REMTELY PILOTED AIRCRAFT: EVOLUTION, DIFFUSION, AND
THE FUTURE OF AIR WARFARE

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Abstract

In the realm of air warfare, no topic has generated more controversy or discussion in recent years than the implications of the increased use and proliferation of remotely piloted aircraft (RPAs). This dissertation seeks to build on existing models of technology, diffusion, and doctrine to examine the present and future role of RPAs in warfare. To do so, I place RPAs in the context of a broader Revolution in Military Affairs (RMA), evaluating their effectiveness relative to other capabilities, modeling their likely diffusion and evolution, and examining the legal implications for conflict. I conclude many of the challenges posed by RPAs will be different than the current debate suggests, with issues like automation the laws of targeted killing being secondary to understanding the distinctions between tactical and strategic RPAs and the potential for escalation of conflict based on limited understanding of the true capabilities of the RPA. Strategic RPAs are revolutionary in their impact to small wars, but are unlikely to diffuse widely given the limited strategic requirements for this type of warfare and the high financial and organizational costs of building such systems. Tactical RPAs will spread globally and rapidly, but will be limited in their military application and are more likely to be problematic for their misuse than for the new capabilities they provide. This perspective will provide policymakers a framework for better understanding both the strengths and limitations of RPA warfare, and outline basic planning considerations for future wars based on the spread of this technology as well as institutional obstacles to diffusion posed to states, including the U.S.
Preface

In 2000, then-U.S. Air Force Col Tom Ehrhard published a dissertation evaluating the history of Remotely Piloted Aircraft (RPAs) for the purposes of gaining broader understanding of the nature of weapons system developments. His work, cited frequently in my own dissertation, is considered by many airpower scholars to be the definitive work on the history of RPAs within the United States. Among his findings were the argument that “the US defense establishment, led by the intelligence community, the Air Force, and the Army, has over-spent on UAV development” given the weaknesses of RPAs compared to manned airframes, and that given the trajectory of weapons system development and alternative airframes it would likely be years before RPAs were employed as weapons systems (Ehrhard T. P., 2000, p. 578). Later that year, Predator would launch its first hellfire missile in a test environment and in November of the following year it would see its first operational strike in Afghanistan, ushering in the ‘drone war’ era.

This is not to critique Dr. Ehrhard, who remains an authority on airpower and RPAs specifically, but merely to illustrate the challenges of prediction given the clandestine nature of military programs and the complexity of the dynamic security environment which drives the process of innovation. Despite this complex environment, policy-relevant research in the social sciences must be able to make basic predictions to enable the policymaking process, through open research detailing the underlying assumptions and models guiding the process. In this spirit, this dissertation presents a number of scenarios for both the spread of RPAs and the evolution of airpower doctrine given recent trends. In fifteen years, these predictions may run
into the same challenges that Dr. Ehrhard’s did in 2000, due I hope to changes in the underlying security environment which has spurred their development.

Many individuals have helped me to get to this point, beginning first and foremost with my family. My loving wife Ruthie and children Mikey, Rebecca, and Sarah have made numerous sacrifices over the years both in my military career and in my three years at Princeton, and I can only strive to spend the rest of my lie making it up to them. To my parents, who were my first teachers and always there to support me in my endeavors, through the numerous ups and downs, and to my extended family, I give great thanks for their help in achieving this goal.

I am greatly indebted to the faculty of both the Woodrow Wilson School and the Department of Politics at Princeton University, who have been tremendously supportive of my work and professional development throughout my tenure. My committee and contributors, Aaron Friedberg, Tom Christensen, Wolfgang Danspeckgruber, Jacob Shapiro, and Michael O’Hanlon have been invaluable to the process. Aaron and Tom have worked closely with me since the day I entered Princeton, helping to ensure I could navigate the advanced Political Science curriculum given my history background while never shying away from giving me direct advice (Tom’s pointed questioning during General Examinations will be remembered by myself and my associates long after the content of this dissertation is forgotten by all). Wolfgang and the staff of the Liechtenstein Institute on Self Determination never failed in his enthusiasm for the topic and assistance in publishing and distributing my work.

Coming to Princeton would not have been possible without the support of a number of a number of individuals within the Air Force who went above and beyond to facilitate my tour at this institution. I am most indebted to my former commanders, Brigadier General Thomas Geary and Colonel JohnDavid Willis, who were critical to the approval of my admissions package and
navigating the assignments process to assure it became a reality. I also could not forget to thank for his mentorship and support in this process Lieutenant Colonel Andrew “Dixie” Cupp, who sadly died of cancer one year after I entered the program.

I also would be remiss not to thank the countless individuals who have shaped my intellectual and professional development over the years, from the numerous exemplary educators I have had over the years, to my military comrades in 11th Air Force, the 17th Training Wing, the 25th Infantry Division G-2 Staff in Iraq 2007, and the CGOs, civilian, and enlisted personnel of the Kapisa Provincial Reconstruction Team. Too many have aided over the years, but in particular I would like to acknowledge the contributions of Trevor Albertson, Steve Aufrecht, Dave Blair, Lieutenant General David Deptula, Dana Deree, Mike Evans, Abigail Friedman, Sam Gardiner, Jeanne Heidler, Ron Kasten, Chris Kidd, Darrick Lee, Deborah Pearlstein, Greg Protasel, Christine Roe, Tyrone Sadler, Kim S REPPELE, Vance Skarstedt, Steve Stedman, David “Jake” Timm, Grant Weller, among the many over the years who have helped shape my perspectives.

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Michael P. Kreuzer

August 2014
To my wife and children
# Table of Contents

Abstract .......................................................................................................................... iii

Preface ............................................................................................................................. iv

Chapter 1: Introduction ................................................................................................. 1

  - Modeling the RPA Innovation – Argument in Brief .............................................. 5
  - Key Concepts of the Targeting Revolution ............................................................ 11
  - The Platform vs. the System .............................................................................. 11
  - The Revolution in Military Affairs .................................................................... 13
  - Automation and Autonomy ............................................................................... 18
  - Implications of RPAs ......................................................................................... 19
  - Cost Effectiveness of RPAs ............................................................................... 20
  - Military Effectiveness of RPAs ......................................................................... 21
  - The Diffusion of RPAs ...................................................................................... 26
  - The Future of RPAs .......................................................................................... 30
  - What this Work is, and What it is Not ............................................................... 35
  - The Way Ahead .................................................................................................. 36

Chapter 2: The Evolution of the RPA ......................................................................... 40

  - Early RPAs as ISR platforms ........................................................................... 42
The Information Revolution ........................................................................................................... 45
The Precision Revolution .................................................................................................................. 50
The Robotics Revolution and Modern RPAs .................................................................................. 59
Strategic vs. Tactical RPAs ............................................................................................................ 62
Arming the Predator ......................................................................................................................... 65
Tactical Attack RPAs – Task Force ODIN .................................................................................... 71
Experimental, Developmental, and Recently Cancelled Programs .............................................. 75
Automation and Autonomy ............................................................................................................. 79
Understanding the Move to RPAs to Date ..................................................................................... 87
Summary ........................................................................................................................................ 89

Chapter 3: The RPA and the Targeting Revolution ................................................................. 91

Military Innovations and Revolutions in Military Affairs ................................................................ 94
The Revolution in Military Affairs Debate ..................................................................................... 99
Technological Revolutions, RPAs, and the Targeting Revolution ................................................. 106
The Limits of RPAs and the Targeting Revolution ........................................................................ 114
The Evolution of Air Warfare and the Targeting Revolution ........................................................ 116
Total War and Great Power Conflict – Coercion and Deterrence .............................................. 118
Limited War - Industrial Web and Warden’s Rings ..................................................................... 124
The Dilemma of Airpower in Small Wars ..................................................................................... 134
Kill or Capture – Human Targeting and Airpower in Iraq and Afghanistan ............................... 143
<table>
<thead>
<tr>
<th>Chapter 6: Diffusion of RPAs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption-Capacity Theory</td>
<td>295</td>
</tr>
<tr>
<td>State-Level Drivers of Adoption</td>
<td>301</td>
</tr>
<tr>
<td>Case 1: Aircraft Carriers</td>
<td>305</td>
</tr>
<tr>
<td>Case 2: Cruise Missiles</td>
<td>314</td>
</tr>
<tr>
<td>Predicting the Diffusion of RPAs</td>
<td>325</td>
</tr>
<tr>
<td>Summary</td>
<td>330</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 7: Present and Future RPA Trends in Military Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic RPAs in Limited Wars</td>
</tr>
<tr>
<td>Problems with Current RPAs and the ‘Libya Model’ – The Syria Case</td>
</tr>
<tr>
<td>UCAVs and Future RPA Employment in Limited Wars</td>
</tr>
<tr>
<td>Tactical RPAs in Limited Wars and Small Wars</td>
</tr>
<tr>
<td>Swarm Tactics</td>
</tr>
<tr>
<td>Support Roles for RPAs</td>
</tr>
</tbody>
</table>
Tactical RPAs in Action Today - Middle East & Caucasus Scenarios and Implications .......................... 351

Strategic RPAs and Near-Peer Competitors .......................................................................................... 356

Envisioning Possible RPA Roles in Southeast Asia .............................................................................. 361

The RPA and the Nation-State – Domestic Roles of RPAs ................................................................. 367

Final Thoughts ...................................................................................................................................... 370

Appendix 1: RPA Database Comparison, 2006-2009 ................................................................. 376

Appendix 2: Terrorist Plots in U.S. After 9/11/2001 ....................................................................... 379

Appendix 3: Link Analysis of al Qa’eda Organization ................................................................... 381

Appendix 4: The World’s Aircraft Carriers ..................................................................................... 382

Appendix 5: List of Cruise Missiles by Country .............................................................................. 383

Appendix 6: RPA Diffusion ................................................................................................................. 385

Bibliography ......................................................................................................................................... 387
## Figures

- Figure 1: Application of Airpower across the spectrum of conflict and target sets ................................................. 8
- Figure 2: Possible Future RPA Missions in Targeting Revolution Matrix ................................................................. 32
- Figure 3: D-21 mounted on M-21 (modified A-12) ........................................................................................................ 43
- Figure 4: Four sector aggregation of the U.S. workforce, 1860-1980 (Bell, 1981, p. 521) ........................................ 48
- Figure 5: U.S. RPA Development ......................................................................................................................................... 61
- Figure 6: Strategic vs. Tactical RPAs ............................................................................................................................... 63
- Figure 7: U.S. Army Roadmap for RPA Intelligence Operations ....................................................................................... 64
- Figure 8: Number of RPA Strikes by Year/Country ........................................................................................................... 69
- Figure 9: Autonomous Profile of RQ-4 Global Hawk (Bellissimo, 2010, p. 18) ............................................................. 83
- Figure 10: DoD Framework for the Design and Evaluation of Autonomous Systems ..................................................... 85
- Figure 11: Autonomy Levels for Unmanned Systems Metrics .......................................................................................... 86
- Figure 12: Warden's Rings (Smith R. J., 1999) .................................................................................................................. 127
- Figure 13: System of Systems Analysis .......................................................................................................................... 130
- Figure 14: Targeting Cycle Phases and Notional Air Tasking Cycle ............................................................................ 130
- Figure 15: Surface and Subsurface Elements of an Insurgency ...................................................................................... 144
- Figure 16: F2T2EA Process ............................................................................................................................................. 149
- Figure 17: Sample "Baseball Card" ................................................................................................................................. 155
- Figure 18: Predator/Reaper Manning .............................................................................................................................. 169
- Figure 19: Factors Influencing RPA-Based Solutions ................................................................................................... 219
- Figure 20: Comparison of Global Hawk Flight Characteristics ..................................................................................... 221
- Figure 21: Size comparison of RQ-4 Global Hawk with U-2 and Boeing 737 .............................................................. 222
- Figure 22: RQ-4 Control and Communications Infrastructure .......................................................................................... 224
Figure 23: USAF Class-A Mishaps, 2001-2012 ................................................................. 225
Figure 24: Class A or B Mishaps per 100,000 hours comparison ............................ 226
Figure 25: US RPA Procurement ............................................................................... 227
Figure 26: Afghanistan Airstrike Civilian Casualties ............................................... 249
Figure 27: Source of Afghan Civilian Casualties ......................................................... 249
Figure 28: Attempted Islamist attacks and plots against the U.S ............................ 258
Figure 29: Suicide attacks in Afghanistan & Pakistan versus RPA strikes in Pakistan .... 261
Figure 30: FATA - RPA Strikes vs. Blame for Suicide Bombings in Pakistan .............. 263
Figure 31: RPA Strikes vs. 'FATA's Biggest Problem' .............................................. 265
Figure 32: Yemeni Terrorist Attacks vs. RPA Strikes .............................................. 268
Figure 33: Targeting Challenge in Small Wars ......................................................... 272
Figure 34: Potential State Responses to Major Military Innovations ......................... 297
Figure 35: States Employing Aircraft Carriers ......................................................... 313
Figure 36: Cruise Missile Proliferation ...................................................................... 320
Figure 37: The Diffusion of RPAs .............................................................................. 327
Figure 38: Syrian Surface-to-Air Missile Systems .................................................. 338
Figure 39: Swarm and Cloud simplified CONOP ..................................................... 340
Figure 40: Adversary Reactions to Leadership Targeting ......................................... 345
Figure 41: Constraints on Targeting Beyond Technology ......................................... 360
Tables

Table 1: Diffusion of RPAs ................................................................. 27
Table 2: U.S. Bomb and Missile Development ........................................ 52
Table 3: Bombing Accuracy from World War II to Gulf War ...................... 53
Table 4: Expenditure of Precision Guided Munitions by Conflict ................. 54
Table 5: Comparison of select 1,000lb bombs in U.S. inventory .................... 56
Table 6: Levels of Automation ................................................................ 81
Table 7: Potential strategies for kinetic targeting across spectrum of conflict .... 93
Table 8: Krepinevitch’s Revolutions in Military Affairs ............................... 96
Table 9: Horowitz’s Major Military Innovations .................................... 98
Table 10: Application of Warden’s Rings .............................................. 129
Table 11: Warden’s Rings and Insurgent Organizations ............................. 145
Table 12: Means of Targeting Insurgent Organization ............................... 147
Table 13: Model for Air Campaign Planning Across Spectrum of Conflict .... 157
Table 14: Distribution of USAF General Officer Billets ............................ 183
Table 15: The Pyramid of Honor .......................................................... 191
Table 16: Examples of U.S. RPAs ........................................................ 216
Table 17: U-2/RQ-4 Cost Comparison ................................................... 222
Table 18: Civilian Casualties from Afghanistan RPA strikes versus all airstrikes .. 250
Table 19: BIJ Reports on Civilian Casualties in Yemen ............................... 252
Table 20: Financial Intensity Drivers ...................................................... 298
Table 21: Adoption-Capacity System-Level Diffusion Predictions ............... 300
Table 22: Strategy for Adoption Based on Adoption Capacity Theory ......... 304
Table 23: Horowitz's Distribution of Aircraft Carriers (Horowitz M. C., 2011, p. 80) .................. 308

Table 24: Current Distribution of True and Assault Aircraft Carriers ........................................... 311

Table 25: Variation in Capacity for Carriers .................................................................................... 311

Table 26: Cruise Missiles .................................................................................................................. 322

Table 27: Diffusion pattern of cruise missiles .................................................................................. 323

Table 28: Predicted Rate of Diffusion of Tactical and Strategic RPAs ............................................ 326
Chapter 1: Introduction

In the early morning hours of November 4, 2002, an American crew operating from an undisclosed location carried out a mission deemed critical to the U.S. war on terrorism. That day, operating an aircraft in Yemeni airspace, they launched a Hellfire missile at a vehicle they and other U.S. intelligence assets had been monitoring. The target was Qaed Sinan al-Harethi, a key suspect in the 2000 bombing of the U.S.S. Cole who U.S. diplomats had been lobbying Yemeni officials to apprehend for the preceding months. Killed along with him were five other suspected al Qa’eda operatives, to include Kamal Derwish, an unindicted co-conspirator in the Cole bombing and an American citizen. In what Deputy Defense Secretary Paul Wolfowitz would call "a very successful tactical operation," the United States had opened a new front in the War on Terror using one of the newest weapons in its air inventory, the armed Remotely Piloted Aircraft (RPA).

