁶ In reviewing the policy in *Foreign Policy* magazine, Micah Zenko notes the U.S. “has a unique opportunity and responsibility to not only set precedents for the use of armed drones, but to determine which countries might acquire these systems and hold them accountable for their use.”⁸⁷

Inherent in the U.S. Government’s view on the appropriate use of armed unmanned aerial systems by other countries are four principles that must be met before any transfer can take place.⁸⁸ These principles are as follows: “Recipients are to use these systems in accordance with international law, including international humanitarian law and international human rights law, as applicable; Armed and other advanced UAS are to be used in operations involving the use of force only when there is a lawful basis for use of force under international law, such as national self-defense; Recipients are not to use military UAS to conduct unlawful surveillance or use unlawful force against their domestic populations; and as appropriate, recipients shall provide UAS operators technical and doctrinal training on the use of these systems to reduce the risk of unintended injury or damage.”⁸⁹

The third set of primary sources that indicate the U.S. policy on unmanned systems capable of implementing joint fires missions are the hearings and proposed bills

⁸⁶ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems.”

⁸⁷ Zenko, “The Great Drone Contradiction.”

⁸⁸ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems.”

⁸⁹ Ibid.

that have been introduced by the U.S. Congress, largely in response to the use of armed unmanned aerial systems for counterterrorism strikes by the DOD and the Central Intelligence Agency (CIA). The most notable of these hearings took place before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government Reform in the House of Representatives of the 111th Congress. These hearings, which took place on March 23, 2010 and April 28, 2010, are referred to as the “Rise of the Drones” hearings.⁹⁰

The first hearing, entitled *Unmanned Systems and the Future of War*, examined the “operational, political, and legal questions associated with” unmanned systems.⁹¹ It included unmanned systems, both armed and unarmed, across all physical domains. The hearing included testimony by experts from government, academic, and industry associations, such as: Peter W. Singer, director of the 21st Century Defense Initiative at the Brookings Institution; John Jackson, professor of Unmanned Systems at the U.S. Naval War College; and Michael Fagan, chairman of the Unmanned Aerial Systems Advocacy Committee of the Association for Unmanned Vehicle Systems International.⁹²

The second hearing, entitled *Examining the Legality of Unmanned Targeting*, also

⁹⁰ U.S. Congress, House, *Rise of the Drones: Unmanned Systems and the Future of War, Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government*, Serial No. 111-118, 111th Cong., 2nd sess., March 23, 2010, accessed May 19, 2015, <http://permanent.access.gpo.gov/gpo9194/pt1.pdf>, 1; U.S. Congress, House, *Rise of the Drones II: Legality of Unmanned Targeting, Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government*, Serial No. 111-120, 111th Cong., 2nd sess., April 28, 2010, accessed May 19, 2015, <http://permanent.access.gpo.gov/gpo9194/pt2.pdf>, 1.

⁹¹ U.S. Congress, House, *Rise of the Drones*, 1.

⁹² *Ibid.*

consisted of a series of experts, this time from law schools and judicial institutions.⁹³ The contents of the first hearing were particularly relevant to the research in this thesis, while the contents of the second hearing dealt more with the legal decisions that must be made before unmanned systems can be employed.

Further Congressional hearings on military unmanned systems have been held on the Obama Administration's "drone policy," and the separation of activities between DOD and CIA.⁹⁴ These hearings, while not directly addressing the future use of unmanned systems, do include information on the views of the legislative branch with regard to the use of armed unmanned aerial systems in current conflicts. Examples include the session in April 2013 on the use of "drones for targeted killings," and the March 2013 filibuster of the confirmation of John Brennan for the position of CIA Director.⁹⁵ In part, the issue that has spurred these hearings is the CIA's exemption from the White House policy guidance; analysis in *Defense One* noted that since the policy was released in May 2013, forty-six percent of lethal strikes by armed unmanned aerial systems have fallen outside of the policy guidance.⁹⁶ One example of legislation

⁹³ U.S. Congress, House, *Rise of the Drones II*, III.

⁹⁴ In addition to hearings on the Obama Administration's drone policy, the U.S. Congress has also held multiple hearings on the integration of unmanned aerial systems into the U.S. National Airspace, though these hearings have primarily involved the Federal Aviation Administration and deconfliction with civilian air traffic.

⁹⁵ Sabrina Siddiqui, "Obama Administration Skips Senate Drone Hearing," *Huffington Post*, April 24, 2013, accessed May 5, 2015, http://www.huffingtonpost.com/2013/04/23/obama-drone-hearing_n_3142144.html.

⁹⁶ Micah Zenko, "Obama's Drone Reforms Don't Apply to 46 Percent of Strikes," *Defense One*, April 27, 2015, accessed April 28, 2015, <http://www.defenseone.com/threats/2015/04/obamas-drone-reforms-dont-apply-46-percent-strikes/111211/>.

introduced to address this issue is H.R. 466, proposed by the House of Representatives of the 114th U.S. Congress, that seeks to prohibit the CIA from “using an unmanned aerial vehicle to carry out a weapons strike or other deliberately lethal action.”⁹⁷

In some instances, the new or greatly expanded capabilities identified earlier in this chapter are referenced in the documents and statements that constitute the existing, publicly available policy guidance on the use of military unmanned systems capable of implementing joint fires missions. It can be assumed at this point in the three-phase research methodology that public references to those capabilities means entities within the U.S. Government have actively considered the implications of those capabilities, though perhaps not all aspects of the implications. Any aspects of the capabilities that are not mentioned are considered gaps (as identified in the next section) that will need to be addressed in public statements or documents in order to influence the behavior of other nations.

The first capability identified was the reduced exposure of U.S. personnel to hostile fire. This capability is often referenced generally in the primary documents examined. For example, President Obama has stated that targeted lethal action, most commonly implemented using armed unmanned aerial systems, reduces the risk to U.S. personnel and U.S. interests by noting that “the primary alternative to targeted lethal action would be the use of conventional military options. As I’ve already said, even small special operations carry enormous risks. . . . And invasions of these territories lead us to

⁹⁷ U.S. Congress, House, H.R. 466.

be viewed as occupying armies, unleash a torrent of unintended consequences, are difficult to contain.”⁹⁸

Precisely because of this reduction in risk to U.S. personnel and U.S. involvement, several sources noted the desire to increase availability of military unmanned systems. According to James Lewis from the Center for Strategic and International Studies, “One of the Obama administration’s goals is to ‘regularize’ the drone program, making it more a part of accepted U.S. practice in the future.”⁹⁹ Indeed, several high-profile weapons systems are already being considered with the intention that they be unmanned. The Air Force’s Long Range Strike-Bomber, formerly the Next Generation Bomber, which would receive \$1.2 billion in research, development, test, and evaluation funding in the FY2016 President’s Budget (the largest single research, development, test, and evaluation program for the Air Force) and is awaiting the responses to competitive proposals, is being developed as “optionally manned.”¹⁰⁰ In April 2015, Secretary of the Navy Ray Mabus said the manned F-35 will “almost certainly be the last manned strike fighter aircraft the Department of the Navy will ever buy or fly.”¹⁰¹

⁹⁸ U.S. President, “Remarks by the President at the National Defense University.”

⁹⁹ Tabassum Zakaria, “U.S. Drone Policy: Obama Seeking To Influence Global Guidelines,” *Huffington Post*, May 17, 2013, accessed May 5, 2015, http://www.huffingtonpost.com/2013/03/17/us-drone-policy-obama_n_2895015.html.

¹⁰⁰ Aaron Mehta, “Bomber, Sixth-Gen Take Cuts in Chairman's Markup,” *Defense News*, April 24, 2015, accessed April 29, 2015, <http://www.defensenews.com/story/defense/policy-budget/budget/2015/04/24/bomber-sixth-gen-fighter-house-chairman-mark/26331555/>.

¹⁰¹ Sam LaGrone, “Mabus: F-35 Will Be ‘Last Manned Strike Fighter’ the Navy, Marines ‘Will Ever Buy or Fly’,” *USNI News*, April 15, 2015, accessed May 5, 2015,

The U.S. Government has also noted issues that will exist with an increased use of unmanned systems. For example, Representative John F. Tierney observed at the “Rise of Drones” Congressional hearings that while unmanned systems reduce the personnel directly threatened by enemy fire, they also make it unclear as to who could be considered a lawful combatant: “the Air Force pilot flying a Predator from thousands of miles away in Nevada? Or the civilian contractor servicing it on the air-strip in Afghanistan?”¹⁰²

The second capability identified is the use of autonomous decision making by unmanned systems. While this capability has very limited availability in current unmanned systems, the U.S. Government has identified this issue as a challenge and is working to lead efforts to address it. President Obama, in an interview with author Mark Bowden noted, “creating a legal structure, processes, with oversight checks on how we use unmanned weapons, is going to be a challenge for me and my successors for some time to come.”¹⁰³ However, it seems to be understood that autonomy in unmanned systems is approaching rapidly. In April 2015, Secretary of the Navy Ray Mabus stated, “Unmanned systems, particularly autonomous ones, have to be the new normal in ever-increasing areas.”¹⁰⁴

<http://news.usni.org/2015/04/15/mabus-f-35c-will-be-last-manned-strike-fighter-the-navy-marines-will-ever-buy-or-fly>.