The 2002 strike was not the first operational use of the Hellfire-armed Predator RPA, as a 2001 strike in Afghanistan demonstrated the capability in a combat zone (though it was not acknowledged to be an RPA strike at the time). Nor was it the only operation involved in what today is classified as a ‘targeted killing,’ as manned aircraft such as AC-130 gunships and cruise missiles had previously been used for such missions. However, the location of the strike far from military operations in Afghanistan, the U.S. claims of credit for the strike against opposition from the Yemeni government,¹ and lack of clarity over whether the strike was

¹ U.S. Diplomats in Yemen had arranged meetings in the preceding months with Yemeni tribal leaders hoping to arrange the hand-over of al-Harethi and Ambassador Hull had been maintaining contact with the Yemeni government in the run-up to the strikes. Yemen, however, was concerned for matters of internal security and
conducted by the military or another government agency combined to present a number of questions over the character of the war being waged by the United States and its implications for future warfare. In the years immediately following the attacks of September 11th 2001 and in the run-up to another potential war in Iraq, this attack drew scant attention and was largely seen as the triumph of America’s new pre-emptive military posture towards terrorism. As time has passed and the RPA has moved to a central position in U.S. counterterrorism operations beyond clearly defined war zones in places like Afghanistan and from tactical to strategic strikes, the questions surrounding the merits and dangers of RPA warfare have grown significantly.²

In the realm of air warfare it is likely that no topic has generated more controversy or discussion in recent years than the implications of the increased use and proliferation of RPAs. The increased reliance on RPAs by the United States for attack missions in Pakistan and Yemen has generated intense debate in legal and military communities over the legal and ethical implications of these systems, while the proliferation of RPAs has expanded from 41 countries in 2005 to 76 in 2011 generating concern for future impacts in air war (UK, 2012). Critics have questioned whether the increased safety of warfighters afforded by RPAs to the risks of combat has increased the likelihood that policymakers will prematurely move toward war to achieve a desired policy outcome,³ and whether their use outside of designated war zones is disapproved of the U.S. openly claiming credit for the attack and had disapproved of what they saw as diplomats “freelancing” inside Yemen trying to buy-off tribal leaders (Smucker, The intrigue behind the drone strike, 2002).² News reporting at the time from CNN to the Christian Science Monitor note critiques from Yemen and list other RPA operations that had been launched in Afghanistan, but few articles immediately following the strike suggest domestic opposition. One CBS story with an AP byline notes the divide at the time from the Human Rights community, with Amnesty International rejecting the killing as unlawful while Human Rights Watch said it was acceptable as a wartime act (Officials: American al-Qaeda can be targeted and killed, 2002). See, Sources: US Killed Cole Suspect (2002), Risen and Santora (2002), and Smucker (2002) for other examples of reporting at that time. All recent reporting over current RPA strikes I have reviewed prominently discusses critiques of the strategy.³ Examples are highlighted in a British Defense Ministry study from 2011, which poses the question “If we remove the risk of loss from the decision-makers’ calculations when considering crisis management options, do we make the use of armed force more attractive? Will decision-makers resort to war as a policy option far sooner than
counterproductive by serving as a source of recruitment for terrorist organizations. Simon Jenkins summarizes this at the extreme, saying “The greatest threat to world peace is not from nuclear weapons and their possible proliferation. It is from drones and their certain proliferation (Jenkins, 2013).” Others, meanwhile, have argued for the virtues of RPAs and their potential for uses in other conflicts beyond the war on terror. Anne-Marie Slaughter, a proponent of U.S. intervention in Syria, argued in January 2014 “if he (Pres. Obama) is willing to contemplate using force against Al Qaeda without international authorization in the future, why not use drones now to strengthen the moderate Syrian opposition and force Assad into serious negotiations?”

Similar debates over the role of technology and its dangers and potential have occurred throughout history as advances in technology have been perceived to dehumanize warfare, increase standoff range, and elevate strategic decision making to policymakers far removed from the horrors of the battlefield. The English long bow, cavalry, and the airplane among other innovations served to extend the standoff range of weapons systems and increasingly created the perception of dehumanizing the adversary, leading to questions on the morality of such weapons in war. As these innovations rapidly spread throughout the international system, advocates and critics alike saw the potential for revolutions in warfare that would change the underlying nature of conflict. The rapid pace of technological change post-World War II has magnified this debate, especially within the context of U.S. grand strategy. The Cold War era saw the rise of

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previously? which is in turn repeated in John Sifton’s Feb 2012 article on the history of drone warfare (Sifton, A Brief History of Drones, 2012).
4 In the Second Lateran Council of 1139, the Catholic Church declared “We prohibit under anathema that murderous art of crossbowmen and archers, which is hateful to God, to be employed against Christians and Catholics from now on (Second Lateran Council, 1139).” Similarly, in the 1600s, Cervantes noted “the devilish invention of artillery (enables a)...base cowardly hand to take the life of the bravest gentleman...a chance bullet, coming nobody knows how or from whence, fired perchance by one that fled affrighted at the very flash of his villainous piece, may in a moment put a period to the vastest designs... (Fuller, 1945, 1998, pp. 91-92).” See also Rosa Brooks for additional discussion of historic complaints against other innovations (Brooks, What’s Not Wrong With Drones?, 2012).
ballistic missiles and cruise missiles and with it the fulfillment of the vision of early airpower theorists who foresaw scenarios where bombs would be able to penetrate any defensive system, and in so doing to threaten the vital centers of an adversary to deter or swiftly end hostilities. The late Cold War saw further innovations in precision strike both for conventional bombs and cruise missiles, enabled by lasers, GPS, and other technological systems. Today, RPAs continue this trend of extending the range of U.S. firepower far beyond the range of an adversary’s ability to counter, virtually eliminating the risks of combat posed to operators.

The RPA innovation comes at a time of increased visibility of advanced technology’s impact on warfare, from the prospect of cyber-attack as a new domain for warfare, to the role of technology in the intelligence collection and analysis process – what some have labeled “big data” (Cukier & Mayer-Schoenberger, 2013). U.S. demonstrations of the impact of precision-guided munitions by the United States during the 1990s in conflicts from the Gulf War (1991)\(^5\) to conflicts in Yugoslavia and the War on Terror have fueled interest in precision weapons throughout the world, and the late 2000s saw a dramatic increase in the proliferation of cruise missile technology and similar advanced systems.\(^6\) As proponents extol the value of persistent air presence in combat zones, the potentially lower costs of operations, and the decrease risk to American operators, critics question the potential for increased collateral damage due to increased strike frequency, the potential for ‘blowback’\(^7\) from air strikes, and the precedents set for international norms generated by the U.S.’s use of RPAs in executing the War on Terror.

\(^5\) Hereafter all references to the ‘Gulf War’ refer to the 1991 conflict.
\(^6\) This is an area where the military and policy communities diverge in interpretation, as military awareness of the role of PGMs received broad recognition in 1982 as a result of the Falklands War amplified by the Bekaa Valley operation. By 1988, Iraq was using PGMs as preferred munitions, while the U.S. shifted to a PGM-dominated force in the late 1990s. The military has also long placed cruise missiles in a separate category until recently, while policy-oriented literature tends to blur the two categories.
\(^7\) Blowback is defined here as an increase in opposition to military operations resulting from the violence caused by those operations. The principle argument of RPA opponents is that blowback from strikes is sufficiently large to offset any strategic gains from those airstrikes.
Critics and advocates alike have posed the question of how these technologies should be employed, how they will spread to other nations, and how the international community should respond to the prospect of RPA proliferation.

**Modeling the RPA Innovation – Argument in Brief**

The central aim of this dissertation is to serve as a significant study on the role of RPAs in warfare as they exist today, and make basic projections on how other states will adopt RPAs in the future. At the core of this work is the goal of answering a broad, underlying research question: *How will the RPA innovation impact military strategy and international security?* My goal is to provide policymakers a framework for better understanding the strengths and limitations of RPA warfare, and outline basic planning considerations for future wars based on the projected spread and innovations of this technology. This will entail understanding the technological, organizational, and doctrinal strengths and limitations of fielding such weapons, both for the U.S. and foreign powers. Further, such an approach will extend knowledge of the diffusion of technology by applying and modifying existing models for the diffusion of technology and military power, organizational change, and the employment of strategic airpower as applied to the case of RPAs to enhance the academic literature on this policy-relevant, highly charged debate. Most current diffusion literature examines the rate of spread of power and technology throughout the system, this study will reverse that process to examine the likelihood of individual states to adopt technologies.

From the time of their emergence as a key tool in the U.S. War on Terrorism in 2007, RPAs have been central to an ongoing debate on the role of technology in modern warfare. Some, from the writers of Wired Magazine to noted author P.W. Singer, have spoken of RPAs as
revolutionary in terms of their implications for warfare, envisioning a world where humans are effectively removed from the decision-making process of many aspects of future wars and advanced technology nations are increasingly insulated from paying the cost of war in blood, and possibly treasure given what they see as the low cost of RPAs. If these forecasts are accurate, the RPA may become a destabilizing technology susceptible to rapid proliferation as predicted by Michael Horowitz, which could lead to increases, rather than decreases in warfare and human suffering.

I reach a largely different conclusion. The RPA, rather than a revolution by itself, represents the latest of a series of new innovations that are part of a larger Revolution in Military Affairs (RMA) for airpower, which I refer to as the targeting revolution. As a result, their impact is likely to be far more modest than many observers believe. Removing the pilot from the aircraft serves two improvements over traditional aircraft which affect the utility of RPAs. First and most readily apparent, they reduce the risk to the operator. Second, they increase the duration of flight for RPAs, allowing for ‘persistent’ operations. The reduced risk to operators increases the utility of the RPA for missions which are categorized as ‘dirty’ or dangerous, where the aircraft can be built small and expendable to use in primarily a tactical environment. These RPAs, tactical RPAs,\(^8\) will proliferate widely and rapidly, but will not fundamentally revolutionize the system of warfare. Instead, they will largely complement existing capabilities such as intelligence collection, fire support, and resupply within existing military systems.

\(^8\) Strategic and Tactical are difficult terms as a key principle of targeting is that the nature of the target, rather than the platform, dictates whether a mission is tactical or strategic. I define these terms related to RPAs based on their control mechanisms, which is closely correlated to their range and generally their mission sets. An RPA controlled by line-of-sight is a tactical RPA, whereas one controlled by a global communications network such as satellites and data link is a strategic RPA. The division between two classes simplifies the process for the purposes of this dissertation but, as with aircraft in general, RPAs can be further subdivided into a great variety of classifications. For instance, the U.S. Army subdivides their RPAs into five classes, while other scholars have separated ‘micro RPAs’ from tactical RPAs. Those distinctions have implications for tactics but are unlikely to be as significant for questions of diffusion and stability.
Strategic RPAs, which are large and expensive and capable of operating at great distances from the operator, will be more revolutionary owing to the trait of persistence in uncontested airspace, or ‘dull’ missions. These RPAs, such as Predator and Reaper, will revolutionize small wars\(^9\) and limited wars following the establishment of air superiority by enabling strategic bombing against non-fixed targets such as individuals. This had previously been nearly impossible due to the ‘classic’ limitation of airpower, the transient nature of aircraft. The persistent characteristic of RPAs, their on-board sensors and links to a global network of real-time intelligence collection and analysis, and precision munitions either on-board or carried by other networked assets combine to overturn this limitation.

Understanding the implications of RPAs requires an understanding of the targeting revolution, and how RPAs fit within the system. The targeting revolution is ultimately the culmination of two revolutions: the nuclear revolution and the information revolution. The nuclear revolution, however, stands to a large extent as independent of the targeting revolution in that its impact was broader than just military strategy, but to a higher political domain. The innovations of the information revolution pertain to air warfare almost wholly in the military domain, enabling military strategies focused on military and leadership targets in limited wars and small wars. From an operations standpoint, this is where the targeting revolution has its greatest impact. The first phase of the information revolution, focusing on speed and precision, was most applicable against fixed and defended targets such as would be the case with state actors in limited wars. Overcoming these obstacles has been the primary focus of airpower development since the introduction of aerial warfare. The second phase, brought about with the

\(^9\) This term denotes wars generally of a non-international character, to include counterterrorism, counterinsurgency, and other conflicts that involve the use of kinetic force but are not fought between nation states. Other terms, such as ‘non-international conflict’, are used to describe these conflicts when the relevant literature, such as the legal literature, standardizes that language.
RPA, enables persistent coverage in controlled airspace, which is most applicable to small wars and ‘Phase 4’ operations\textsuperscript{10} where targets are non-fixed but generally undefended from air attack. Controlled airspace is vital to enabling this system of warfare, as the characteristics of persistence which enables the RPA also would make it highly vulnerable to a state with an advanced air defense system.

**Figure 1: Application of Airpower across the spectrum of conflict and target sets**

<table>
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<tr>
<th>Spectrum of Conflict</th>
<th>Range of Target Sets</th>
<th>Enabling revolution</th>
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<tr>
<td>Total Wars</td>
<td>Population: Nuclear Deterrence</td>
<td>Nuclear Revolution</td>
</tr>
<tr>
<td>Limited Wars</td>
<td>Military: Cruise missiles, stealth, PGMs</td>
<td>Targeting revolution, Phase 1 (1990s)</td>
</tr>
<tr>
<td>Small Wars</td>
<td>Leadership: Strategic RPAs, ‘Reachback’ support</td>
<td>Targeting Revolution, Phase 2 (2000s)</td>
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Figure 1 illustrates this perspective of the utility of kinetic air power across the spectrum of warfare against potential categories of targets. Building on the works of Robert Pape and the counterinsurgency literature of David Kilcullen among others, I find the optimum targeting strategy for a state actor is against military forces and support networks, while kinetic operations against non-state actors is likely to be most effective against key leadership. As the intensity of a conflict shifts from major international wars between great powers through limited wars and

\textsuperscript{10} This would include the latter phases of a limited war such as Iraq after the fall of Saddam Hussein in 2003, where the potential state actor threat still remained but their traditional military assets have been destroyed making the problem set appear more like a civil war or failed state.
ultimately civil strife, the targets shift first toward military targets alone to keep conflicts limited, and ultimately to leadership targeting as military forces are increasingly difficult to differentiate and as the objective is to eliminate a competing claim to legitimacy. Within this structure, the revolutionary aspects of the RPA are applicable solely to the lower right corner, as small wars occur in permissive air environments which allow for persistent operations, the unique capability provided by strategic RPAs.¹¹

The information revolution produced three sub-revolutions critical to the development of RPAs, referred to in other texts as technological revolutions themselves – the microprocessor, precision, and robotics. Each of the three innovations of the information revolution provides technologies enabling weapons systems, communication, and targeting which combine to enable global network-centric warfare. These include a series of innovations such as GPS, cruise missiles, stealth, and communications infrastructure enabling ‘reachback’ intelligence processing. The RPA represents a new innovation with the potential to synergize these other capabilities with a persistent loiter capability over a target area sufficient to overcome the transient nature of aircraft which has historically been the key barrier to airpower in small wars. Thus, the targeting revolution can be seen as impacting war at all levels of conflict, but the RPA will be limited for the foreseeable future as a game-changing technology to the lower levels of the spectrum of conflict once air superiority is established.

Once the nature of the RPA’s role within the broader targeting revolution is clarified, the implications for the future of warfare can be more easily understood. Strategic RPAs that are

¹¹ Differentiating RPAs by class is difficult as the model of Network-Centric Warfare emphasizes effects over platforms, thus the same platform can be either tactical or strategic dependent on the nature of the target. For the purposes of this book, strategic RPAs are those that are designed for use independent of a fielded force, both for area surveillance and targeting of opposing forces, command hierarchies, high-value targets, and infrastructure. Tactical RPAs are smaller aircraft designed to be used in conjunction with fielded forces within a conventional battlespace.
potentially revolutionary will be limited in their proliferation as few countries have the strategic requirement to employ such an aircraft in small wars,\textsuperscript{12} while tactical RPAs will spread rapidly but ultimately have a more minor impact as they do not change the underlying system of warfare, described by Biddle as the Modern System, and they will be readily available to both sides of conflicts. Rather than thinking of all RPAs as being akin to global systems like strategic missiles, it is easier to think of strategic RPAs like strategic bombers (which few countries adopted) and tactical RPAs like attack helicopters. The adoption of the former by a state has significant implications for the international system, the adoption of the latter is relatively minor for the system as a whole but a key consideration for states at the tactical to operational level. Emerging strategic RPAs with maritime capabilities have the potential to be revolutionary in the conduct of naval operations particularly in peacetime operations, but the true effects of maritime RPAs are reliant on developmental systems that have yet to be demonstrated.

As this work is focused on a broad policy problem rather than a unique puzzle, I apply multiple models from a variety of disciplines to shed greater light on the diffusion and potential future roles of RPAs. Examining the spread of RPAs requires first understanding their utility in warfare – what is the RPA innovation and what does it really mean in the broader context of modern warfare. To this point, the bulk of studies and other literature surrounding RPAs show a focus on the tactical utility of the U.S. campaigns in Afghanistan, Pakistan, and Yemen from a military standpoint while policy discussions have focused around the legality of operations and the impact of proliferation, generally with an ominous undertone. In both cases, the primary focus of study is the technology itself, with other factors surrounding the employment of RPAs

\textsuperscript{12}Lt Gen David Deptula (USAF-R) indirectly noted this strategic requirement in discussing the overall cost of the U.S. defense budget, saying “I hear people talk about, well you know, the U.S. military spends more money than the next 17 nations combined. Well, the next 17 nations combined are not committed to maintaining peace and stability around the world. We are (Bluey, 2012).” The lower right corner represents those peace and stability operations, which is a mission set limited mainly to the U.S. and allies.
largely looked at in a secondary role. This study starts with the impact of the RPA on military systems first through the lens of the Revolution in Military Affairs literature, placing doctrine and employment as the priority over the focus on the technology.

**Key Concepts of the Targeting Revolution**

Throughout this volume, I use a number of terms and concepts which are controversial and involve disputed definitions. This section is designed to wade through both those definitions and concepts to explain my choices for the terminology and how they fit into the broader discussion of RPAs, beginning with my choice for the term RPAs above other commonly used terms. First and foremost is the term RPA itself.

**The Platform vs. the System**

I use the phrase RPA in place of alternative designations, such as unmanned aerial vehicles (UAVs) or drones, to emphasize both the human element at work in the operation of these systems, and the level of sophistication for which ‘drones’ I feel has a negative and insufficient connotation. This terminology is itself controversial, as advocates of traditional airframes see it as trying to elevate all pilots to the same level regardless of their platform.\(^\text{13}\) RPAs are defined as robotic, fixed- or rotary-winged aircraft capable of sustained controlled flight using onboard propulsion and aerodynamic lift and designed for return and re-use.\(^\text{14}\) This definition excludes blimps, balloons, missiles, and other similar forms of pilotless aircraft. This is in itself controversial as many of the capabilities provided by RPAs can also be provided in

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\(^\text{13}\) Air Force historian Robert Dorr is among those critical of the terminology for this reason (Dorr, The Air Force of 2030, 2012, p. 60).

\(^\text{14}\) Definition derived from Tom Ehrhard’s writing on the subject (Ehrhard & Work, 2008).
some environments by those types of aircraft. Many of the implications of RPAs can apply to piloted blimps as well but my desire is to limit the technical analysis of existing programs.

Throughout this work, I refer to aircraft as ‘platforms,’ which is the common terminology used through both Air Force and Joint U.S. military doctrine to define aircraft, ships, and vehicles. Though undefined in the doctrine itself, a platform is generally any structure on which a military capability, such as a weapon or an intelligence collection system, can be mounted. The purpose of this terminology is to separate the airframe itself from the military capability it provides. In many discussions, as is the case often with the RPA, the former becomes the object of discussion when in fact the emphasis should be on the latter.

The RPA alone represents a major military innovation in platforms, which is critical to understanding the difference between strategic and tactical RPAs for both use and proliferation. A platform’s utility as a military capability is dependent on its payload, its weapons, and its support infrastructure. For tactical RPAs the platform is most important, for strategic RPAs the overall system is important. Successful leadership targeting requires precision intelligence for time and location, reliable precision munitions, and a low time lag from the execution command to the missile strike. The RPA platform enables near-real-time strikes through persistent coverage pre-positioning munitions over a target location at the time a strike order is issues, while precision munitions and global communications networks enable the other pieces of the puzzle to make the strategic and surgical nature of the strike a reality. Without the other components, the RPA platform would be potent as a coercive tool but unable to target individuals, significantly altering its utility.

For this reason, many authors also speak of RPAs in terms of the system, calling them UASs for Unmanned Aircraft (or Aerial) Systems. This is somewhat problematic for me once
again because of the ‘unmanned’ reference, especially when emphasizing the system as a whole which is heavily manned. However, it is advantageous at times for highlighting the role in the system, rather than simply the platform and I do also use this acronym occasionally, especially when it is directly quoted in another text with which I elaborate on the concept.

**The Revolution in Military Affairs**

One key issue that is disputed within the literature is what constitutes a ‘revolution’ and thus what is ‘revolutionary.’ In evaluating RPAs, I differentiate between three often entangled concepts: a technological revolution, a major military innovation, and a Revolution in Military Affairs. A technological revolution is marked by a major change in technology with widespread effects across all sectors of society, a major military innovation is a major change in the conduct of warfare that increases the efficiency with which capabilities are converted to power often stemming from a technological revolution, and a Revolution in Military Affairs is a shift in the character of warfare fueled by a transformation of military systems. A series of technological revolutions have filled critical gaps to produce the targeting revolution, and supplement existing systems in the ground domain.

In this definition, I emphasize the change in the *character* of war, vice a change in the *nature* of war. In too many cases, advocates of an ongoing revolution in military affairs have in a sense oversold the implications of such a revolution, implying that new systems would enable war to be fought in a relatively clean manner with technology assuring easy victory through the demonstration of overwhelming capabilities.\(^{15}\) Technology and societal changes bring about Revolutions in Military Affairs, which change the way wars are fought (the character of war),

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\(^{15}\) See Joel Achenbach’s discussion of the run-up to the Iraq War and discussion of the early phases of the Afghanistan war in early 2003 as an example of this critique (Achenbach, 2003).
but the nature of war as identified by Clausewitz remains a constant. It is defined by passion, probability, and reasoned constraint in the form of political objectives. Those who advocate for a change in the nature of war see war too much through the lens of the latter phases, almost wishing away the passions and animosities of human nature that will always play a key role in both the decision to initiate war and the dangers of escalation once war begins. Or, as General George S. Patton once warned, “How easily people can fool themselves into believing wars can be won by some wonderful invention rather than by hard fighting and superior leadership (Pryor, 2004).”

From the early 1990s scholars have debated whether various advances in military technology have represented a new Revolution in Military Affairs. Krepinevitch (1992, 1994), Vickers and Martinage (2006), and Watts (2011) have been leading proponents of an ongoing RMA based on a broad base of technological innovations, and others such as Rip and Hasik (2002) identify individual innovations to be revolutionary. Keaney and Cohen (1995) took a more moderate position, stating the early signs of a Revolution in Military Affairs were present but not yet sufficient to declare that a true revolution was underway. Biddle (2004), on the other hand, saw too much focus on technology potentially dangerous, arguing instead that force employment is what truly matters and that none of the technologies exhibited were game changers in terms of ground warfare.

This volume falls largely into the first category, arguing that a broad-based revolution is underway and that the RPA innovation represents a key element in that revolution. However, by distinguishing between classes of RPAs and their operational utility in conflict, I frame the debate slightly differently, noting that the revolutionary systems put forth by Biddle and Krepinevitch are not necessarily in direct conflict with one another and that both play key roles
in modern wars. Krepinevitch looks at a macro approach to warfare through the strategic lens and how technology enables new means of analyzing and striking an adversary for strategic effects, while Biddle examines ground warfare from the operational level down. I argue Krepinevitch’s Revolution in Military Affairs is applicable mainly to airpower (the targeting revolution), while Biddle’s still dominates land warfare. This complicates direct comparison because I argue that the technological innovations associated with the targeting revolution have led to systematic changes in air warfare and thus a true Revolution in Military Affairs, while supplementing existing systems of both land and naval warfare and thus not revolutionary for those military systems. This fits with Krepinevitch’s model, as naval revolutions are identified independent of land warfare revolutions in his model.

The new military system enabled by the targeting revolution has come under many names over the years, from ‘industrial web’ to its most recent incarnations, ‘system of systems targeting’ and ‘net centric warfare.’ This system of strategic warfare views competing factions as complex networks with the overall strategy being to strike at critical nodes in the adversary away from the traditional military operating environment. The Gulf War marked in a sense the ‘coming out’ of Network-Centric Warfare in the application of strategic targeting enabled by advanced sensors and limited use of precision munitions, while the experiences of the 1990s in the Balkans through Afghanistan and Iraq in the early 2000s demonstrated both pros and cons of airpower as it existed at the time. Airpower could rapidly destroy a conventional military and with support could effectively destroy an opposing regime, but it still suffered from the same critiques in small wars that plagued airpower from the earliest years of aerial warfare, that it was transient and therefore could not hold territory. The RPA is thus a platform provides this critical capability in Network Centric Warfare, where once air superiority is established the combination
of persistence, precision, and intelligence allows for effective kinetic engagement against a nonconventional adversary.\textsuperscript{16}

Though technology has been critical to bringing about the targeting revolution, I argue that the revolution has largely been doctrine-driven by ideas in doctrine which predate the technology required, in many cases by decades. Early airpower theorists Giulio Douhet and Billy Mitchell argued that the aircraft would fundamentally alter war in such a way by allowing the state that possesses ‘command of the air’ to bypass fielded forces and take the war directly to their enemy’s ‘vital centers.’ The timing of the targeting revolution and the visible changes stemming from it are technology-centric, but they find their roots in doctrinal requirements for capabilities that extend to the earliest days of airpower theory. This is an interactive relationship, with doctrine driving technological change which in turn reshapes doctrine as the technology is employed and evaluated, but ultimately with airpower the change in doctrine has remained ahead of the change in technology.