¹⁰² U.S. Congress, House, *Rise of the Drones*, 3.

¹⁰³ Shane.

¹⁰⁴ LaGrone.

The U.S. Government approach to autonomous military unmanned systems, which is distinct from efforts underway for autonomous vehicles for civilian transportation, is being led by DOD. Specifically, DOD Directive 3000.09 “Autonomy in Weapon Systems,” issued in 2012, is a first attempt at beginning the global dialogue on autonomous unmanned systems.¹⁰⁵ The Directive is broad ranging, and provides guidelines for the “design, development, acquisition, testing, fielding, and employment of autonomous and semi-autonomous weapon systems” that are “lethal or non-lethal, kinetic or non-kinetic,” though it only allows for fully autonomous systems to apply non-lethal force.¹⁰⁶ The goal of the Directive seems to be the reduction of “potential consequences of an unintended engagement or loss of control of the system to unauthorized parties.”¹⁰⁷ However, as noted by Human Rights Watch, limitations on the development and use of fully autonomous systems can be waived with the approval of two undersecretaries of defense and the Chairman of the Joint Chiefs of Staff.¹⁰⁸

Because of the guidelines provided by DOD Directive 3000.09, the U.S. Government has not been supportive of outlawing the use of autonomous armed unmanned systems altogether. At a 2015 conference held by the United Nations to discuss a preemptive ban on armed unmanned systems, leader of the U.S. delegation

¹⁰⁵ Department of Defense, Department of Defense Directive 3000.09, *Autonomy in Weapon Systems* (Washington, DC: Department of Defense, November 21, 2012).

¹⁰⁶ *Ibid.*

¹⁰⁷ *Ibid.*

¹⁰⁸ Human Rights Watch, “Review of the 2012 US Policy on Autonomy in Weapons Systems,” April 16, 2013, accessed May 5, 2015, <http://www.hrw.org/news/2013/04/15/review-2012-us-policy-autonomy-weapons-systems>.

Michael D Meier stated, “The United States has a process in place, applicable to all weapon systems, which is designed to ensure weapons operate safely, reliably and are understood by their human operators,” and noted DOD Directive 3000.09 provides “a framework for how the United States would consider proposals to develop lethal autonomous weapon systems.”¹⁰⁹

The third capability identified is the greatly expanded on-station times that could be available for military unmanned systems. While there are references to long-range operations or extended loiter times in the primary sources reviewed, these are generally viewed as an expansion of the mission profiles for current manned systems. While DOD is exploring options for greatly expanded on-station times, to the point of being essentially indefinite, the potential for these types of systems to enter the U.S. inventory does not seem to be addressed in either executive or legislative branch public statements or documents.

The fourth capability identified is highly-precise kinetic and non-kinetic targeting available through a combination of persistent surveillance of targets, a short sensor-to-shooter chain, and the potential to approach close to targets. This capability seems highly valued by national decision-makers, and is often referenced in public statements and documents. In his speech at National Defense University in May 2013, President Obama defended the use of armed unmanned aerial systems by stating, “Conventional airpower

¹⁰⁹ John Zarocostas, “Arms Control Advocates Rally to Prevent Development of Killer Robots,” McClatchyDC, May 11, 2015, accessed May 12, 2015, <http://www.mcclatchydc.com/2015/05/11/266271/arms-control-advocates-rally-to.html>.

or missiles are far less precise than drones, and are likely to cause more civilian casualties and more local outrage.”¹¹⁰

The desire to hit the right target and minimize collateral damage has been emphasized during the previous decade of conflict in which the United States has been engaged. U.S. Government views on the use of military unmanned systems capable of implementing joint fires missions have been inextricably linked to the performance of armed unmanned aerial systems in counterterrorism operations, especially in Pakistan. In a meeting with General Ashfaq Parvez Kayani, Pakistan’s Chief of Army Staff, then-CIA Director Leon Panetta “had come to believe that the Predator and other unmanned aerial vehicles were the most precise weapons in the history of warfare. He wanted to use them more.”¹¹¹ In 2013, Chairperson for the Select Committee on Intelligence Senator Diane Feinstein disclosed the existence of a classified document that she said claims civilian collateral damage each year from U.S. targeted strikes by armed unmanned aerial systems in Pakistan number in the single digits.¹¹²

The United States has also recognized the importance of attempting to guide the actions of other countries in their use of armed unmanned systems, specifically unmanned aerial systems, because of their effectiveness in creating precise effects on targets. In 2013, Spokesperson for the National Security Council Caitlin Hayden stated, “We are constantly working to refine, clarify, and strengthen the process for considering

¹¹⁰ U.S. President, “Remarks by the President at the National Defense University.”

¹¹¹ Bob Woodward, *Obama’s Wars* (New York: Simon and Schuster Paperbacks, 2010), 366.

¹¹² Coll.

terrorist targets for lethal action” and “we are establishing standards other nations may follow.”¹¹³

Phase 2-2: Aspects of New Capabilities
not Addressed by Policies

While it has been shown that there are several references to the new or greatly expanded capabilities of unmanned systems capable of implementing joint fires missions in publicly stated guidance provided by the executive and legislative branches, there are also some aspects of these capabilities that have not been obviously addressed. It is these aspects where initial policy suggestions stem from, as they have the potential to cause issues with U.S. foreign relations. These are some of the potential gaps in existing U.S. policy on unmanned systems.

While the benefits of reducing the exposure of U.S. personnel to hostile fire are espoused in public documents and statements, the implications of that risk reduction are in many instances not addressed. The increased use of armed unmanned aerial systems in conflict areas (e.g., Yemen, Somalia, Libya, Syria) signals the U.S. intent to use unmanned systems to engage in areas where the United States wants to limit the involvement of ground forces. Pending declared limitations on armed unmanned systems use, the foreign relations message is the United States will continue to use these systems globally at will.

Similarly, the U.S. record of recovering downed or disabled unmanned systems is not consistent (for example, in Afghanistan versus in Syria), which casts uncertainty on U.S. resolve in recovering unmanned assets. As noted in a Center for Strategic and

¹¹³ Zakaria.

International Studies report, “To date, the United States has not enacted CONOPs to treat UAS as expendable. (Ground forces veterans of Iraq and Afghanistan recall with some irony the risk they incurred to recover UAS that crashed for one reason or another, lest the aircraft and sensors fall into the hands of the enemy—the very UAS that were supposed to provide standoff and warning to keep them safe from enemy attacks.)”¹¹⁴

While attacks on U.S. unmanned systems would seemingly fall under existing rules of engagement, the U.S. response in Iran and Syria has been significantly less than what would be expected for a manned asset. Finally, the United States has not specifically noted the intended response to armed unmanned systems by other countries, though no indication has been made that the rules of engagement present in each area of responsibility would not also apply.

The rules on the use of autonomous capabilities in unmanned systems are perhaps the set of issues that are most robustly defined under existing publicly declared statements and documents. Through DOD Directive 3000.09, the United States has attempted to establish which systems should be developed and under which circumstances.¹¹⁵ It also attempts to address the notion of “consequences of failures in autonomous and semi-autonomous weapon systems that could lead to unintended engagements.”¹¹⁶ While unintended engagements alone do not constitute the full set of actions an unmanned system could execute that could violate international laws, the

¹¹⁴ Brannen, 8.

¹¹⁵ Department of Defense, Department of Defense Directive 3000.09.

¹¹⁶ Ibid.

existence of the Directive and accompanying public discourse shows these issues are being addressed.

The overall lack of public discussion on the potential capability of future unmanned systems to have greatly expanded or even indefinite on-station times leaves open the foreign relations questions previously identified. During the Cold War, the United States was willing to conduct missions of finite duration using manned platforms in the territorial waters and airspace of the Soviet Union for intelligence gathering.¹¹⁷ The United States has not explicitly excluded the possibility of doing the same for current day adversary nations using armed unmanned systems. Similarly, in peacetime, there is no indication of how the United States would respond to an armed unmanned system near its borders.

The foreign policy issues associated with the potential capability of unmanned systems to create effects of increased precision, both kinetic and non-kinetic, are similar to some of those associated with the reduced threat to U.S. personnel—does the decrease in associated risks lead to a preference to use unmanned systems and a propensity to engage in conflicts where the United States might otherwise be disinclined? If so, the ability of adversaries to respond with proportional force might be compromised because of the advanced capabilities of U.S. unmanned systems. This could result in the general tendency to undermine the doctrine of deterrence.

It should be noted that in some instances, these policy gaps might be intentional omissions designed to protect the existence of capabilities or operations. However,

¹¹⁷ Associated Press, “New Nuclear Sub Is Said to Have Special Eavesdropping Ability,” *The New York Times*, February 19, 2005, accessed May 6, 2015, http://www.nytimes.com/2005/02/20/politics/20submarine.html?_r=0.

without public statements or documents outlining the U.S. positions on these issues, the net impact to foreign relations is to leave other countries (adversaries as well as allies) guessing on U.S. intentions. While this might be beneficial to negotiations in some instances, it introduces a greater amount of uncertainty in foreign relations and has the potential to lead to inadvertent conflict.