The targeting revolution is most applicable to RPAs in the context of strategic RPAs, those that are reliant on global communications infrastructure, advanced intelligence networks to enable timely precision targeting with global reach. As such, they represent the central focus of examination in this volume, and their employment by the U.S. Air Force represents the bulk of discussion for organizational and doctrinal changes. While the bulk of writing on RPAs today focuses on their technical aspects, from production to effectiveness, I find the organizational challenges posed by RPAs to be among the greatest challenges to adoption of the RPA innovation. The RPA poses challenges to warfighter’s conceptions of who constitutes a warfighter and the nature of the warrior ethos. It creates challenges for recruiting and promoting

\textsuperscript{16} In this context defined as any military adversary not consisting of a fielded military force, to include sub-national actors such as insurgencies and terrorists, as well as militia and special operations forces fighting on behalf of a state actor outside of a traditional maneuver environment.
individuals in the RPA field who can build a strong force, procure needed airframes, and build tactics, techniques, and procedures for the effective employment of RPAs while the Air Force maintains a vigorous manned aircraft requirement as well. Lessons, good and bad, can be learned from past experiences with the missile and intelligence career fields, but the RPA and the greater challenges posed by the targeting revolution as a whole may pose a more existential challenge to the Air Force’s conception of itself and how its warfighters relate to the application of force compared with more traditional models of warfare.

While strategic RPAs are revolutionary in their impact, the vast majority of RPAs both currently employed and likely to diffuse in the future will be tactical RPAs, which are much less a game-changer than the more well recognized strategic RPAs. Tactical RPAs have been integrated into many militaries worldwide over the past three decades, have been used in numerous conflicts, and while they have impacted those conflicts in terms of increasing collection capability they have not fundamentally altered the existing systems for land warfare. Cover, concealment, and small unit maneuver, which Stephen Biddle classified as the Modern System, still dominates the world of tactical RPAs. Tactical RPAs will be a force multiplier at the operational level of war given their relative expendability owing to the lack of a pilot and the low cost associated with the platform. Future RPAs could potentially extend some of the revolutionary implications of strategic RPAs to limited wars, but likely only as part of a system that can secure airspace control for a duration sufficient to allow for persistent operations. Several models put forward late in this volume, such as ‘swarm and cloud’ strategies, could enable this in the future.
Automation and Autonomy

The use of RPAs by the United States and the prospect for the spread of robotics to other aspects of warfare have led many to criticize the innovation on the grounds that it is inherently dangerous for computers to overtake operational aspects of war. As with the word “drones” itself, “autonomy” is today a loaded word that carries with it many negative connotations, despite the fact that many existing systems operate with varying levels of automation and autonomous operations. Automation, I argue, is an inherent aspect of the targeting revolution, because just as the main outcome of the Industrial Revolution was the automation of mechanical processes, the microprocessor’s implication is the automation of decision-making processes.

From a normative standpoint, the argument over the future of autonomy within warfare as highlighted by autonomous functions of the RPA and perceptions of autonomous operations is one of the most heated debates surrounding the issue. The existing literature focuses primarily on either the technological side, defining levels of automation and classifying systems within a hierarchy (Sheridan & L. Verplank, 1978), or on what might be called the philosophical side, emphasizing the dangers of loss of human control and its negative impacts on warfare (Turse & Engelhardt, 2012). The U.S. Department of Defense Report on Automation (2012) and Peter W. Singer (2010) look at both of these perspectives, with the Defense Department report emphasizing that too much emphasis on levels of automation may be hindering development while Singer notes the need for balance at the policy level to clarify what is actually occurring.

This work emphasizes the levels of autonomy not as a guidepost for development, but for understanding the nature of automation in framing the policy debate; where it is a benefit to operations, and where it might become questionable is vital to the decision maker’s process for procurement, employment, and normalization in warfare. To this end, I examine automated
systems in existing aircraft, automated/automatic defensive weapons systems, and automation in communications and analysis. This background in automation ads insight into what already constitutes acceptable applications of autonomy, and where policy makers might seek to draw lines, either formally via treaty or through the establishment of international norms, to prevent certain forms of automation in offensive warfare. Using the levels of autonomy and discussing other methods for understanding autonomy, I demonstrate the importance of comprehending automation and autonomy through processes, rather than platforms. The key discussion is not whether or not to automate weapons, but which processes (targeting, the decision to strike, etc.) should be automated and to what extent.

Implications of RPAs

The targeting revolution model provides a theoretical context for the conditions under which the RPA represents a potentially revolutionary innovation for the conduct of warfare. The continued adoption and spread of the innovation is, however, contingent on the fact, or at minimum, the perception of other states that the innovation does work and is worth the costs to implement, financially and organizationally. To evaluate the RPA within the targeting revolution to date, I examined the cost effectiveness of RPAs and the demonstrated military utility of U.S. RPA campaigns to date. RPAs, contrary to some assertions that they represent a cheap substitute for manned alternatives, represent a costly investment for most states, and whose military utility appears to be real but minor.

The data available suggests RPAs as used by the U.S. are effective at finding and targeting key leaders, and that process in turn has disrupted the al Qa’eda network’s strategic aims. The classified nature of the programs have limited the U.S. ability to exploit these gains,
however, and have increased the risk of ‘blowback’ against U.S. operations, though I see no significant data demonstrating that such blowback is already occurring. Thus, the RPA campaign is likely to be seen as moderately successful for waging small wars, but with few states having the strategic requirement for such a capability this is unlikely to significantly impact proliferation given the costs involved. It will however pose challenges for building laws and norms for RPAs within the framework of international law as states pursue and critique the use of the RPA based on perceptions and misperceptions of its actual employment.

**Cost Effectiveness of RPAs**

The issues of cost and military effectiveness represent the aspects of the RPA which receive the most scholarship, with writers highlighting the low per-unit costs of RPAs relative to other airframes as among their greatest strengths and that which will lead to the most proliferation. This combines with empirical analysis of U.S. RPA operations in Pakistan, Yemen, Afghanistan, and elsewhere to create images both of rapid proliferation and regular human targeting in future wars as principal arguments against the precedents for RPAs that the U.S. has set.

I review both the cost data and empirical evidence surrounding the effectiveness of RPAs in U.S. operations and come away with a set of different conclusion. First, on the cost front, I find that reports of cost savings are generally overstated, especially for strategic RPAs. Looking at the example of the Global Hawk, which is the sole RPA in the U.S. inventory that can be directly compared to a manned alternative with the U-2, I find that the costs are for the most part comparable with the capabilities being the key tradeoff. The Global Hawk adds increased persistence in exchange for decreased payload, which results in lesser capabilities for its onboard
sensors. Given future U.S. projected requirements, the U.S. Department of Defense has chosen that the sensors are sufficient as they have chosen to pursue the Global Hawk, but ironically given the amount of ‘RPAs are cheaper’ arguments the fact that the Global Hawk was cost prohibitive for many years suggests the challenges to this perspective. Predator and Reaper have no direct manned alternatives, likely for the reason that their persistent capability has shaped their mission, a capability which is significantly degraded by manned airframes.

Tactical RPAs similarly appear to be low-cost per unit, but this perspective also fails to include a number of factors, particularly higher rates of operations tempo under extreme conditions for the airframe which significantly increase the costs of RPAs over time. Further, many of these RPAs cannot be compared to manned aircraft as there is no manned alternative – the mission is unique to RPAs and thus any costs would be added to existing requirements, rather than replacing a more expensive manned mission. Overall, unique capabilities distinguish most RPAs from manned alternatives more often than cost considerations.

Military Effectiveness of RPAs

In January 2013 Michael Boyle, a former counterterrorism advisor to President Obama, penned a piece in International Affairs outlining why he opposed the U.S. RPA campaign in Pakistan as running counter to U.S. interests. Using the 2010 failed Times Square bombing as evidence of blowback, he argued that RPA attacks in Pakistan run counter to U.S. interests because the empirical evidence offered for their success is weak, because they undermine the stability and credibility of our allies, and because the U.S. example of RPAs has ushered in an

17 Though often contrasted to advanced fighter aircraft, the closest comparison for many tactical RPAs is a manned tactical helicopter.
era of proliferation that will be counter to U.S. long-term interests. In doing so, Boyle moved to the forefront for RPA critics, a list which includes Code Pink director Medea Benjamin and authors Nick Turse and Tom Engelhart, who similarly speak of the RPA as counterproductive and dangerous precedents for the future of war. Boyle’s arguments are also largely in line with some other academic surveys of the RPA campaign, which include Living under Drones, the product of the joint work by the Stanford and New York University Law Schools, the analysis conducted by Gregory Johnsen of tribes in Yemen, and the conclusions of the Community Appraisal & Motivation Programme in Understanding FATA. At the other end of the spectrum, a number of scholars to include Christopher Swift, Christine Fair, and the empirical work of Patrick Johnston and Anoop Sarbahi suggest tactical successes are occurring and that claims of blowback are overstated.

I review both the raw data available and the methodologies of the existing literature on U.S. RPA campaigns and fall largely within the latter camp. The empirical evidence suggests that the RPA campaigns are having tactical success, and that some of those tactical successes are resulting in strategic successes for the U.S. in its ultimate goal of defeating al Qa’eda at the strategic level by dismantling and disrupting its central leadership. Captured documents from the raid on Osama bin Laden suggest the central leadership of al Qa’eda was no longer able to function in the FATA, and that bin Laden sought greater restraint on al Qa’eda elements in Yemen so as not to draw U.S. operations to that theater. As the program is currently being executed, however, the program is not as successful as it potentially could be. U.S. silence stemming from its classified nature yields the information environment to the adversary, allowing al Qa’eda to exploit even perceived failures and instances of collateral damage for their gain and preventing the U.S. from exploiting its successes.
Further, the successful destruction or dismantling of al Qa’eda’s central leadership would likely result in short-term increases in tactical threats from al Qa’eda as local networks would be less restrained by the central leadership and more likely to seek to raise their own profile. In this light, increased al Qa’eda activity in Yemen and elsewhere, as well as infighting between factions such as the al Nusra Front and the Islamic State of Iraq and Syria, might paradoxically be an indication of strategic success as much as blowback. Time to evaluate the long-term resilience of the al Qa’eda network and its ability to reconstitute its strategic core will be required to determine the true effects of U.S. operations.

If the strategic RPA is most applicable to small wars as I propose, one of the greatest challenges to their effective employment is the lack of strong international laws and norms governing what constitutes a small war and the parameters for states to intervene in such conflicts. One of the most significant critiques of the U.S. RPA program against the al Qa’eda network is that it is an unlawful assassination program with no checks and balances, while the U.S. administration disputes this characterization insisting that the campaigns are legitimate wartime actions. Effective military operations are relying on the exploitation of successful tactical strikes, and therefore until the U.S. resolves the questions surrounding the legal status of the ‘targeted killing program’ the overall effectiveness and future utility of such programs will remain in doubt. The challenge of the legality of RPAs stem not from an issue of legality under International Humanitarian Law (IHL) or International Human Rights Law (IHRL), but the fundamental lack of clarity on which sets of laws apply based on the ambiguity surrounding the parameters of a non-international armed conflict/small war. Put another way, the problem is not with *Jus in Bello* applied to RPAs, but *Jus ad Bellum* applied to non-international conflicts.
Establishing better norms for what constitutes *Jus ad Bellum* begins with strengthening domestic laws clarifying war powers as they apply to foreign interventions short of a traditional Article 1 Declaration of War. Such a move is a necessary first step because domestic law dictates the ‘proper authority’ under *Jus ad Bellum*. Omar Bashir (2012) and Gregory McNeal (2013) have made a case for independent oversight, Medea Benjamin (2013) has argued that the RPA strikes as used today are illegal in almost all cases, and Rosa Brooks (2013) argues for a distinction between strikes on the “conventional battlefield” and those beyond. I argue for a system similar to that advocated by Brooks, with a higher reporting requirement for the President through an amendment to the Authorization for Use of Military Force of 18 September 2001, to formally declare regions of military operations and organizations which have been designated as allies of the September 11th, 2001 attackers in the context of that authorization. This would create two separate categories of RPA strikes but with the “conventional battlefield” being larger in scope to allow for strategic attack. Inside the areas and organizations openly declared by the President, traditional military rules of engagement and targeting would apply, with limited conventional oversight (an Article 2 operation) as *Jus ad Bellum* criteria are firmly established. Once such zones are established, a system of review similar to those proposed by Bashir, McNeal, and Brooks would be utilized to assure accountability and increase perceptions of legitimacy as International Human Rights Law would apply, altering standards of proportionality and imminence of threat.

The question of impacts of sovereignty and overreliance on military power are two of the greatest lingering questions. Peter Bergen (2012) argued the “time has come for some kind of international convention on the legal framework surrounding the uses of such weapons, which promise to shape the warfare of the future as much as tanks and bombers did during the 20th
century.” Others have stated that U.S. operations in Pakistan and Yemen might be used to justify China striking targets in Turkey or India increasing operations in Pakistan. While there is a short-term issue with misperceptions leading to overuse of RPAs, which is already occurring to an extent in Israel and elsewhere, normalizing RPAs within the context of other forms of air warfare is likely sufficient. Existing conventions on bombing, proliferation and other aspects of air warfare incorporate most of the questions posed by RPAs, with the experience of time and normalization of the technology necessary to demonstrate that they don’t fundamentally alter traditional models of sovereignty. Increased discussion of true capabilities and cost is necessary to building international norms in the use of RPAs, with the legal structure largely already in place for incorporation.

The role of automation in RPAs and other related innovations for ground and naval warfare will likely require the greatest evaluation in terms of modifying international laws and understanding of the obligations and accountability of combatants in warfare. However, looking to both to customary international law and written agreements such as the Hague Convention of 1907, I argue a foundation already exists to answer many of the questions on automating systems. The key becomes the development of norms of accountability and responsibility for those in command of autonomous weapons systems to be responsible for the actions of RPAs the same way they would be accountable for human soldiers in accordance with international law.\(^{18}\)

This not only provides an accountability mechanism, but a limitation on governments themselves developing autonomous weapons even as the technology becomes widely available.