Phase 3: Historical Analogies that can Provide Insight on Unmanned Systems Issues

With potential policy gaps having been identified, the next step is to provide some initial guidance for future policy makers who will have to address these gaps. These policy makers will have to weigh not only the capabilities of unmanned systems in formulating their policy, but also the moral, ethical, and legal climate in which the policy is being developed. These moral, ethical, and legal aspects of the climate can change with time. However, unmanned systems are not the only weapon systems that have required such policy considerations. In order to provide background for future policy makers on some of the issues they will have to deal with, it is helpful to examine historical weapons systems that also affected U.S. foreign relations as analogies for unmanned systems.

While many weapons systems have had some effect on U.S. foreign relations, those that were selected as case examples in this thesis share similar traits with unmanned systems and their effect on U.S. foreign relations. The first of these are collectively the various types of nuclear weapons found in the U.S. arsenal. Nuclear weapons are perhaps the greatest example of weapons for which strategic policies were developed not only for their use, but also for the U.S. reaction to their use by other nations. These weapons were also major drivers of U.S. foreign policy for over half a century. The second set of

systems that continue to affect U.S. foreign policy are space systems. Here, the United States developed a set of policies on how it intended to use space systems, and advocated for how other countries should use these systems. Space systems, like nuclear weapons, are also subject to international treaties on their use and limitations on capabilities (e.g., weaponization of space). Manned naval aviation, the third set of systems examined, was similar to unmanned systems in that at its introduction it held the potential to influence all of the warfighting functions. Finally, the fourth set of weapons, and ones that could be considered very primitive unmanned systems, is naval mines. Advanced versions of these expendable munitions employ automated functions that allow them to perform the “sense-think-act” actions similar to those required of unmanned systems capable of implementing joint fires missions.¹¹⁸

In examining weapons systems that have affected U.S. foreign policy, perhaps none are as overshadowing as nuclear weapons. Since the development of the nuclear bomb during World War II, the threat of nuclear annihilation has caused the United States to develop policies that guide its own use of these weapons, and caused the United States to take a leadership role in shaping which countries could acquire these weapons and how their development would be monitored. While unmanned systems are not likely to assume the same destructive power as nuclear weapons, insights might be gained by seeing how the United States approached developing foreign policy around a weapons system in the early years after their introduction.

The first insight is that public declarations of intended use and U.S. views on appropriate use drove U.S. interactions with other countries, particularly the Soviet

¹¹⁸ Riza, 14.

Union. In a speech describing the U.S. view on its intended use of nuclear weapons to deter aggression, Secretary of State John Foster Dulles in 1954 stated the United States would rely, “primarily upon a great capacity to retaliate, instantly, by means and at places of our own choosing.”¹¹⁹ This declared policy of massive retaliation made it clear to countries with which the United States interacted how the United States planned to use nuclear weapons, and what they could expect in response to the use of nuclear weapons. A second associated insight, however, is that the United States must remain consistent in its use of a publicly declared policy, or the credibility of that policy comes into question; the U.S. use of conventional forces only in Korea in the 1950s and Vietnam in the 1960s showed an inconsistency with declared policy.

With regards to the U.S. policy on the use of nuclear weapons by other countries, the United States has spent the past half century promoting counter-proliferation in the international arena. However, while these efforts have certainly delayed or inhibited some countries from developing or acquiring nuclear weapons, there are certainly more countries with access to nuclear weapons today than in previous decades, including some that are hostile to the United States. Given the difference in relative difficulty of developing nuclear weapons versus armed unmanned systems, an insight to derive is that non-proliferation efforts for unmanned systems are likely to have limited effectiveness in the long term. A recent DOD report titled “Military and Security Developments Involving the People’s Republic of China 2015” notes, “In 2013, China unveiled details of four UAVs under development—the Xianglong, Yilong, Sky Saber, and Lijian—the

¹¹⁹ Peter Paret, ed., *Makers of Modern Strategy from Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), 740.

last three of which are designed to carry precision-strike capable weapons;” the Lijian is also considered a stealth system.¹²⁰ Even countries with which the United States shares a close relationship are ready to develop and export armed unmanned systems; Shaul Shahr, “head of Israel Aerospace Industries’ military aircraft division believes its future profits reside in the market for unmanned combat air vehicles.”¹²¹

The development of policies for space systems, starting with the launch of Sputnik I in 1957, offers insights for unmanned systems.¹²² In particular, policies and international treaties on the weaponization of space can provide insight on how the United States and the international community have approached the potential dual-use nature of space systems in the same way policymakers will need to view the numerous civilian applications of unmanned systems.¹²³

The 1967 Outer Space Treaty, which the United States helped initiate and help persuade over 100 countries to be signatories of, places restrictions on the orbiting of certain weapons in space or basing them in space (e.g., on the moon).¹²⁴ However,

¹²⁰ James Drew, “Report: China Wants Stealthy UAVs along with Fifth-Gen Fighters,” *Flightglobal*, May 11, 2015, accessed May 11, 2015, <http://www.flightglobal.com/news/articles/report-china-wants-stealthy-uavs-along-with-fifth-gen-412172/>.

¹²¹ James Drew, “AUVSI: IAI Stresses Big Future for UCAVs,” *Flight Daily News*, May 7, 2015, accessed May 11, 2015, <http://www.flightglobal.com/news/articles/auvsi-iai-stresses-big-future-for-ucavs-412033/>.

¹²² Steve Garber, “Sputnik and The Dawn of the Space Age,” *NASA History*, October 10, 2007, accessed May 7, 2015, <http://history.nasa.gov/sputnik/>.

¹²³ Jane C. Hu, “The Battle for Space,” *Slate*, December 2014, accessed May 7, 2015, http://www.slate.com/articles/health_and_science/space_20/2014/12/space_weapon_law_u_s_china_and_russia_developing_dangerous_dual_use_spacecraft_single.html.

¹²⁴ *Ibid.*

specifying what constitutes a weapon has been challenging, and numerous attempts to amend the treaty by members of the United Nations Office for Outer Space Affairs have resulted in little progress.¹²⁵ In some instances, Russian and Chinese attempts to amend the treaty were met with resistance from the United States, which saw the amendments as a threat to its technological dominance in space.¹²⁶ The insights to be gained for unmanned systems are that international regulation of dual use technologies can be difficult to agree on, and by proposing agreements the United States could later find itself arguing against stringent international regulations in order to maintain technological superiority.

However, inaction on the part of the United States in the international dialogue on armed unmanned systems is also likely not an appropriate course of action. According to researchers at the Rand Corporation, “The United States will need to address how its own use of these systems can be fit into a broader set of international norms so as to discourage their misuse by others. While the track record for constraining the use of emerging technologies has been mixed, there is evidence that U.S. leadership—and failure to lead—can matter in shaping international behavior.”¹²⁷ The problem policymakers will need to contend with is that, just like the *National Space Policy of the*

¹²⁵ United Nations Office for Outer Space Affairs, “International Space Law,” United Nations, accessed May 7, 2015, <http://www.unoosa.org/oosa/en/SpaceLaw/index.html>.

¹²⁶ Hu.

¹²⁷ Lynn E. Davis, Michael J. McNerney, James S. Chow, Thomas Hamilton, Sarah Harting, and Daniel Byman, “Armed and Dangerous? UAVs and U.S. Security” (Santa Monica, CA: Rand Corporation, 2014), accessed May 5, 2015, http://www.rand.org/pubs/research_reports/RR449.html.

United States of America, any policy developed asserting a reaction to the use of unmanned systems by other countries will be met with anxiety and accusations from those countries.¹²⁸

Like unmanned systems, the development of U.S. naval aviation in the years between World War I and World War II introduced technological capabilities that could affect all of the warfighting functions and had to be integrated into existing organizational structures. Today, naval aviation is an integral part of U.S. Navy capabilities, and can provide insights into how unmanned systems could similarly become a seamless part of the military services. The method of integrating unmanned systems into the military services will provide indicators to other countries as to how the United States intends to use these systems, which will influence U.S. relations with other nations.