\(^{18}\) The Hague Convention of 1907 states “The laws, rights, and duties of war apply not only to armies, but also to militia and volunteer corps fulfilling the following conditions: To be commanded by a person responsible for his subordinates; To have a fixed distinctive emblem recognizable at a distance; To carry arms openly; and to conduct their operations in accordance with the laws and customs of war (The Hague Convention, 1907).” Including RPAs within the definition of ‘armies’ as applies to soldiers and other fighters imposes a positive duty on officers to command and be responsible for the actions of RPAs.
The Diffusion of RPAs

Once the framework for understanding the implications of the targeting revolution and the RPA innovation are established, I examine the diffusion of the technology based on states perceptions of their needs and capabilities to adapt, as well as longer-term trends in employment and normalization of these weapons given the capabilities of the systems. If the RPA represents a major military innovation within a revolution, rather than a revolution in and of itself, its implications for the future of warfare based on its capabilities are much more limited than Boyle, Horowitz, and Singer among others have proposed. Many states are likely to adopt the RPA, but few are likely to adopt the full targeting revolution that goes with it. Most states will use the platform in other ways, from internal security to increased strategic ISR, but often at higher costs versus a manned alternative and thus with lesser impact. For this reason as the roles of RPAs expand in technologically advanced states to other mission sets, such as suppression of enemy air defense, the adoption of similar RPAs by other states will be less likely if that state has not already adopted a similar manned capability. Tactical ISR will likely see the greatest future growth based on the near universal requirement for battlefield intelligence, the dangers of the mission, the dual-use civilian/military nature of such airframes, and the per-unit cost of acquisition. The impact of these systems will however be limited by the historical limitation of attempts to overcome the fog and friction of war – as new sources in intelligence arise, new problems arise as well which will limit the gains from the source.

Defining the RPA as a major military innovation and differentiating types of RPAs by capabilities and potential missions is essential to making predictions for the diffusion of RPAs. Using Horowitz’s Adoption-Capacity Theory as a baseline for the rate of diffusion, I predict strategic RPAs, such as Predator, Reaper, and future Unmanned Combat Air Vehicles (UCAVs)
will diffuse at a slow rate given both financial costs and complexity. The U.S., Europe, China, Japan, Russia, and India, are most likely to pursue advanced strategic RPAs given their strategic requirements and current investments in advanced military technology, with differing results based on their specific requirements, doctrines, and demonstrated capabilities. The U.S. and Europe are likely to have the most success, with China, Russia, and India successfully developing and demonstrating RPA platforms, but of limited utility operating at extended ranges. Japan, meanwhile, will likely collaborate closely with the U.S. to integrate RPAs into their existing defense forces.

As the debate over the use of RPAs by the U.S. in Afghanistan, Pakistan, and Yemen has continued, one key aspect has been the question of what happens when the United States no longer has a monopoly on the RPA. This is itself a bit misleading as the U.S. has never truly had a monopoly over the RPA as Israel demonstrated the potential for RPAs in the early 1980s, but the broader question of diffusion of advanced RPAs is vital to guiding U.S. operations today. To understand and model the diffusion of RPAs, I utilize Michael Horowitz’s model of Adoption-Capacity Theory to gain insights on the rate and nature of diffusion of military innovations.

Table 1: Diffusion of RPAs

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<tr>
<th>Level of organizational capital required to implement major military innovation</th>
<th>Level of financial intensity required to implement major military innovation</th>
</tr>
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<tbody>
<tr>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
| Low | Rapid diffusion  
- Tactical RPAs  
- Global | Moderate diffusion  
- Prestige RPA platforms used in tactical roles  
- China, Russia |
| High | Moderate diffusion  
- RPAs acquired through partnership  
- Japan, India, European states | Slow diffusion  
- Strategic RPAs/UCAVs  
- U.S., U.K. Germany, Israel, future China |
Adoption-Capacity Theory projects the rate of diffusion of a military innovation by evaluating its costs to implement versus its organizational capacity to adopt the change. Costs to implement are a factor of the dual-use civilian-military applications of the innovation, and the per-unit cost of the asset. Organizational capacity, meanwhile, is a function of the organization’s age, willingness to experiment, and critical task focus. Unlike Horowitz, however, who models innovations as single innovations falling into one type on his 2x2 matrix, I model the same underlying platform innovation as producing multiple innovations with differing rates of diffusion as each innovation is used differently. In Horowitz’s case study, for example, he models all flat top carriers as attempts at implementing the aircraft carrier innovation, whereas I argue that the amphibious ship represents a fundamentally different innovation with greater potential for diffusion, much as the tactical RPA versus the strategic RPA.

I divide RPAs as platforms between tactical and strategic RPAs based on their connectivity to their operator, which differentiates those that are part of global networks and those that are more simple locally controlled line-of-sight RPAs. In addition, countries can develop RPAs which have the appearance and payload of strategic RPAs, but due to a number of technological and organizational barriers they are unable to achieve the same capabilities. The strategic requirements and organizational capacity of states will dictate which types of RPAs they will pursue, while the rate of diffusion can be predicted by applying Horowitz’s Adoption-Capacity Theory.

Because of the civilian applications for tactical RPAs, from local law enforcement, property security, aerial photography, etc., and the relatively low financial costs per unit, the

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19 The fact that the U.S. has adopted both types of vessels, a critical detail omitted from Horowitz’s case study, demonstrates this point.
tactical RPA has a low financial intensity. Smaller battlefield RPAs equipped with limited sensors such as full-motion video and basic offensive weapons are easy to operate by individuals and small units, and thus require low amounts of training or modifications of existing organizations; they represent a moderate increase in existing scout capabilities. These can be potentially problematic in the near future for border regions given their ability to violate airspace with limited ability for detection or interception, but given the rate of diffusion and limited capabilities beyond intelligence collection they are unlikely to provide any state with a significant military advantage. Their biggest threat will be an overestimation of their capabilities or overuse to aggravate a neighbor which could unintentionally escalate a conflict.

Strategic RPAs, given the reachback and precision engagement requirements, the high per-unit costs, and the limited dual-use potential of a long-range, satellite operated, high-altitude ISR collector with bombing capability, will be very slow to diffuse. Some organizations will have the economic capacity but lack the organizational flexibility or global network capability to incorporate the full strategic RPA, and they will be likely to adopt RPA platforms as prestige weapons but to limited operational use beyond line-of-sight. Other states that possess the organizational capacity but lack the economic means will likely ally closely with first movers to gain access to the airframes in combined operations. Advanced technological states such as Japan and European states, for instance, have adopted a number of components of the targeting revolution and can adopt strategic RPAs with allied support, either through leasing of the RPA platforms or the global communications and targeting infrastructure, as the sharing of technology and sunk costs of existing technologies adopted by the state lower the overall costs of pursuing the innovation.
The development and adoption of future RPAs will vary based on the specific paths that adopters choose to follow. In one example, the ‘swarm and cloud’ model where satellite UCAVs escort manned bomber assets, the cost of the overall system will remain high while the system is itself reliant on an expensive manned bomber at its core with a pilot commanding multiple semi-autonomous assets via line-of-sight control. While each individual platform might come at a cost savings versus an escort of F-35s, the fact that the escorts are added might itself be a product of the RPA innovation (as currently such missions are unescorted) and the overall system is both expensive and complicated. This again points to slow diffusion of this system of warfare.

The Future of RPAs

One theme throughout this work is the gap between the expectations of technology and their actual capabilities. The RPA is highly susceptible to irrational expectations today, specifically with the potential misuse of tactical RPAs. Tactical RPAs are likely to spread rapidly and across the globe, but are unlikely to be game-changers for international conflicts. However, there is the potential for significant disruption in the short-term owing to miscalculations from poor understanding of the potential benefits of possessing such RPAs. States who perceive a significant power gain from a tactical RPA similar to what they would expect to see from a strategic RPA like Reaper may be prone to act more aggressively in pursuing objectives with a rival, potentially leading to a conflict that might otherwise not have occurred. Meanwhile, advanced technology states might be hesitant to develop RPAs for similar misunderstandings of their role in conflict, leading to the failure to properly implement the

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20 Tactical RPAs are likely to have their greatest impact domestically, both for government and private sector initiatives. These operational changes, however, fall outside the scope of my research in terms of their effects on society, but is addressed in discussing the diffusion of RPAs due to the implications of dual-use technologies. Their greatest impact for international relations will likely be in the exchange of arms between states and the sharing of tactics for domestic and tactical employment of the systems.
innovation. Looking at historical examples of the introduction and overly-optimistic policy projections of early airpower theorists and the policies of ‘cruise missile diplomacy’ in the 1990s, I argue a similar pattern exists with the introduction of new military technologies, with potentially devastating short-term results until expectations of the actual capabilities of the technology are normalized. This perceived capabilities increase, rather than an actual capabilities increase, is where the likelihood for disruption from RPAs arises, and why a thorough understanding of RPAs within the context of broader air warfare context is so vital.

To evaluate the future of RPAs, I look at both my matrix of the targeting revolution and the diffusion of technology to make basic projections about likely innovations in RPAs in the future and how different states are likely to adopt those changes. In the case of the U.S., I look at future scenarios for the development of RPAs in capacities outside of small wars. A great deal of current discussion of RPAs involves improving survivability in hostile environments, suggesting an increased RPA role in future limited wars against conventional opponents. Re-examining my model for the optimum uses of airpower enabled by the targeting revolution, I examine the conditions under which the RPA could become effective at targeting against military forces in both a small war and a conventional limited war, as well as for leadership targeting in limited wars similar to the 2003 attempt to decapitate the Iraqi leadership at the start of the Iraq War. While I see such scenarios as technically feasible and outline a variety of sample concepts for such operations, I see the use of RPAs in limited wars as being most effective in supplementing existing doctrines with most of the current literature suggesting any attempt to decapitate a head of state, even if successful, will be limited in its effects on the state under most circumstances. Even so, it is likely to become an appealing option for future policymakers (even to a point of being a political necessity) just as it was in 2003. This will
become more appealing if larger numbers of RPAs, coordinated through a global strike apparatus, can simultaneously strike multiple leadership nodes at various levels of command (both civilian and military), theoretically plunging the opposing state into chaos.

**Figure 2: Possible Future RPA Missions in Targeting Revolution Matrix**

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Military</th>
<th>Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Wars</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Limited Wars</strong></td>
<td>Close Air Support Interdiction</td>
<td>Decapitation Strikes</td>
<td></td>
</tr>
<tr>
<td><strong>Small Wars</strong></td>
<td>Signature Strikes</td>
<td>Personality Strikes</td>
<td></td>
</tr>
</tbody>
</table>

Such a strategy will likely be appealing for policymakers given past attempts to quickly win wars with such a decapitation strike and the RPAs characteristics which favor such a strategy, but a move in this direction is I argue potentially destabilizing. It may hasten victory in early phases of operations, but is more likely to lead to state failure and a prolonged ‘Phase 4’ operation which would likely be avoided by a conflict with more limited aims and a negotiated settlement with a surviving state government. Further, excessive optimism over the potential for
success of such an operation would weaken the restraints of conventional deterrence, making more conflicts likely.\textsuperscript{21}

After looking at RPA development in the U.S., I examine their likely future use in two other regions of the world to highlight patterns of future diffusion and innovation. First, in examining Southeast Asia, I look at the peacetime implications of strategic RPAs in international airspace. The disputes over islands and territories in that region and the capabilities of strategic RPAs suggest that the RPA will become an ideal aircraft for monitoring naval activities and in so doing deterring attempts to change the status of territories through landing forces. At the same time, should a crisis escalate to the point of conflict, the strategic RPA could become a critical piece of a larger weapons system for targeting U.S., Japanese, or Chinese vessels. This will be reliant on future developments not of the RPA platform itself, but of payloads such as Broad Area Maritime Surveillance, and connectivity to weapons systems such as the DF-21D. This is an emerging potential mission for RPAs that is in its infancy, but is more likely for growth and innovation in this region given the actors and their strategic requirements than is a strategic RPA in a leadership targeting role.

Finally, in the greater Middle East, I look at the proliferation of tactical RPAs in the Caucasus, to Iran, to Israel, and in the Gulf Region to see how states and non-state actors are experimenting with smaller RPAs to achieve more limited objectives in both active combat zones and in contested regions. This area represents the area most likely to have a war accidentally triggered by escalation of RPA activities, but is also showing clear indications of a steep learning curve on both sides of RPA operations in terms of normalizing the use of RPAs as aircraft and developing counters to their tactical use.

\textsuperscript{21} See John Mearsheimer’s work on conventional deterrence for the conditions under which deterrence will failure, with the perceived success of a \textit{blitzkrieg} campaign being the most dangerous scenario for deterrence failure (Mearsheimer, 1985).
Overcoming expectations is central to examining the true nature of RPAs and the targeting revolution. However, policymakers from all nations, including the U.S., will continue to be influenced by perceptions of what the RPA can do which may greatly exceed its actual capabilities, undermining progress in developing the technology. If the RPA is a disruptive technology in the near future, it will be likely due more to its misuse than to the capabilities it adds to conflict. Misunderstandings of expectations for RPAs will not just be a problem for the risk of unintentional escalation of conflicts, but also for diffusion and inefficient military spending. Much like the United States looked to cruise missiles in the 1990s as a tool to intervene in conflicts that appeared to be low risk and with the potential to achieve key strategic objectives, the cruise missile rapidly proved itself to be a mismatch for many of the missions due to the limitations of the platform that policymakers didn’t fully understand at the time. This tempted policymakers to take precipitate action, without the coordination and authorization required for manned operations.

More importantly, a study of the strengths and limitations of RPAs as weapons of war may provide insights to the domestic applications of RPAs and the potential revolutionary implications of RPAs within states. While the threat to RPAs posed by adversaries limits their utility in wartime environments, the absence of an adversary will likely increase the utility of the RPA both in international airspace such as the maritime environment and for states in domestic applications, both in the commercial and government sector. Together, these types of peacetime innovations led by robotics such as the RPA might have a far greater impact than their implications in wartime.
What this Work is, and What it is Not

This work is designed as an evaluation of the evolution of RPAs to date, and based on those observations applying theories of diffusion, adoption, and international relations to assess the future trajectory of the RPA innovation. RPAs have generated a great deal of discussion in the past three years owing to their increasingly central role in U.S. counterterror operations, and it is my feeling that many of the debates and questions asked about RPAs fundamentally misunderstand both the technology in question and the nature of military innovation. By focusing on the history and evolution of the weapons system, my hope is to refocus the debate on the important issues surrounding the deployment of RPAs.