One insight to be gained from the history of naval aviation is how the importance of the integration of aviation into the U.S. Navy signaled its importance to allies and adversaries. This was made possible because in the early years of naval aviation, a small cadre of leaders in the U.S. Navy recognized the importance of naval aviation on the future of naval combat, and they were able to convince influential civilian leaders of the potential of naval aviation. It was the creation of U.S. naval aviation representation and

¹²⁸ James Oberg, "The Dozen Space Weapons Myths," *The Space Review*, March 12, 2007, accessed May 7, 2015, <http://www.thespacereview.com/article/826/1>; U.S. President, *National Space Policy of the United States of America* (Washington, DC: The White House, June 28, 2010), accessed May 7, 2015, https://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

institutions, independent of existing organizational structures, that supported the development of naval aviation.¹²⁹

An example of how having a strong advocate for naval aviation could generate representation and institutions was the work of Admiral William A. Moffett. Admiral Moffett influenced many of the civilian supporters of naval aviation at the highest levels of the U.S. Government, and his newly established Bureau of Aeronautics became a formidable lobbying force to the White House, Congress, and the Department of the Navy.¹³⁰ Having his position be politically appointed further strengthened the clout and independence of the naval aviation establishment, and helped solidify its links to the highest echelons of government.¹³¹

A recent event shows a similar approach could be developed for unmanned systems. In April 2015, Secretary of the Navy Ray Mabus announced the creation of a Deputy Assistant Secretary of the Navy for Unmanned Systems, and that an N-99 section to handle unmanned systems issues would be created in the Chief of Naval Operations' staff.¹³² He noted that the new Deputy Assistant Secretary position was created “so that all aspects of unmanned—in all domains—over, on and under the sea and coming from the

¹²⁹ Barry Watts and Williamson Murray, “Military Innovation in Peacetime,” in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan Millett (New York: Cambridge University Press, 1996), 384; Geoffrey Till, “Adopting the Aircraft Carrier: The British, American and Japanese Case Studies,” in *Military Innovation in the Interwar Period*, ed. Williamson Murray and Allan Millett (New York: Cambridge University Press, 1996), 210.

¹³⁰ Till, 210-211.

¹³¹ *Ibid.*, 210.

¹³² Freedberg, “Secretary Of Drones: Mabus Creates DASD For Unmanned.”

sea to operate on land—will be coordinated and championed.”¹³³ Such an organizational change signals the importance the United States places on unmanned systems to the militaries of other countries. A Center for Strategic and International Studies report goes so far as to recommend the establishment of a Defense Unmanned Systems Office within the Office of the Secretary of Defense in order to “ensure high-level focus within the department, create an effective coordinating function between military departments on investment decisions, and tie the compelling vision and strategy outlined in the OSD *Unmanned Systems Integrated Roadmap* to the PPBE process.”¹³⁴

Naval mines could be considered unmanned systems with basic automated engagement logic. In addition to contact mines, there are also influence mines, which can use a variety of sensors (such as those that use hydrophones, sense vibrations, or register disturbances in a magnetic field) to identify when a ship is passing in close proximity.¹³⁵ In using these types of sensors, the mines are in essence conducting a rudimentary version of the same “sense-think-act” actions that are required of unmanned systems.¹³⁶

Insights that can be gained from naval mines, which could be viewed as surrogates for unmanned systems (they are typically not considered unmanned systems in the same way as the systems discussed in this thesis because they are expendable), stem from the use of these systems that make automated decisions to employ lethal force and can be on-station indefinitely. The United States, for example, employed close to 25,000

¹³³ LaGrone.

¹³⁴ Brannen, 15.

¹³⁵ LaGrone.

¹³⁶ Riza, 14.

naval mines in the waters near Japan during World War II, many of which are still there.¹³⁷

The United States has asserted that armed naval mines can be deployed in international waters during peacetime provided the country deploying the mine maintains “an on-scene presence in the area sufficient to ensure that appropriate warning is provided to ships approaching the danger area, and all armed mines must be expeditiously removed or rendered harmless when the imminent danger has passed.”¹³⁸ Whether the United States will assert similar provisions for armed unmanned systems that are capable of loitering on-station for greatly extended periods has yet to be seen.

Attempts to limit the use of naval mines have also been subject to international debate. The only treaty governing naval mines is the Convention of 1907 Relative to the Laying of Automatic Submarine Mines (Hague VIII), and, unlike landmines, naval mines are regarded as lawful weapons.¹³⁹ Again, even with a treaty in place, the definition of a naval mine is unclear; an insight to be reiterated is the ability of the United States to build international consensus on the use of military unmanned systems will be difficult. Another similarity with unmanned systems is that naval mines, in the lead up to the treaty, were considered a relatively inexpensive weapon that could be used to threaten

¹³⁷ LaGrone.

¹³⁸ Chatham House, The Royal Institute of International Affairs, *International Law Applicable to Naval Mines*, International Security Department Workshop Summary, October 2014, accessed May 7, 2015, <https://www.usnwc.edu/getattachment/2532931a-d351-4663-a96f-22cb5173c5c4/Chatham-House-Workshop-Summary--International-Law-.aspx>.

¹³⁹ *Ibid.*

superior powers; for this reason many countries refused to limit their ability to use these weapons and the Hague treaty was not strongly worded.¹⁴⁰

Results of Research Methodology

The intent of this chapter was to use the three-phase research methodology described in chapter 3 to gather the information needed to form conclusions that could answer the primary and secondary research questions. Those conclusions will be discussed in chapter 5. The information gathered was informed by the context provided by the literature review in chapter 2, and used the qualitative approach to research.

¹⁴⁰ D. G. Stephens and M. D. Fitzpatrick, “Legal Aspects of Contemporary Naval Mine Warfare,” in *Loyola of Los Angeles International and Comparative Law Journal* 21, no. 4 (August 1999): 554.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Having reviewed the literature on the subject of unmanned systems capable of implementing joint fires missions in chapter 2, established a systematic three-phase research methodology in chapter 3, and examined primary sources and historical analogies that enable a better understanding of policies for these unmanned systems in chapter 4, it is now possible to directly address the primary and secondary research questions identified in chapter 1. In doing so, it is also possible to establish a set of general conclusions on the state of U.S. policy on unmanned systems capable of implementing joint fires missions, and provide recommendations for future policy makers addressing the subject. As is evident from the limitations and delimitations required to maintain a reasonable scope for this thesis, there are also further areas of research available for interested scholars.

Revisiting the Research Questions

In order to address the primary research question, five secondary research questions were established to examine the multiple facets of this complex topic. Using the information garnered from the literature review and the examination of primary documents, the answers to these secondary research questions build a rationale with which to answer the primary research question. However, as additional information emerges in the public forum, the answers to even the secondary research questions will continue to evolve. As has been seen from the amount of information available for each

of these questions, each secondary research question could itself be a thesis topic in its own right.

As shown in chapter 3, the three-phase research methodology addresses each research question in turn, so it is appropriate to revisit the diagram originally shown as figure 2. Using the insights gathered in chapter 4, the diagram has been updated as figure 3 to reflect a potential solution set for the analysis of the research questions. It should be noted that Phase 2, Step 1 in the diagram shows where issues associated with new or greatly expanded capabilities are referenced in public statements or documents. While the assumption is that this public mention implies additional effort is being conducted to assess this issue, it does not mean the issue is fully addressed in existing policy. It is also worth noting that the historical analogies listed in Phase 3 provide insight into the corresponding significant policy gaps (Phase 2, Step 2), but as can be seen in chapter 4, historical analogies can provide valuable insights for the development of policies for unmanned systems beyond these issues alone.

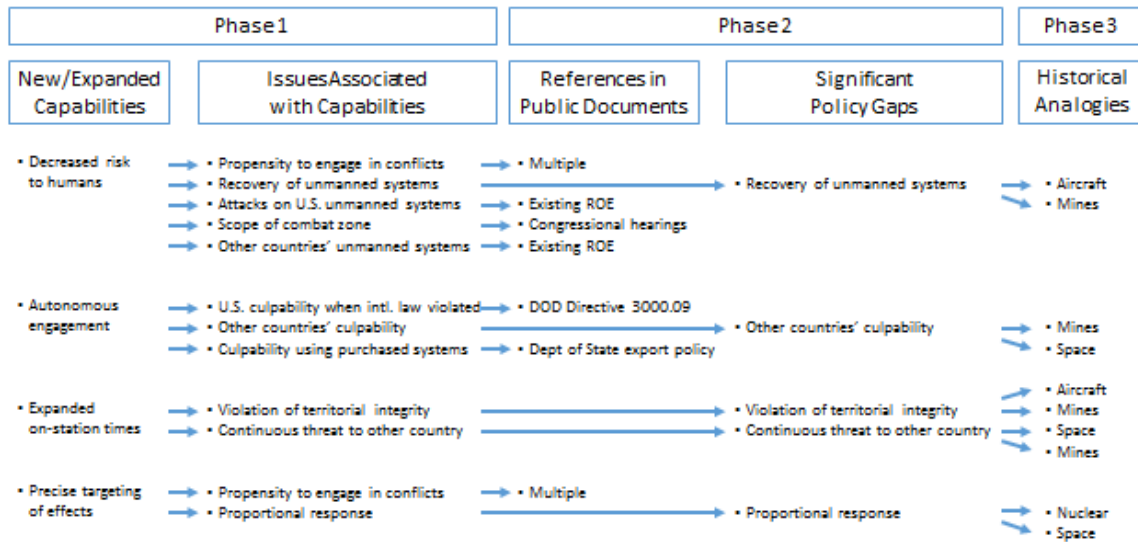


Figure 3. Results of Three-phase Research Methodology

Source: Created by author.

The first of these secondary research questions is, What capabilities do current and near-future unmanned systems have that have not been available to national leaders in the past? Four new or greatly expanded capabilities of unmanned systems that have the potential to provide U.S. national decision-makers with options were identified through the review of DOD source documents in Phase 1, Step 1 of the three-phase research methodology. These four capabilities were the ability to execute joint fires missions while greatly limiting the exposure of humans to hostile fire, the ability to provide pre-defined autonomous engagement criteria, greatly expanding (to potentially indefinite) on-station times, and the ability to provide highly-precise targeting of effects, both kinetic and non-kinetic. Each of these capabilities has been discussed at length in chapter 4.

The second question is, What are the effects of unmanned systems capabilities on U.S. foreign policy efforts? The effects in the question are the influence of the issues

brought forth by the new or greatly expanded capabilities identified in the previous question, as each of these issues has the potential to trigger a foreign relations incident because of a lack of clarity of U.S. intentions. These issues were identified in Phase 1, Step 2 of the three-phase research methodology, and were discussed in relation to each of the four capabilities identified in chapter 4. These issues include the increased propensity for the United States to engage in combat operations using unmanned systems due to the decreased risk to U.S. personnel, high precision of effects, and potential for minimized collateral damage. Other issues include the willingness to recover unmanned systems, the anticipated U.S. response to attacks on its unmanned systems, the anticipated response to other countries' use of armed unmanned systems, and the scope of the combat zone when unmanned systems are employed. Issues associated with autonomous engagement include the culpability of the United States when using armed unmanned systems, the culpability of other countries using unmanned systems, and how culpability is viewed for exported systems. Issues associated with expanded on-station times include the potential to violate the territorial integrity of other countries, and the manner in which armed unmanned systems could be positioned to pose a continuous threat to other countries. A final issue, associated with the precise targeting of effects, is the potential for countries to be limited in their ability to provide a proportional response to attacks by armed unmanned systems.

The third question is, What publicly-stated national-level policies exist for the military use of unmanned systems? While there are a variety of public statements and documents by leaders in the U.S. Government that reference unmanned systems, those described in chapter 4 as part of Phase 2, Step 1 of the three-phase research methodology have been instrumental in shaping the public dialogue on unmanned systems. These

include the public statements and documents issued by the White House that address the use of unmanned systems in the context of their influence on foreign relations (mainly as part of the drone policy), the Department of State's policy guidance on the export of armed unmanned systems (which includes the implied U.S. Government views on the their appropriate use by other countries), the Congressional hearings that have taken place on armed unmanned systems (including the *Rise of the Drones* sessions), and DOD guidance on the intended use of unmanned systems' capabilities (including guidelines on the development and use of autonomous weapons systems).

The fourth question is, What publicly-stated national policies exist as a result of other countries developing unmanned systems capable of performing fires missions? References to the development and use of armed unmanned systems by other countries were also covered in chapter 4 as part of Phase 2, Step 1 of the three-phase research methodology. While the United States has started international dialogues on issues such as autonomous weapons systems and expected uses for exported armed unmanned systems, there is otherwise very little public documentation on how the United States intends to shape international expectations on the use of military unmanned systems capable of implementing joint fires missions.

The fifth question is, What other historical weapon systems could serve as analogies for development of policies for new military capabilities? As described in chapter 4 as part of Phase 3 of the three-phase research methodology, several weapon systems could provide insights for policy makers attempting to address issues dealing with military unmanned systems capable of implementing joint fires missions. The four that were identified for this thesis were nuclear weapons, space systems, naval aviation,

and naval mines. These were chosen because of their applicability to the issues associated with the significant policy gaps identified in Phase 2, Step 2 of the three-phase research methodology. Aspects of other weapon systems could be used as well, depending on the specific issue being addressed. For example, policy makers dealing with the international dialogue on restrictions on the use of armed unmanned systems could reference the treaty discussions that have taken place on cluster munitions, land mines, or blinding laser weapons.¹⁴¹ For now, the four examples examined in chapter 4 should provide policy makers with a place to start their research.

Having established an understanding of the issues brought up by the secondary research questions, it is now possible to examine the primary research question itself, What national policies need to be developed to guide U.S. leaders in their use of military unmanned systems that implement joint fires? While the discussion of Phase 2, Step 2 of the three-phase research methodology in chapter 4 identifies the most significant policy gaps with regards to military unmanned systems capable of implementing joint fires missions, it is clear that additional effort and clarification is required for all of the issues previously identified. The most significant policy gaps, for which little or no public references have been made and U.S. actions thus far have been contradictory or confusing, are the U.S. views on: the recovery of unmanned systems, the culpability of countries using autonomous armed unmanned systems, the potential for the long-term violation of territorial integrity of other countries, the use of armed unmanned systems to pose a continuous threat to other countries, and the restrictions the use of unmanned systems places on other countries' ability to provide a proportional response. In

¹⁴¹ Zarocostas.

conjunction with the continued development of policies already being constructed (and the release of public statements or documents that explain the U.S. views contained in those policies), these significant policy gaps are where U.S. policy makers can start to address issues that have the potential to cause foreign relations problems for the United States in the future.

Conclusions

Beyond the answers developed to address the primary and secondary research questions, it is also possible to provide some general conclusions based on the review of the literature and the examination of primary documents that deal with unmanned systems capable of implementing joint fires missions. These conclusions can be viewed as observations on the current state of policies and policy efforts on the subject. While temporal, these observations can help guide policy makers as they consider the issues that will need to be dealt with in establishing robust policy recommendations.

The first observation is while U.S. policy constrains the use of autonomous decisions for fires, the United States will still need to deal with autonomous systems from both allies and adversaries that have the capability of implementing fires missions. DOD Directive 3000.09 is a strong beginning to an international dialogue on the use of autonomous weapons systems, but further public documentation is required to show how the United States considers the use of unmanned systems with autonomous capabilities by other nations.¹⁴² Beyond even this discussion is the establishment of U.S. views on autonomous unmanned systems that are sold to third parties, and the culpability of the

¹⁴² Department of Defense, Department of Defense Directive 3000.09.

original vendor nation. Using DOD Directive 3000.09 as a basis to promote views on these subjects in the international community will place the United States in a leadership role in this emerging field.

The second observation is the United States approach to dealing with the adversary use of unmanned systems seems to be focused on the military Instrument of National Power, while the diplomatic, informational, and economic pressures that could be applied receive limited exposure in publicly declared policies. The four principles espoused in the Department of State's "U.S. Export Policy for Military Unmanned Aerial Systems" provide a view on the expected use of unmanned aerial systems sold by the United States to allied nations, and implies a potential economic consequence of the withholding of unmanned systems technologies, but is limited in scope. The United States has provided clear views on the consequences for the proliferation and use of other weapons systems (e.g., chemical munitions, land mines), so the topic of armed unmanned systems will need to be dealt with in a similar manner.

The third observation is the international availability of unmanned systems will preclude the same treaty approaches that were successful in some weapons systems that serve as historical analogies. Already, some nations are developing unmanned systems capable of implementing fires missions, and some of those countries are readily willing to sell the technologies involved to countries with which the United States is not on good diplomatic terms. With the addition of the dual civilian-military use of many unmanned systems technologies, using treaties to limit the proliferation and use of unmanned systems capable of implementing joint fires missions will be challenging.

The fourth observation is the conflation of the questions, Should unmanned systems be used in this situation? and How will unmanned systems be used in this situation? are limiting the development of policy on the use of unmanned systems capable of implementing joint fires missions. In any situation where unmanned systems are being considered, national decision-makers will need to answer the first question before proceeding. This will determine whether unmanned systems are even an option for national decision-makers. It must then be remembered that unmanned systems could be one of several ways in which the desired effect could be achieved. In some cases, whether that effect (e.g., targeting a U.S. citizen abroad) should even be achieved is a matter of national dialogue independent of the use of unmanned systems.

Recommendations

While the purpose of this thesis, as described in chapter 1, is to provide useful information to policy makers without making explicit policy recommendations, there are a few observations that warrant inclusion because of their persistent presence throughout the research conducted. These observations are not recommendations on what the policies on unmanned systems capable of implementing joint fires missions should be, but rather they are recommendations on how these policies should be developed. Doing so could help to avoid potential unintended consequences or omissions in the policies that are needed.

The first recommendation is the United States should publicly clarify its positions on the use of unmanned systems capable of implementing joint fires missions, and the anticipated U.S. response to the use of these unmanned systems by other countries. Making these positions public helps other countries (both allies and adversaries)

understand U.S. actions and the potential consequences of their own action, which could lead to fewer misunderstandings that have kinetic results. The United States will always reserve the right to deviate from its own policies (assuming those deviations are moral, ethical, and legal), but identifying situations where the United States will and will not use certain unmanned systems capabilities can be a powerful foreign relations communications tool. In doing so, the United States should also identify how it expects other countries to use their unmanned systems, not just the countries to which the United States is providing exports and where expectations of use are already delineated.¹⁴³

The second recommendation is future policies should equally address air, land, and maritime unmanned systems. As President George W. Bush noted in his December 11, 2001 address at The Citadel, “Now it is clear the military does not have enough unmanned vehicles. We’re entering an era in which unmanned vehicles of all kinds will take on a greater importance—in space, on land, in the air, and at sea.”¹⁴⁴ While DOD research and development of unmanned systems covers systems in all of the physical domains, many of the national policies dealing with unmanned systems only address unmanned aerial systems. At a time when there is already a national debate on the civilian integration of self-driving vehicles, the United States needs to aggressively address ground and maritime systems in order to get ahead of many of the same issues already being addressed for airborne platforms. These ground and maritime systems already exist, and while they are not present in large numbers in the U.S. inventory, it

¹⁴³ U.S. Department of State, “U.S. Export Policy for Military Unmanned Aerial Systems.”