This entails putting the RPA in the context of other weapons systems, and in the context of the political aims of those who use the weapon. War is ultimately an attempt to impose political will by the use or threat of use of force, and thus the ends, ways, and means of conflict must all be considered together. Too often, debates over RPAs ignore or write-off counterfactual means of military intervention and criticize RPAs for traits that would be similarly exhibited by alternative means of conflict. In many cases, attacking the RPA becomes a substitute for attacking the underlying policy, which is an unnecessary distraction from the real debate which should be made.

At the same time, this is not a call for increased use of RPAs in new military interventions. Although at times this work engages the debate on the utility of strategic bombing (Pape 1995, Gentile 2001 among others) and argues for the tactical successes of RPAs where they have been used to date, a significant motivation for this work came from discussions I have had with policymakers over military interventions in Libya and Syria, where I argued against intervention while policymakers were overestimating the capability and requirements of RPAs.
The RPA is an effective tool in a given, limited set of circumstances. The goal here is to enlighten policymakers and observers on what those capabilities and limitations are that they may better understand the tools and strategies for implementing policy.

This is also not an operational or tactical guidebook for doctrinal employment of RPAs in future combat scenarios. I highly recommend the works of David Blair, Jaylan Haley, and the numerous researchers at institutions like RAND who have written extensively on future uses of RPA aircraft and on whom I heavily relied on researching this work. But, the main goal of this writing is for those who are active at the strategic level, and for those who have an interest in understanding the macro-effects of RPAs in modern warfare to understand to what extent RPAs can truly be used to achieve strategic objectives, and what are the true potential hazards of their use.

**The Way Ahead**

This book is divided into two broad sections, the first focusing on the development of RPAs within the United States to date which represents the first mover and current global leader in RPA technology. This section can be viewed as an expanded case study of RPAs within the context of the Revolution in Military Affairs literature, which posits that technological, doctrinal, and organizational changes together result in new systems of warfare that change the character of war. I argue that the RPA is one of several key technological innovations enabling the targeting revolution, rather than a revolution by itself. Chapter 2 introduces the RPA through evaluating the history both of unmanned aircraft and the technological developments of the information revolution which occurred in parallel through the late 20th Century. Chapters 3 and 4 examine the RPA within the targeting revolution, defining it as a doctrine-driven revolution enabled by
recent technological developments. The RPA is identified in this section as the most recent of a chain of technological innovations that enable longstanding visions of the potential of airpower, which include nuclear weapons, delivery systems such as missiles, and precision guidance. The strategic RPA must be understood in the broader context of this larger system of airpower, because its significance is diminished as a stand-alone innovation. Organizational changes are addressed last, as based both on literature and publicly available data on the U.S. adoption of RPAs, this is a key area where first movers struggle with maintaining the advantages of adopting a new innovation. Institutional biases from organizational norms and structure to views within the organization of the way wars should be fought have historically limited first movers in maintaining the lead on innovation, and debates over procurement, recognition, and promotion of RPA operators suggest these factors may be an impediment to continued adoption of RPAs by the U.S. Air Force.

Chapter 5 concludes the first section with an evaluation of the RPA in operations in Afghanistan, Pakistan, and Yemen. First examining the costs of RPAs, I find the projections of radical savings for RPAs over manned missions to be overstated. Savings may exist, but are difficult to firmly establish and are secondary to the capabilities tradeoffs involved in the manned versus remote debate. I then look at actual performance, finding RPAs have shown some clear short-term successes in degrading the operational capacity of the al Qa’eda strategic network, while questions of long-term effectiveness remain unresolved in large part owing to their still cover nature. Due to this challenge, I look at the legal issues surrounding RPAs through the lens of International Humanitarian Law (IHL) or International Human Rights Law (IHRL). I find the problem with the legal debate and the resulting challenges of disclosure are caused by the lack of international norms or laws to define what constitutes the scope and limitations of non-
international conflicts and thus which set of laws applies. Once this issue is reconciled, it is easier to refine both IHL and IHRL to accommodate RPAs within existing laws and norms rather than through new conventions.

The first half of the dissertation is an examination of the development and uses of RPAs to date. The second, in contrast, uses literature of diffusion and airpower strategy to visualize the future spread and uses of RPAs. Chapter 6 outlines models of diffusion of military technology and power, and proposes a strategic perceptions corollary to adoption-capacity theory to make country-specific judgments about whether or not a state will adopt RPAs, and in what capacity they will adopt them. This model is tested through shadow cases of cruise missiles and aircraft carriers, which share a number of common elements with RPAs in terms of projections of proliferation, hidden obstacles to adoption, and a variety of systems for adopting specific platforms without investing in the full targeting revolution. Based on the lessons of models of historical diffusion, the chapter concludes with the implications for the diffusion of RPAs, showing that smaller tactical RPAs will likely continue to rapidly diffuse and evolve, and with it so will tactics. These RPAs will be less revolutionary in their effects, however, than strategic RPAs which will continue to slowly diffuse and evolve.

Chapter 7 concludes this work examining the future of RPAs by applying the lessons of RPAs to date and the models presented in this work to frame the larger policy debates surrounding the diffusion of RPAs. It examines the potential short-term hazards for overuse of RPAs that may increase the risk of military hostilities. This examines debates within the U.S. over using RPAs in military options outside of the War on Terror to include suggestions that they could be used to enforce a no-fly zone in Syria, as well as other potential hotspots which could be aggravated by an RPA presence such as China-Japan, Armenia-Azerbaijan, and the Israeli-
Palestinian conflict. In part, this reiterates the desire of this work to separate critical issues posed by the RPA innovation from red herrings that all too often dominate not just the RPA debate, but those of many other military innovations throughout history. By identifying what the capabilities of the RPA and the targeting revolution truly are, my hope is that policymakers can shift the focus of future research away from issues that have largely already been resolved or are based on fundamental misunderstandings of the capabilities of the technology and how policymakers can employ them as an effective instrument of power.
Chapter 2: The Evolution of the RPA

As airpower doctrine evolved over the 20th Century, a series of technological innovations occurred, most visibly in the latter part of the century, which profoundly increased the capabilities of air warfare along with society at large. The information revolution, which drove leaps in the fields of information, communication, precision, and robotics have had impacts throughout modern militaries, as well as society at large. These innovations have been necessary for an RMA to take place, but despite claims of some proponents, I do not classify each as having been sufficiently an RMA unto itself. Rather, these innovations have served either to amplify the capabilities of an employer or to replace the risk of human life with the added cost of the innovation while producing a similar capability.

In many respects, 1971 can be identified as year zero of the information revolution, which in turn leads to the targeting revolution. Precursors to the revolution were underway with the first modern computers and early connections of what would come to be the Internet pre-date 1971, but invention of the microprocessor I see as the key event that enables the three interrelated sub-revolutions of the technological era: information, precision, and robotics. This is often dubbed the ‘information revolution’ encompassing all three, as the information revolution is the first and most apparent revolution with mass appeal in society, and because the tech firms that are associated with that firm also dominate the hardware and innovation markets that enable them to also spearhead many of the innovations of the other two revolutions. As a result, I at times allow the verbiage of the information revolution to overshadow the other two, but I see it ultimately as simultaneous with the others as part of a common broader technological revolution.
When combined with the evolving doctrines of airpower and applied to the lingering problem of how to fight counterinsurgency from the air, these technological revolutions came together to produce not just a variety of individual capabilities that magnified existing military power, but created a networked system of intelligence exploitation, persistent surveillance, and precision targeting that fundamentally altered the character of air warfare in small wars. No longer limited by the transient nature of airpower and better able to distinguish between adversary fighters and civilian fighters, airpower has, since 2008, emerged as one of the central campaigns in the U.S. war on terrorism.

2007 represents a key inflection point in the targeting revolution, the moment when doctrines and technologies came together in ways that altered the character of air warfare in small wars. Although this represents the time when the technology and doctrine came together to change the system, most of the technological innovations, like the doctrinal changes, were the result of gradual evolution over the better part of a century. The RPA itself is as old as the aircraft (if not older depending on how the term is defined), and innovations in information technology and robotics have been an ongoing development virtually as long as human history, with significant innovations on both fronts occurring since the 1940s. What 1971 represents for the social revolution, 2007 will likely represent for the military revolution.

In the context of these doctrinal and technological changes, the RPA itself serves as a weapons platform capable of facilitating advancements in military power in conjunction with advancements in each of these revolutions. As a stand-alone, however, its utility is limited largely to supplementing existing capabilities. The Global Hawk, a high altitude strategic intelligence collector, is in many ways an unmanned variant of the U-2 with the added benefit of persistent coverage and the tradeoff of what is considered a slightly inferior collection suite.
Depending on the mission set, this unmanned variant may perform better or more efficiently than the U-2, but the underlying military capability remains roughly the same. Small, tactical intelligence collectors may improve a local commander’s situational awareness of the battlefield, but increased access to information at the tactical level is unlikely by itself to significantly alter the course of war as such systems can be defeated and too much information at the tactical level can overwhelm a commander, leading to decision paralysis. The operations of Predator and Reaper in Afghanistan and elsewhere strike many observers as revolutionary, but there is disagreement on exactly why. As I will demonstrate, the revolution occurs solely when the platform combines with an information network capable of processing/analyzing large streams of multi-source intelligence information and a weapons system capable of precision engagement sufficient to overcome the longstanding obstacle to airpower in small wars – persistent airspace coverage and reasonable discrimination between combatants and civilians.

**Early RPAs as ISR platforms**

Although the increased visibility of RPAs in the past decade have made them a significant topic, the RPA has been part of the story of airpower dating to World War I, when the first experiments were conducted on remotely guided aircraft as crude, early cruise missiles. The Army Air Corps in World War II converted B-17s and B-24s into automatically piloted, explosive-laden aircraft that would be flown toward targets, have the pilot eject, and the aircraft function as a cruise missile guiding toward a desired target (Ehrhard T., 2010). U.S. RPA technology saw a boost following World War II, with the Air Force working closely with the National Reconnaissance Office (NRO) to develop RPAs for missions over Russia and China (Figure 3 shows a D-21 used for such purposes). RPAs nearly came into used during the Cuban
Missile Crisis, which was only blocked when RPA advocated urged Gen Curtis LeMay to cancel the flights as the programs were too sensitive (Ehrhard T., 2010, p. 8) when there were bigger plans for the systems ahead. RPAs in this era faced numerous obstacles, from their price tag (Ehrhard noted they were small, but not cheap), and increasingly in competition with satellites for the intelligence budget.

**Figure 3: D-21 mounted on M-21 (modified A-12)**

![D-21 mounted on M-21 (modified A-12)](image)

After some significant usage in Vietnam and Southeast Asia conducting BDA, which the RPAs could fly but manned aircraft could not due to weather, and scouting surface to air missile locations, RPA development transitioned in 1974 when the NRO divested itself of the mission to focus attention on satellites, leaving the Air Force and Central Intelligence Agency (CIA) responsible for their further development. Shortly thereafter, Strategic Air Command would relinquish its RPA programs, leaving Tactical Air Command responsible for further RPA development.

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22 (CSI - D-21).
development. By the late 1970s, costs, the lack of openness in development, and other institutional factors contributed to the decline in U.S. operational RPA development.23

At the same time, the reorganization of U.S. Forces in Europe around AirLand battle refocused a number of Defense Department research programs around new responses to the emerging threat of tactical nuclear weapons and how to defeat/deter their use. In 1971, John Stuart Foster Jr., then director of defense research and engineering at the Pentagon and a longtime model aircraft enthusiast, had the idea to take a basic model aircraft such as he was working with and attach a camera to it for tactical reconnaissance and, possibly in the future, load it with deliverable weapons sufficient to monitor and attack tactical targets. At the time, ‘fleeting and perishable’ targets, as the initial press releases noting the capabilities of the Predator in 2001 referred, at this time likely were tanks and mobile missile positions along the Fulda Gap. In 1973, the Defense Advanced Research Projects Agency (DARPA) built the first two prototypes, dubbed Praeire and Calere, which weighed 75 lbs each and could stay aloft for two hours with a 28-pound payload (Kaplan, 2013).

The immediate impact of these smaller, perishable RPAs was the first wave of tactical RPAs, which would be developed under the control of the U.S. Army in the 1980s. Among the first of these RPAs was the BAE Sky Eye, which was capable of flying at an altitude of 15,000 ft and with a loiter time of up to eight hours. This system was followed in 1986 with the RQ-2 Pioneer and the RQ-5 Hunter. These smaller aircraft capable of flying in dangerous situations due to their relative expendability supplemented Army (and later Navy) commanders at the operational level by supplementing ISR collection on the battlefield and in the maritime environment. The RQ-2, flying in support of naval operations in the Gulf War, achieved fame

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23 Ehrhard extensively details the various RPA programs in development in the 1960s through 1990s, as well as the budgeting process, tension between Strategic Air Command and Tactical Air Command, inter-agency relations and relations with Congress.
when Iraqi soldiers on Faylaka Island signaled their intention to surrender to the aircraft, marking the first time enemy soldiers had ever surrendered to an RPA (Pioneer RQ-2A UAV).

Beginning with the invention of the microprocessor in 1971, a slew of new technologies with potential military applications emerged in rapid succession. As the Army and Navy continued the development of tactical RPAs, DARPA, under the guidance of a study led by Albert Wohlstetter, examined the implications of numerous fledgling technologies beginning in the 1970s that would encapsulate the targeting revolution. The first emphasis came on new precision guided munitions, beginning with laser and radar guidance and moving toward GPS guidance by the 1980s, followed by increased emphasis on longer-range RPAs, which would see their first significant operational use in the 1990s.