¹⁴⁴ John W. Dietrich, ed., *The George W. Bush Foreign Policy Reader: Presidential Speeches with Commentary* (Armonk, NY: M. E. Sharpe, 2005), 128.

would be a mistake to wait until their use causes a foreign relations conundrum before making applicable policy decisions.

Areas of Further Research

This examination of national policies for unmanned systems capable of implementing joint fires missions has perhaps only uncovered the complexity of this issue, and there is much work that could still be done on the topic. In order to best assist policy makers as they attempt to bring clarity to this difficult subject, there are a few areas of further research that should be considered by future scholars. Each of these topics could add to the national base of knowledge on unmanned systems, and help inform how they could be used to best effect.

The first potential area for research is to examine policies for unmanned systems in the Joint Warfighting Functions other than fires (command and control, intelligence, movement and maneuver, protection, and sustainment).¹⁴⁵ While unmanned systems capable of implementing joint fires missions are typically the most contentious because of the ability to generate effects on an adversary and their current use in counterterrorism operations, unmanned systems supporting other Joint Warfighting Functions could have just as great an impact on U.S. foreign relations without proper guidelines.

The second potential area for research is to examine the perceptions of use by allies and adversaries when unmanned systems are employed. When a weapons system is used, there are effects on the relationships the United States has with other countries, including the adversary that was attacked, allies that benefit from U.S. offensive or

¹⁴⁵ Joint Chiefs of Staff, Joint Publication 3-0, xiv.

defensive actions, and observer countries who will consider the event with respect to their potential future actions. The United States might achieve the tactical effect desired through the use of unmanned systems, but whether it achieves the strategic messaging it desires has yet to be seen.

The third potential area for research, closely related to the third phase of the three-phase research methodology in this thesis, is the effectiveness of the implementation of policies used in the cases examined as historical analogies. While this thesis examines weapon systems with aspects that are similar to issues being faced by unmanned systems today, it does not assert that the policies implemented by the United States for those historical analogies were effective. For policy makers to gain the most insight from historical analogies, arguments should be made as to the effectiveness of each policy that was created for the other weapon systems chosen as historical analogies. Insights can still be gained even if a policy is determined not to be effective.

BIBLIOGRAPHY

Books

- Davies, Martin, and Nathan Hughes. *Doing a Successful Research Project: Using Qualitative or Quantitative Methods*. 2nd ed. New York: Palgrave Macmillan, 2014.
- Dietrich, John W., ed. *The George W. Bush Foreign Policy Reader: Presidential Speeches with Commentary*. Armonk, NY: M. E. Sharpe, 2005.
- Gardner, Lloyd C. *Killing Machine: The American Presidency in the Age of Drone Warfare*. New York: The New Press, 2013.
- Hakes, William, and Jennifer Priestley. "Problem Solving and Psychological Traps." In *Smart Choices. A Practical Guide to Making Better Decisions*, edited by John S. Hammond, Ralph L. Keeney, and Howard Raiffa. Cambridge, MA: Harvard University Press, 1999. Accessed May 19, 2015. <https://analytics.kennesaw.edu/~jpriestl/PubPapers/Problem%20Solving%20and%20Psychological%20Traps.pdf>.
- Irvin, David W., Jr. *History of Strategic Drone Operations*. Paducah, KY: Turner Publishing Company, 2003.
- Merriam, Sharan B. *Qualitative Research: A Guide to Design and Implementation*. San Francisco, CA: John Wiley and Sons, 2009.
- Murray, Williamson, and MacGregor Knox. "The Future Behind Us." In *The Dynamics of Military Revolution, 1300-2050*, edited by MacGregor Knox and Williamson Murray. 175-194. New York: Cambridge University Press, 2001.
- _____. "Thinking About Revolutions in Warfare." In *The Dynamics of Military Revolution, 1300-2050*, edited by MacGregor Knox and Williamson Murray, 1-14. New York: Cambridge University Press, 2001.
- Paret, Peter, ed. *Makers of Modern Strategy from Machiavelli to the Nuclear Age*. Princeton, NJ: Princeton University Press, 1986.
- Parker, Geoffrey, ed. *The Cambridge History of Warfare*. Cambridge, UK: Cambridge University Press, 2005.
- Riza, M. Shane. *Killing Without Heart: Limits on Robotic Warfare in an Age of Persistent Conflict*. Washington, DC: Potomac Books, 2013.
- Shafritz, Jay M. *Words on War*. New York: Simon and Schuster, 1990.

- Singer, Peter W. *Wired for War: The Robotics Revolution and Conflict in the 21st Century*. New York: The Penguin Press, 2009.
- Till, Geoffrey. "Adopting the Aircraft Carrier: The British, American and Japanese Case Studies." In *Military Innovation in the Interwar Period*, edited by Williamson Murray and Allan Millett, 191-226. New York: Cambridge University Press, 1996.
- Watts, Barry, and Williamson Murray. "Military Innovation in Peacetime." In *Military Innovation in the Interwar Period*, edited by Williamson Murray and Allan Millett, 369-416. New York: Cambridge University Press, 1996.
- Woodward, Bob. *Obama's Wars*. New York: Simon and Schuster Paperbacks, 2010.

Government Documents

- Defense Acquisition University. "Acquisition Framework." *Defense Acquisition Guidebook (DAG)*. Fort Belvoir, VA: Defense Acquisition University, June 28, 2013. Accessed April 24, 2015. <https://dag.dau.mil/Pages/acqframework.aspx>.
- Defense Advanced Research Projects Agency. *Breakthrough Technologies for National Security*. Arlington, VA: Defense Advanced Research Projects Agency, March 2015. Accessed April 9, 2015. <http://go.usa.gov/3rut4>.
- Department of Defense. Department of Defense Directive 3000.09, *Autonomy in Weapon Systems*. Washington, DC: Department of Defense, November 21, 2012.
- _____. *Quadrennial Defense Review 2014*. Washington, DC: Government Printing Office, 2014. Accessed May 19, 2015, http://www.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf.
- _____. *Unmanned Systems Integrated Roadmap: FY2013-2038*. Washington, DC: Government Printing Office, 2013. Accessed May 19, 2015. <http://www.defense.gov/pubs/DOD-USRM-2013.pdf>.
- Department of Defense, Defense Science Board. *Task Force Report: The Role of Autonomy in DOD Systems*. Washington, DC: Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, July, 2012.
- Gertler, Jeremiah. Congressional Research Service Report for Congress R42136, *U.S. Unmanned Aerial Systems*. Washington, DC: Library of Congress, January 3, 2012.
- Joint Chiefs of Staff. Joint Publication 3-0, *Joint Operations*. Washington, DC: Government Printing Office, August 2011. Accessed May 19, 2015. http://www.dtic.mil/doctrine/new_pubs/jp3_0.pdf.

National Institute of Standards and Technology. NIST Special Publication 1011, *Autonomy Levels for Unmanned Systems (ALFUS) Framework, Volume I: Terminology, Version 1.1*. Gaithersburg, MD: National Institute of Standards and Technology, September 2004.

U.S. Congress. Congressional Budget Office. *A CBO Study: Policy Options for Unmanned Aircraft Systems*. Washington, DC: Government Printing Office, June 2011.

_____. House. Committee on Intelligence. “To prohibit the Central Intelligence Agency from using an unmanned aerial vehicle to carry out a weapons strike or other deliberately lethal action and to transfer the authority to conduct such strikes or lethal action to the Department of Defense.” 114th Cong., H.R. 466, January 22, 2015. Accessed April 22, 2015. <http://thomas.loc.gov/cgi-bin/query/z?c114:H.R.466>.

_____. House. *Rise of the Drones: Unmanned Systems and the Future of War, Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government*. Serial No. 111-118, 111th Cong., 2nd sess., March 23, 2010. Accessed May 19, 2015. <http://permanent.access.gpo.gov/gpo9194/pt1.pdf>.

_____. House. *Rise of the Drones II: Legality of Unmanned Targeting, Hearing before the Subcommittee on National Security and Foreign Affairs of the Committee on Oversight and Government*. Serial No. 111-120, 111th Cong., 2nd sess., April 28, 2010. Accessed May 19, 2015. <http://permanent.access.gpo.gov/gpo9194/pt2.pdf>.

U.S. Department of State. “U.S. Export Policy for Military Unmanned Aerial Systems.” February 17, 2015. Accessed April 4, 2015. <http://www.state.gov/r/pa/prs/ps/2015/02/237541.htm>.