**The Information Revolution**

By 1970, the groundwork was already being laid for what had today been characterized as the information revolution, a transformation society-wide from the industrial age to what the literature at the time was broadly calling the “post-industrial era.” The DARPA creation of what would come to be known as the Internet, advancements in computing and processing, satellite technology, and its broader impacts on society at large increasingly shaped all aspects of life, to include the military domain. Writing in 1970, Zbigniew Brzezinski stated, “The transformation that is now taking place, especially in America, is already creating a society increasingly unlike its industrial predecessor. The post-industrial society is becoming a ‘technetronic’ society: a society that is shaped culturally, psychologically, socially, and economically by the impact of technology and electronics-particularly in the area of computers and communication (Brzezinski, 1970, p. 10).”
As with debates over RMAs, debate remains over whether a social revolution on the scale of the agrarian or industrial revolution has in fact taken place, and what defines that revolution. Robert Noyce, writing in 1977, argued that a true revolution was under way, as microelectronics have led to a qualitative change in human capabilities while noting that as the revolution is still in its nascent stages, new theories had yet to be developed on how to exploit the potential for integrated circuits (Noyce, 1981, pp. 29-30). J. Sidney Webb, quoted in 1976, saw it as “the second industrial revolution” in that it “multiplies man’s brainpower with the same force as the industrial revolution multiplied man’s muscle power (Perlowski, 1981, p. 105).” Steven Saxby, writing in 1990, largely concurred defining the nature of the revolution as tooted in the link between information, computers, and communication. “The foundation of the technological revolution that is today characterized as the architect of the ‘Information Age’ can be found in the relationship between information, the computer and communications. The application of microelectronics to these computers has generated a convergence between all three that today and in the future will continue to promote the societal transformation that has been characteristic of the very short life of the relationship so far (Saxby, 1990, p. 85).” For the most part, the “information age” and the microprocessor revolution have been synonymous in the literature, especially from the 1970s through 1990s. Both the precision and robotics revolution have also occurred as a result of the microprocessor, which is thus the core technological innovation to all three revolutions. Based on the literature and popular acceptance of the microprocessor being part of the information revolution, I use the terms here interchangeably even though it may be problematic at times as advocates of each of the three major revolutions have at varying times tried to broaden the definition of one to encompass at least one of the others.24

24 By using the terminology for the information revolution and the microprocessor revolution, I to an extent imply the precision and robotics revolution are sub revolutions of the information revolution. P.W. Singer implies
The term “post-industrial society” as used by Brzezinski was coined by Daniel Bell in the late-1960s, and was popularized largely after publication of his book on the subject in 1973. In 1979, he expanded on this model framing the information revolution identifying three dimensions relevant to telecommunications: 1. The change from a goods producing to a service society, 2. The centrality of the codification of theoretical knowledge for innovations in technology, and 3. The creation of a new “intellectual technology” as a key tool of systems analysis and decision theory (Bell, 1981, p. 501). This model envisioned a transfer as the central agents of change in society from “talented tinkerers” of the industrial era to a system based in broad theoretical processes linking diverse scientific fields which in turn results in new products and theories. The industrial age was focused on products while the post-industrial era focuses on processes that in turn produce products. Central to this revolution is communications and sharing of information. The broader implications raised by Bell, to include the transition from a manufacturing to an information and service society (noted by Figure 4), design of cities in the post-industrial era, the prospect for improved governance (such as Vice President Gore’s initiatives of the 1990s and movements since to increase transparency, ease contact with elected officials, and allow for applications to government programs online; and against this backdrop the dilemmas of convenience versus privacy), are further introduced as the central dilemmas for policy moving forwards.

similarly that the precision revolution is a sub-function of the robotics revolution by encompassing precision munitions as early predecessors of robotics, etc. Ultimately, I believe the microprocessor represents a revolutionary technology that spawns to date three interrelated revolutions that should be viewed as equal in status with respect to their applications in the military domain, but the existing literature on the information revolution would lead to too many requirements for clarification to distinguish in this section.
Bell noted “The really major social change in the next two decades will come in the third major infrastructure, as the merging of technologies of telephone, computer, facsimile, cable television and video discs lead to a vast reorganization in the modes of communication between persons; the transmission of data; the reduction if not the elimination of paper in transactions and exchanges; new models of transmitting news, entertainment and knowledge; and the reorganization of learning that may follow the expansion of computer-assisted instruction and the spread of video discs (Bell, 1981, p. 533).” He was skeptical at the time of the ability of the computer to be an educator based on the fact that education is based both on the ability to learn and the cultural milieu, a debate which currently rages over the effectiveness of online education, but the broader implications of the Internet were clear to Bell at the time.

Within the military domain, this issue came to be encapsulated in the broader doctrine of “net-centric operations,” a term that first came into being in the mid-1990s and was popularized during the wars in Iraq and Afghanistan. Per the Congressional Research Service, “Network
Centric Operations relies on computer equipment and networked communications technology to provide a shared awareness of the battle space for U.S. forces. Proponents say that a shared awareness increases synergy for command and control, resulting in superior decision-making, and the ability to coordinate complex military operations over long distances for an overwhelming war-fighting advantage (Network Centric Operations: Background and Oversight Issues for Congress, 2007).”

As early as 1980, the concept of net-centric operations was already being openly discussed in major periodicals, if not by its 1990s terminology. One cover story of Newsweek Magazine from 1980 noted, “Once they are in place, these new technologies will make possible an astonishing new breed of weapons and military hardware. Smart robot weapons – drone aircraft, unmanned submarines, and land vehicles-that combine artificial intelligence and high-powered computing can be sent off to do the jobs that now involve human risk…..‘This is a very sexy area to the military, because you can imagine all kinds of neat, interesting things you could send off on their own little missions around the world or even in local combat’….An intelligent missile guidance system would have to bring together different technologies-real-time signal processing, numerical calculations, and symbolic processing, all at unimaginably high speeds-in order to make decisions and give advice to human commanders (Weizenbaum, 1985, p. 91).”

25 The discussion of net-centric operations in the 1990s in many ways represents the information revolution coming full circle, at least in terms of public perception. Concrete military goals played a critical role in the information revolution from the onset, notably the need for automated computational capacity to analyze the trajectory of ballistic missiles in the early years of the Cold War. “At the Ballistic Research Laboratory at Aberdeen, Maryland, more than 200 personnel were engaged in producing firing and bombing tables required by the US army and air-force (sic) to pursue their wartime operations. A single firing table might contain between 2000 and 4000 trajectories. It was estimated that the plotting of a single trajectory would take a human being, working unaided, two hours to perform the arithmetic and twelve hours to apply it (Saxby, 1990, p. 93).” This need for rapid computing led to the development of the Electronic Numerical Integrator and Computer (ENIAC), one of the first digital computers. ENIAC was used by the lab from 1947-1955, however it wasn’t until 1971 that the Sperry Rand Corporations’ patent on the technology was broken, enabling significant advancements in computing from that point forward (Saxby, 1990, p. 102). This legal decision coincided with Intel’s development of the microprocessor, ushering the era of both personal computers and super computers. DARPA similarly played a critical role in the development of the Internet for sharing information between its research computer networks.
While much of the public legacy of the Gulf War was the impact of ‘smart bombs’ and the Air Campaign in aiding to bring about a decisive victory, many commanders credited the computer with being the real technology that was critical to victory in the conflict. Computers aided in the organizing and tracing of troop movements, the processing of intelligence, the war gaming of battle plans, and the dissemination of all this information to the people who needed it. As General Norman Schwarzkopf would later recount, “I couldn’t have done it all without the computers (Singer, 2009, p. 58).”

The discussion of the early 1980s revolved largely around the computational processes of the microcomputer based on the imagined possibilities that would flow from this information revolution. To bring the vision to fruition for effective military operations necessitated two subsequent technological revolutions, which in many ways flowed from the microprocessor and are thus derivations of the information revolution, but that impact specific aspects of technology with finite applications. The precision revolution and the robotics revolution were both required to supplement the processing and communications capabilities to overcome performance gaps of existing weapons systems to make net-centric warfare a reality.

The Precision Revolution

While RPAs advanced as an ISR platform, the precision revolution began to alter the development of munitions beginning in the late 1970s. Prior to the 1970s, the U.S. Air Force was accused of a preference for platforms over munitions, resulting in a force dominated by the latest-generation fighters and avionics, but lacking a similar technological expansion in the realm of munitions. This left the Air Force with advanced delivery systems for high-explosive bombs reliant on the guidance technologies and tactics developed in World War II (Lambeth, 2000, p.
The 1970s through 1990s saw steady growth in development of precision guided munitions (PGMs), beginning with electro-optical (EO) and Imaging Infrared (IIR), to laser guidance, and ultimately to Global Positioning System (GPS) guidance with the JDAM series.\(^{26}\)

Though the PGMs of the Gulf War received wide media coverage which in turn led to the first discussion of the advent of the RMA in the early 1990s, but has since been widely reported they represented a very small proportion of the overall weapons employed.\(^{27}\) Further, those systems employed in the Gulf War consisted largely of laser guided bombs, weapons that were precise but manpower intensive and relatively older technology (dating to the mid-1970s as employed, with some forerunners used in Vietnam). Despite their being referred to as “smart bombs,” Rip and Hasik note that only two weapons systems employed in the Gulf War, the CALCM missile system and the related naval Tomahawk Land Attack Missile (TLAM), which were capable of relatively autonomous operations.

The industrial revolution provided numerous technologies for a steady increase of battlefield lethality, but for the most part navigation and precision technology was not impacted by the developments of the era. While maps and charts had significantly improved owing to aerial observation and other innovations, navigation and positioning remained governed by compass and sextant well into World War II. Radio homing aided in aircraft navigation beginning in the run-up to World War II, and inertial guidance was critical to the development of ballistic missiles in the 1940s through the 1960s. However, “technical limitations precluded the use of precision technology from a wide range of navigational applications. Weight and cost further limited the installation of sophisticated electronic weapons system to a few expensive

\(^{26}\) For a detailed discussion of the history and evolution of precision guided munitions, see Paul Gillespie’s *Weapons of Choice* for a thorough history of PGMs from pre-World War I to the early phases of the War on Terrorism (Gillespie, 2005).

\(^{27}\) See Keaney and Cohen, *Revolution in Warfare?* P. 191.
weapons platforms (Rip & Hasik, 2002, pp. 7-9). Table 2 illustrates the development and evolution of significant U.S. precision weapons system, beginning with the “dumb bombs” of the post-World War II era, which to this day remain the key munitions for aerial bombardment with different “kits” to provide precision guidance. An overall trend can be observed over time from electro optical, to laser, to GPS guidance as the precision revolution advanced. This shift is due to a variety of factors, from the technology available at the time, to the per-unit cost once the precision revolution (in the form of global navigation via GPS or a similar system) had been adopted.

Table 2: U.S. Bomb and Missile Development

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<td><strong>Electro-optical</strong></td>
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<td>GBU-10/12 Paveway I/II</td>
<td>AGM-65C/E Maverick</td>
<td>AGM-114 Hellfire</td>
<td>GBU-24/27 Paveway III</td>
<td>GBU-28</td>
<td>AGM-114 Hellfire II</td>
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<td><strong>Laser-guided</strong></td>
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<td>AGM-114 Hellfire</td>
<td>GBU-24/27 Paveway III</td>
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The AGM-65 Maverick was the first significant precision guided munition to enter the U.S. inventory, reaching operational status in 1972. As alluded to earlier, this weapons system was greatly limited in its employment owing to its price tag and technical issues which made the early variants difficult for pilots to employ from a significant range. The electro-optical sensor and data link system required to guide the weapon to target ballooned the cost of the weapon to
$180,000 per munition (United States Navy Fact File: AGM-65 Maverick, 2009), while the ‘A’ model had a small image presentation to the pilot/weapons systems officer for target acquisition, which required a close approach for targeting (Raytheon (Hughes) AGM-65 Maverick, 2005). Advances in both electro-optical guidance and laser guidance saw the use of precision munitions increase from Vietnam through the Gulf War, but cost and other limitations remained an obstacle throughout the period. Table 3 illustrates the increased accuracy of munitions as the Circular Error Probable (CEP)\textsuperscript{28} declines over the period from over 1,000 meters in World War II to 1-2 meters in the Gulf War for the most advanced precision munitions, a standard of precision that remains roughly the standard to this day. At the same time, Table 4 illustrates the relatively small increase in usage of precision guided munitions over the same timeframe, with significant increases coming post-Gulf War as a ratio of bombs employed, although the total number of bombs significantly declined.

\begin{table}[h]
\centering
\caption{Bombing Accuracy from World War II to Gulf War\textsuperscript{29}}
\begin{tabular}{|l|c|c|c|}
\hline
\textbf{Conflict/Period} & \textbf{Bombs} & \textbf{Aircraft} & \textbf{CEP (m)} \\
\hline
World War II & 9,070 & 3,024 & 1,005 \\
Korea & 1,100 & 550 & 305 \\
Vietnam & 176 & 44 & 122 \\
Autumn 1990 & 30 & 8 & 61 \\
Gulf War (Guided) & 1-2 & 1 & 1-2 \\
\hline
\end{tabular}
\end{table}

\textsuperscript{28} CEP is a measure of accuracy of munitions derived from testing which records the radius of a circle in which 50% of munitions will fall. Thus a CEP of 10m indicates 50% of munitions fired at a point target will hit within 10 meters of the desired aimpoint.

\textsuperscript{29} Table adopted from Hallion’s \textit{Storm over Iraq} (Hallion, 1992, p. 283)
Aside from costs, mission planners who desired to employ either EO/IR or laser guided precision munitions in the Gulf War and subsequent operations faced significant technical obstacles to employment owing to weather, concealment, and other factors. Rip and Hasik list the following key limitations from the era:

- Seekers require operator to acquire target visually, resulting in either decreased situational awareness for an aircraft with a pilot alone or, more frequently, a backseat weapons systems officer. Employment came with tradeoffs of cost (beyond the weapon), weight, situational awareness, and airframes capable of supporting such operations.

- Shortage of laser designator pods at beginning of Gulf War.

- Laser guided systems do not function well with low-level cloud cover, mist, or rainy conditions. This limited employment of the F-117 which only carried two laser guided bombs.

- Rules of Engagement required visual confirmation prior to weapons release.

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30 Table adopted from Rip and Hasik’s *The Precision Revolution* (Rip & Hasik, 2002, p. 224)
- Imaging Infrared (IIR) systems were subject to attenuated IR wavelengths, limiting target accuracy.

- Air defenses force aircraft to higher altitude, increasing probability of adverse weather between the aircraft and target.

- Electro-optical Infrared (EO/IR) systems often required a specific range of thermal contrast, requiring specialized weather forecasts tailored to each mission (pp. 214-218).

Given these obstacles, the Global Positioning System and GPS navigation became the answer to all-weather precision targeting.