U.S. President. *National Space Policy of the United States of America*. Washington, DC: Government Printing Office, June 28, 2010. Accessed May 7, 2015. https://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

_____. Presidential Memorandum, “Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems.” The White House, Office of the Press Secretary. February 15, 2015. Accessed April 4, 2015. <https://www.whitehouse.gov/the-press-office/2015/02/15/presidential-memorandum-promoting-economic-competitiveness-while-safegua>.

_____. “U.S. Policy Standards and Procedures for the Use of Force in Counterterrorism Operations Outside the United States and Areas of Active Hostilities.” The White House, Office of the Press Secretary, May 23, 2013. Accessed April 29, 2015. https://www.whitehouse.gov/sites/default/files/uploads/2013.05.23_fact_sheet_on_ppg.pdf.

Journals/Periodicals

Associated Press. “New Nuclear Sub Is Said to Have Special Eavesdropping Ability.” *The New York Times*, February 19, 2005. Accessed May 6, 2015. http://www.nytimes.com/2005/02/20/politics/20submarine.html?_r=0.

Barry, Charles L., and Elihu Zimet. “UCAVs—Technological, Policy, and Operational Challenges.” *Defense Horizons*, no. 3 (October 2001): 1-8. Accessed May 19, 2015. www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA422553.

Bergen, Peter, and Emily Schneider. “The World Needs New Rules for Armed Drones.” *Defense One*, February 24, 2015. Accessed April 4, 2015. <http://www.defenseone.com/ideas/2015/02/world-needs-new-rules-armed-drones/105933/>.

Boyle, Michael J. “The Costs and Consequences of Drone Warfare.” *International Affairs* 89, no. 1 (January 2013): 1-29. Accessed May 19, 2015. <https://www.law.upenn.edu/live/files/1984-costs-and-consequences-of-drone-warfare>.

Byman, Daniel. “Why Drones Work.” *Foreign Affairs* (July/August 2013). Accessed May 5, 2015. <https://www.foreignaffairs.com/articles/somalia/2013-06-11/why-drones-work>

Callam, Andrew. “Drone Wars: Armed Unmanned Aerial Vehicles.” *International Affairs Review*, 18, no. 3 (Winter 2010): Accessed April 4, 2015. <http://www.iar-gwu.org/node/144>.

Coll, Steve. “The Unblinking Stare.” *New Yorker Magazine*, November 24, 2014. Accessed May 5, 2015. <http://www.newyorker.com/magazine/2014/11/24/unblinking-stare>.

Etzioni, Amitai. “The Great Drone Debate.” *Military Review* (March-April 2013): 2-12. Accessed May 19, 2015. http://usacac.army.mil/CAC2/MilitaryReview/Archives/English/MilitaryReview_20130430_art004.pdf.

Freedberg Jr., Sydney J. “China’s (Not So Scary) Drone Army.” *Breaking Defense*, May 11, 2015. Accessed May 12, 2015. <http://breakingdefense.com/2015/05/chinas-not-so-scary-drone-army/>.

- _____. "Secretary Of Drones: Mabus Creates DASD For Unmanned." *Breaking Defense*, April 15, 2015. Accessed April 22, 2015. <http://breakingdefense.com/2015/04/secretary-of-drones-secnav-mabus-creates-deputy-asst-sec-for-unmanned/>.
- Hastings, Michael. "The Rise of the Killer Drones: How America Goes to War in Secret." *Rolling Stone*, April 16, 2012. Accessed April 4, 2015. <http://www.rollingstone.com/politics/news/the-rise-of-the-killer-drones-how-america-goes-to-war-in-secret-20120416>.
- Hu, Jane C. "The Battle for Space." *Slate*, December 23, 2014. Accessed May 7, 2015. http://www.slate.com/articles/health_and_science/space_20/2014/12/space_weap_on_law_u_s_china_and_russia_developing_dangerous_dual_use_spacecraft.single.html.
- Jontz, Sandra. "Taking the Man Out of Future Unmanned Military Systems." *SIGNAL Magazine*, February 1, 2015. Accessed April 29, 2015. <http://www.afcea.org/content/?q=taking-man-out-future-unmanned-military-systems>.
- Koenig, Alexa. "Department of Justice 'White Paper' Full of Contradictions." *U.S. News and World Report*, February 6, 2013. Accessed May 5, 2015. <http://www.usnews.com/debate-club/has-obama-gone-too-far-with-his-drone-policies/departement-of-justice-white-paper-full-of-contradictions>.
- Kraska, James. "The Law of Unmanned Naval Systems in War and Peace." *Journal of Ocean Technology* 5, no. 3 (Fall 2010): 44-68. Accessed May 19, 2015. http://www.thejot.net/?page_id=837&show_article_preview=193.
- Kurtzleben, Danielle. "Think Tank Employees Tend to Support Democrats." *U.S. News and World Report*, March 3, 2011. Accessed April 27, 2015. <http://www.usnews.com/news/articles/2011/03/03/think-tank-employees-tend-to-support-democrats>.
- LaGrone, Sam. "A Terrible Thing That Waits (Under the Ocean)." *Popular Science*, May 19, 2014. Accessed May 7, 2015. <http://www.popsoci.com/blog-network/shipshape/terrible-thing-waits-under-ocean>.
- Lichtenbaum, Peter, and Rachel Stohl. "What Obama's Drone Export Policy Really Means." *Breaking Defense*, February 27, 2015. Accessed April 4, 2015. <http://breakingdefense.com/2015/02/what-obamas-drone-export-policy-really-means/>.
- Melcher, Lieutenant Colonel David F., and Lieutenant Colonel John C. Siemer, U.S. Army. "How to Build the Wrong Army." *Military Review* 72, no. 9 (September 1992): 66-76. Accessed May 19, 2015. https://server16040.contentdm.oclc.org/cdm4/item_viewer.php?CISOROOT=/p124201coll1&CISOPTR=480&CISOBOX=1&REC=2.

- Roff, Heather. "Reigning in the Killer Robot? The DoD's Directive on Autonomous Weapons." *Huffington Post*, June 16, 2013. Accessed May 4, 2015. http://www.huffingtonpost.com/heather-roff/reigning-in-the-killer-ro_b_3094675.html.
- Shane, Scott. "Election Spurred a Move to Codify U.S. Drone Policy." *The New York Times*, November 24, 2012.
- Siddiqui, Sabrina. "Obama Administration Skips Senate Drone Hearing." *Huffington Post*, April 24, 2013. Accessed May 5, 2015. http://www.huffingtonpost.com/2013/04/23/obama-drone-hearing_n_3142144.html.
- Stephens, D. G., and M. D. Fitzpatrick. "Legal Aspects of Contemporary Naval Mine Warfare." In *Loyola of Los Angeles International and Comparative Law Journal* 21, no. 4 (August 1999): 552-590. Accessed May 7, 2015. <http://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1484&context=ilr>.
- Whitman, Edward C. "Unmanned Underwater Vehicles: Beneath the Wave of the Future." *Undersea Warfare*, no. 15. U.S. Navy. Accessed May 4, 2015. http://www.navy.mil/navydata/cno/n87/usw/issue_15/wave.html.
- Tucker, Patrick. "Every Country Will Have Armed Drones Within 10 Years." *Defense One*, May 6, 2014. Accessed April 9, 2015. <http://www.defenseone.com/technology/2014/05/every-country-will-have-armed-drones-within-ten-years/83878/>.
- Zakaria, Tabassum. "U.S. Drone Policy: Obama Seeking To Influence Global Guidelines." *Huffington Post*, May 17, 2013. Accessed May 5, 2015. http://www.huffingtonpost.com/2013/03/17/us-drone-policy-obama_n_2895015.html.
- Zenko, Micah. "Obama's Drone Reforms Don't Apply to 46 Percent of Strikes." *Defense One*, April 27, 2015. Accessed April 28, 2015. <http://www.defenseone.com/threats/2015/04/obamas-drone-reforms-dont-apply-46-percent-strikes/111211/>.

Online Sources

- American Security Project. "The Strategic Effects of a Lethal Drones Policy." Accessed May 5, 2015. <http://www.americansecurityproject.org/asymmetric-operations/the-strategic-effects-of-a-lethal-drones-policy/>.
- Chatham House, The Royal Institute of International Affairs. *International Law Applicable to Naval Mines*. International Security Department Workshop Summary, October 2014. Accessed May 7, 2015. <https://www.usnwc.edu/getattachment/2532931a-d351-4663-a96f-22cb5173c5c4/Chatham-House-Workshop-Summary--International-Law-.aspx>.

- Davin, Mike. "Drones: Brookings Senior Fellow Shares his Thoughts." *The Business of Robotics*, June 20, 2013. Accessed May 20, 2015. <http://www.thebusinessofrobotics.com/military/drones-brookings-senior-fellow-shares-his-thoughts/>.
- Drew, James. "AUVSI: IAI Stresses Big Future for UCAVs." *Flight Daily News*, May 7, 2015. Accessed May 11, 2015. <http://www.flightglobal.com/news/articles/auvsi-iai-stresses-big-future-for-ucavs-412033/>.
- _____. "Report: China Wants Stealthy UAVs along with Fifth-gen Fighters." *Flightglobal*, May 11, 2015. Accessed May 11, 2015. <http://www.flightglobal.com/news/articles/report-china-wants-stealthy-uavs-along-with-fifth-gen-412172/>.
- Elkus, Adam. "Secret Agent Man: How to Think about Autonomy." *War on the Rocks*, May 4, 2015. Accessed May 4, 2015. <http://warontherocks.com/2015/05/secret-agent-man-how-to-think-about-autonomy/>.
- Foust, Joshua. "Soon, Drones May Be Able to Make Lethal Decisions on Their Own." *National Journal*, October 8, 2013. Accessed April 27, 2015. <http://www.nationaljournal.com/national-security/soon-drones-may-be-able-to-make-lethal-decisions-on-their-own-20131008>.
- Galdorisi, George. "The Dark Side of Unmanned Systems Autonomy." *Defense Media Network*, November 21, 2013. Accessed April 27, 2015. <http://www.defensemedianetwork.com/stories/the-dark-side-of-unmanned-systems-autonomy/>.
- Garber, Steve. "Sputnik and The Dawn of the Space Age." *NASA History*, October 10, 2007. Accessed May 7, 2015. <http://history.nasa.gov/sputnik/>.
- Goodman, Amy, and Peter W. Singer. "Wired for War: The Robotics Revolution and Conflict in the 21st Century." Book discussion on *Wired for War*, C-SPAN, February 6, 2009. Accessed April 27, 2015. http://www.democracynow.org/2009/2/6/wired_for_war_the_robotics_revolution.
- Grady, John. "CNAS: Key Questions Remain in Unmanned Systems Realm." *USNI News*, June 12, 2014. Accessed April 27, 2015. <http://news.usni.org/2014/06/12/cnas-key-questions-remain-unmanned-systems-realm>.
- Hayes, Jack, Bibek Pandey, Ed Krauland, Andrew Irwin, Meredith Rathbone, Anthony Rapa, and Alexandra Baj. "US Policy on the Export of Unmanned Aerial Systems (UAS): A Detailed Look and Analysis." Steptoe and Johnson LLP, April 7, 2015. Accessed May 5, 2015. <http://www.steptoelaw.com/publications-10371.html>.
- Human Rights Watch. "Review of the 2012 US Policy on Autonomy in Weapons Systems." April 16, 2013. Accessed May 5, 2015. <http://www.hrw.org/news/2013/04/15/review-2012-us-policy-autonomy-weapons-systems>.

- International Security. "World of Drones." New America. Accessed April 9, 2015. <http://securitydata.newamerica.net/world-drones.html>.
- Keck, Zachary. "China Is Building 42,000 Military Drones: Should America Worry?" *The National Interest*, May 10, 2015. Accessed May 11, 2015. <http://nationalinterest.org/blog/the-buzz/china-building-42000-military-drones-should-america-worry-12856>.
- LaGrone, Sam. "Mabus: F-35 Will Be 'Last Manned Strike Fighter' the Navy, Marines 'Will Ever Buy or Fly'." *USNI News*, April 15, 2015. Accessed May 5, 2015. <http://news.usni.org/2015/04/15/mabus-f-35c-will-be-last-manned-strike-fighter-the-navy-marines-will-ever-buy-or-fly>.
- Majumdar, Dave. "New Bill Calls for Pentagon Unmanned Systems Office." *USNI News*, April 29, 2014. Accessed May 20, 2015. <http://news.usni.org/2014/04/29/new-bill-calls-pentagon-unmanned-systems-office>.
- Malenic, Marina. "Debate over UCLASS Capabilities Increases Programme Risk, Auditors Warn." *IHS Jane's Defence Weekly*, May 4, 2015. Accessed May 11, 2015. <http://www.janes.com/article/51133/debate-over-uclass-capabilities-increases-programme-risk-auditors-warn>.
- Mallapur, Chaitanya. "India Tops List of Drone-importing Nations." *Yahoo News*, May 4, 2015. Accessed May 11, 2015. <http://news.yahoo.com/india-tops-list-drone-importing-nations-045430204.html>.
- Martinage, Robert, and Shawn Brimley. "The Navy's New Museum Drone and Strategic Malpractice." *War on the Rocks*, April 28, 2015. Accessed April 29, 2015. <http://warontherocks.com/2015/04/the-navys-new-museum-drone-and-strategic-malpractice/?singlepage=1>.
- McIntyre, Jamie, and Reuters. "U.S. Missiles Pound Targets in Afghanistan, Sudan." *CNN*, August 20, 1998. Accessed May 4, 2015. <http://www.cnn.com/US/9808/20/us.strikes.01/>.
- Mehta, Aaron. "Bomber, Sixth-Gen Take Cuts in Chairman's Markup." *Defense News*, April 24, 2015. Accessed April 29, 2015. <http://www.defensenews.com/story/defense/policy-budget/budget/2015/04/24/bomber-sixth-gen-fighter-house-chairman-mark/26331555/>.
- Moudy, Adrienne. "Army Tests Putting NERO Electronic Warfare Jammer on UAVs." U.S. Army, July 10, 2014. Accessed May 4, 2015. http://www.army.mil/article/129608/Army_tests_putting_NERO_electronic_warfare_jammer_on_UAVs/.
- National Museum of the Air Force. "Kettering Aerial Torpedo 'Bug.'" U.S. Air Force, March 25, 2014. Accessed April 27, 2015. <http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=320>.

- Naval Air Systems Command. "X-47B First to Complete Autonomous Aerial Refueling." U.S. Navy, April 22, 2015. Accessed April 24, 2015. http://www.navy.mil/submit/display.asp?story_id=86710.
- Oberg, James. "The Dozen Space Weapons Myths." *The Space Review*, March 12, 2007. Accessed May 7, 2015. <http://www.thespacereview.com/article/826/1>.
- Singer, Peter W. "Wired for War." Accessed April 27, 2015. <http://wiredwar.pwsinger.com/>.
- United Nations Office for Outer Space Affairs. "International Space Law." United Nations. Accessed May 7, 2015. <http://www.unoosa.org/oosa/en/SpaceLaw/index.html>.
- U.S. Customs and Border Protection. "Unmanned Aircraft System MQ-9 Predator B Fact Sheet." U.S. Department of Homeland Security, February 6, 2014. Accessed April 22, 2015. <http://www.cbp.gov/document/fact-sheets/unmanned-aircraft-system-mq-9-predator-b-fact-sheet>.
- U.S. President. "Remarks by the President at the National Defense University." The White House, Office of the Press Secretary. May 23, 2013. Accessed April 9, 2015. <https://www.whitehouse.gov/the-press-office/2013/05/23/remarks-president-national-defense-university>.
- Zarocostas, John. "Arms Control Advocates Rally to Prevent Development of Killer Robots." McClatchyDC, May 11, 2015. Accessed May 12, 2015. <http://www.mcclatchydc.com/2015/05/11/266271/arms-control-advocates-rally-to.html>.
- Zenko, Micah. "10 Things You Didn't Know About Drones." *Foreign Policy*, February 27, 2012. Accessed April 27, 2015. <http://foreignpolicy.com/2012/02/27/10-things-you-didnt-know-about-drones/>.
- _____. "The Great Drone Contradiction." *Foreign Policy*, February 19, 2015. Accessed April 4, 2015. <http://foreignpolicy.com/2015/02/19/the-great-drone-contradiction-unmanned-aircraft-systems/>.

Papers/Reports

- Brannen, Samuel J. *Sustaining the U.S. Lead in Unmanned Systems: Military and Homeland Considerations through 2025*. Washington, DC: Center for Strategic and International Studies, 2014. Accessed April 4, 2015. http://csis.org/files/publication/140227_Brannen_UnmannedSystems_Web.pdf.

- Callaghan, Donald C. "Everyone Has an Unmanned Aircraft: The Control, Deconfliction and Coordination of Unmanned Aircraft in the Future Battlespace." Master's Thesis, Army Command and General Staff College, Fort Leavenworth, KS, 2007.
- Davis, Lynn E., Michael J. McNerney, James S. Chow, Thomas Hamilton, Sarah Harting, and Daniel Byman. *Armed and Dangerous? UAVs and U.S. Security*. Santa Monica, CA: Rand Corporation, 2014. Accessed May 5, 2015. http://www.rand.org/pubs/research_reports/RR449.html.
- Green, Damian A. "The Future of Autonomous Ground Logistics: Convoys in the Department of Defense." Monograph, School of Advanced Military Studies, Fort Leavenworth, KS, 2011.
- National Security Research Division, Rand Corporation. "Dispelling Myths About Armed Drones." Rand Corporation. Accessed May 5, 2015. <http://www.rand.org/nsrd/projects/armed-drones.html>.
- Schwing, Richard P. "Unmanned Aerial Vehicles—Revolutionary Tools in War and Peace." Strategy Research Project, U.S. Army War College, Carlisle Barracks, PA, March 30, 2007.
- Walker, Scott W. "Integrating Department Of Defense Unmanned Aerial Systems into the National Airspace Structure." Master's Thesis, Army Command and General Staff College, Fort Leavenworth, KS, 2010.