From the onset, the implications of precision guided munitions and global navigation provided by Navstar GPS was clear for many observers. Writing in 1981, while GPS was still largely in prototype phase, Philip Abelson and Allen Hammond saw the systems coming together with the other innovations of the information era transforming manned flight. “[E]lectronics plays more than a passive role in military systems; in recent years, advances in electronics have been perhaps the most important factor guiding the evolution of new weapons and new strategies. One example is the emergence of ‘smart bombs’ and other unpiloted weapons, which can evaluate guidance information to track themselves to target or make use of pre-programmed instructions to maneuver evasively. Carried to its logical conclusion, this trend might eliminate the need for many manned aircraft and is at the core of current debates over the B-1 bomber and the cruise missile (Abelson & Hammond, 1981, p. 23).”
Ironically, while analysts had earlier forecast the missile age would doom the manned bomber, the advent of the CALCM and JDAM may have at least temporarily extended their operational life. Up to 1990, bombers were seen as relics of the Cold War with little military utility absent their need for survivability in a nuclear scenario. The B-52’s employment of CALCMs in the Gulf War, from friendly airspace absent a significant air-to-air threat, demonstrated the potential for GPS guided munitions from bomber platforms, but which still cost significantly more than alternative weapons systems. The Air Force then accelerated development of the JDAM weapons system, which like most “smart bombs” would modify existing unguided bombs with a sensor and tail kit to guide the munition to its target. This would overcome the limitations on laser guided bombs, to include weather, and would substantially decrease the cost versus a cruise missile, as depicted in Table 5. Whereas in Vietnam, or in the British experience in the Falklands, a fighter bomber would have had to use its entire munitions load against a runway, a fighter-bomber armed with JDAM munitions could

### Table 5: Comparison of select 1,000lb bombs in U.S. inventory

<table>
<thead>
<tr>
<th>Mark-83</th>
<th>Guidance</th>
<th>CEP</th>
<th>Cost</th>
<th>Notes</th>
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<tbody>
<tr>
<td>AGM-86C Block 0</td>
<td>Unguided</td>
<td>100 meters&lt;sup&gt;31&lt;/sup&gt;</td>
<td>$3,000</td>
<td>Performance limited by time from launch airframe to target</td>
</tr>
<tr>
<td>CALCM</td>
<td>GPS</td>
<td>100 meters&lt;sup&gt;31&lt;/sup&gt;</td>
<td>$2.6 million (FY13)&lt;sup&gt;33&lt;/sup&gt;</td>
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<tr>
<td>GBU-16</td>
<td>Laser</td>
<td>9 meters</td>
<td>$22,000&lt;sup&gt;34&lt;/sup&gt;</td>
<td>Ineffective with poor weather, reduced effectiveness in fire-and-forget mode</td>
</tr>
<tr>
<td>Paveway II</td>
<td>GPS</td>
<td>&lt;5 meters&lt;sup&gt;35&lt;/sup&gt;</td>
<td>$25,000&lt;sup&gt;36&lt;/sup&gt;</td>
<td>CEP rises to 30m if GPS signal is lost</td>
</tr>
<tr>
<td>GBU-32 JDAM</td>
<td>GPS</td>
<td>&lt;5 meters&lt;sup&gt;35&lt;/sup&gt;</td>
<td>$25,000&lt;sup&gt;36&lt;/sup&gt;</td>
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<sup>31</sup> Info derived from FAS.org (Bombs for Beginners).
<sup>32</sup> 1,500 lb warhead; data derived from FAS.org (AGM-86C/D Conventional Air Launched Cruise Missile, 1998).
<sup>33</sup> Cost converted from initial source of $1.875 million in FY99 U.S. dollars. Some public sites estimate cost per missile of $1.5-2 mil based on variant.
<sup>34</sup> Data derived from FAS.org, cost derived from cost of the GBU-12 500lb variant which utilizes the same tail kit (Guided Bomb Unit-12 (GBU-12) Paveway II).
<sup>35</sup> Other sources, such as *Storm over Iraq*, place the CEP of these systems as low as 1 meter.
<sup>36</sup> Derived from cost of Mk-82 munition plus $22,000 cost of tail kit (Joint Direct Attack Munition GBU-31/32/28).
target several aimpoints on the runway (based on intelligence of the takeoff and landing distances required for airframes and the width of the runway) to disable the field, the fuel depots, radar stations, control tower, and airfield defenses.\textsuperscript{37}

These systems are by no means alone in the inventory, with JDAM variants of 500 lb and 2,000 lb in wide use as well, in addition to other guided munitions systems to include the AGM-130 missile, which is a rocket-propelled variant of the GBU-15 Paveway laser-guided munition, and the AGM-154 Joint Standoff Weapon (JSOW), which can carry 1,000 lbs of cluster munitions under GPS guidance to suppress fielded troops or air defense sites, among others. In the event of limited war with a near-peer competitor, a variety of munitions which rely on a mixture of munitions (500 lb, 1,000 lb, 2,000 lb), guidance systems (laser, GPS inertial, etc), and propulsion can be employed based on the target and air defense systems. Once air superiority is established, however, the JDAM has quickly become the weapon of choice.

Advancements in precision munitions led in many cases to an overselling of their capabilities, which led in many ways to the aforementioned problems with cruise missile diplomacy in the 1990s. As policymakers focused on the ability to hit a target within 1m of the desired aimpoint and advocates interested in expanding airpower’s influence emphasized this precision against the lower risks, both in human and political terms, of committing ground forces to battle, key limitations were often overlooked or downplayed. Fundamentally, there are four issues to consider when planning for precision strike operations:

1. The mechanical limitations of the weapons system (guidance type, error rates, blast radius, CEP)

2. The reliability of the underlying intelligence

\textsuperscript{37} See Rip and Hasic, pp. 191-232 for more detailed discussion of the evolution of the JDAM and implications of precision guidance.
3. The timeliness and the time window for the intelligence (when the information would be valid)

4. The strike time for the weapons system from release/launch to impact

The design and testing process of the weapons system is the primary determinant of issue 1, with precision munitions designed for the lowest reasonable CEP and failure rates. However, this is not and cannot be reduced to a zero failure rate or a perfect guarantee of a1m accuracy even with the best systems. Mechanical failures occur, signals are lost, hardware breaks, any number of issues can occur to cause any one munition to fail with potentially catastrophic results even under the strictest design parameters. Issues two, three, and four are reduced in importance when discussing fixed targets, but become the critical barriers to effective targeting with non-fixed targets. Those limitations were exposed in the attempt to kill bin Laden in the 1998 missile strikes, where even with perfect intelligence whether he was at the training camp or not, the probability of striking him would have been low. Increasing the level of intelligence, improving the timeliness of intelligence, and reducing the window from the attack order to placing bombs on target was necessary to enabling precision strike against human targets. The answer to that problem required persistent coverage, enabled by the robotics revolution.

In analyzing the legal oversight of RPAs, Gregory McNeal provided a breakdown of the causes of collateral damage for all weapons system that followed the process for reducing civilian casualties. When the proper procedure was followed, 70 percent of the time collateral damage was due to faulty identification (failure of analysis), 22 percent of the time it was due to mechanical failure, and eight percent of the time it was due to proportionality balancing (accessed damage within the CEP was deemed acceptable given the military necessity), with
zero percent being from a timeliness of intelligence not attributable to one of the other factors (McNeal, 2012).

The Robotics Revolution and Modern RPAs

In the early years of the targeting revolution, Andrew Marshall, director of the Pentagon’s Office of Net Assessment, defined the RMA by saying “The theory is that two factors—information technology and precision strike—are bringing about a basic change in the way wars are fought (Rip & Hasik, 2002, p. 233).” In practice, as the U.S. became involved in two counterinsurgency wars in Afghanistan and Iraq in addition to a broader global struggle against elusive targets, these two factors were insufficient. The experiment in cruise missile diplomacy of the 1990s and the lack of a state with fixed infrastructure on which to focus magnified the time-dimension problem in the targeting cycle – even if a clear target could be identified in time and space, time was required to deliver the weapon to the target location, in most cases leading the weapon to missing the desired target even while hitting with precision the planned coordinate. A third factor, precision coverage, was necessary to enable the basic change to the way wars are fought, and that capability was dependent on advancements in the robotics revolution.

The robotics revolution, like other aspects of the technological era, can trace its roots deep in human history. P.W. Singer briefly summarizes this history dating to Greek and Roman mythology (p. 44-53), with some of the most significant coming in the late-1960s and early-1970s. General Motors began using their first industrial robot in 1962, the first mobile robot came in 1968, and in 1973 the first mobile robot controlled by a computer was produced.
“Numerous advancements were being made, though not on the scale of the computing revolution (Singer, 2009, p. 53).”

The late 1970s through early 1980s saw renewed interest in RPAs looking at potential for long-endurance, high altitude reconnaissance aircraft. A report from President Reagan’s intelligence transition team stated “remotely piloted vehicles…possibly using stealth technology, should be reviewed for…strategic intelligence collection (Ehrhard T., 2010, p. 14). Such a system became a requirement following the deployment by the Soviet Union of road-mobile missile systems, which intelligence sources relied on tracking through electronic emissions, with the goal of integrating the B-2 with RPA data to undermine the Soviet strike capability. The program was first disclosed in 1993, during congressional inquiries into the decision to retire the SR-71, though the Undersecretary of the Air Force James McGovern did give a cryptic response in 1988 over the SR-71, stating “[t]here is no plan at the moment in the Air Force to replace the SR-71 with a manned reconnaissance aircraft (ibid, 15-16).”

Beginning in 1993, the U.S. centralized RPA development under a new office, the Defense Airborne Reconnaissance Office (DARO). Tasked with the development of both manned and unmanned tactical reconnaissance platforms, DARO saw the development of an effective unmanned aerial vehicle program as critical and called for an evolutionary approach of their in mainstream tactical reconnaissance (DARO, 1994). Although lacking a mission requirement in initial development, two programs, Predator and Global Hawk, emerged from the DARO program and were adopted by the armed forces as need for a mid-level, high endurance tactical ISR collector emerged in the former Yugoslavia. The 1990s saw a boom in RPA development, as seen in Figure 5.
In 1995, the Air Force stood up the 11th Reconnaissance Squadron at Indian Springs (northwest of Las Vegas, NV) and put their full weight behind reclaiming control of RPA development when it appeared the Army might take the lead role given its adoption of smaller tactical RPAs like Hunter, with the Air Force taking over initial responsibility for the program in 1996 and fully taking over acquisition in 1998 (Ehrhard T., 2010, p. 51). Also in 1995, the first Predator prototypes saw action in an ISR role over the former Yugoslavia, in Operations Deny Flight and Deliberate Force (Boyne, 2009). Although the Predator and Reaper received the most attention in today, the chart shows that the bulk of RPA innovation continued to occur with smaller, tactical ISR RPA platforms.
Strategic vs. Tactical RPAs

In analyzing RPAs, understanding the distinctions between tactical and strategic RPAs is vital. Tactical RPAs tend to be cheap per-unit for acquisition, which in turn leads to significant attention over the risks of proliferation. Strategic RPAs, conversely, are advanced in technology, are large, and are reliant on a vast network of infrastructure to include satellites and ‘reachback’ centers to analyze the data collected by the RPA along with complementary intelligence sensors. A strategic RPA with satellite data-link can be controlled from virtually anywhere in the world, is limited in its on-station time solely by the design of the airframe, and can conduct advanced missions from ISR collection to precision strategic attack based both on the sensors on-board and the connections to the broader network. Strategic RPAs, operating as part of a global communications network, can extend the reach and the spectrum of operations available based on the added capabilities of the system. As RAND’s Ted Harshberger noted, “it is very difficult to build long-endurance, highly automated, multi-role unmanned systems of the sort often purchased by the United States and its allies….it is extremely easy to produce modest-endurance, partially automated, single-purpose unmanned systems (Harshberger, 2012).”

The U.S. Army classifies RPAs into five groups based on weight, airspeed, and altitude, with what I refer to as ‘strategic’ RPAs generally in groups 4 and 5, while the USAF works almost exclusively with what I categorize as ‘strategic’ aircraft. To differentiate the two, I instead focus as previously noted on the network of support required to operate the asset, rather than the scale of the asset or the mission, to identify RPAs as ‘strategic’ or ‘tactical.’ Figure 6 helps to illustrate this difference, with tactical RPAs being line-of-sight controlled and operating largely within a ‘bubble’ denoting a traditional combat operations zone with aircraft in direct

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38 See the U.S. Army UAS Roadmap, pp. 11-13, for further discussion of the Army classification system.
support of ground operations. In general, this will closely correspond with mission sets and cost associated with the RPA system, but sets a clear dividing line between classes and the capabilities of the platforms. An RPA which is controlled line of sight will be limited in range and duration, and will also be more vulnerable as a result as the operator can be targeted to disable the RPA.

**Figure 6: Strategic vs. Tactical RPAs**

The U.S. Army’s UAS Roadmap demonstrates that such a metric is a good dividing line for RPAs based on mission, as shown in Figure 7. This figure, which the Army uses to illustrate RPA operations, shows links to RPAs being contained within the battlefield so as to maintain operational control, similar to how Figure 6 illustrates tactical RPAs being contained within a bubble distinct from global operations, as well as their call for doctrine to “compliment BCT and below field manuals (U.S. Army Unmanned Aircraft Systems Roadmap 2010-2035, 2009, p. 34)” These are likely to be smaller, cheaper, and carry basic sensors such as electro-optical cameras and basic listening devices so as to allow operators on the battlefield to control and exploit their products.
Tactical RPAs are also important because they are more likely to have civilian applications, both in the government and private sector, owing to their lower per-unit costs, the ability to operate with a single operator with equipment as basic in some cases as a smart phone application, and the limited need for roles beyond line of sight control. The possible commercial and domestic applications of small RPAs has become a hot topic over the past year, fueled in part by Amazon.com’s plans to use RPAs for delivery, and also by fears of government agencies using them for domestic surveillance. Under current Federal Aviation Administration (FAA) regulations, RPAs cannot be used for commercial purposes, but the FAA has signaled its intentions to revise these regulations to allow for commercial RPAs in U.S. airspace by the end of 2015. In December of 2013, the FAA announced six testing sites that would test RPAs in a number of roles and environments to lay the groundwork for such regulations. Included in the list were sites like the University of Alaska Fairbanks, which both offers a variety of environments in which to test (with locations in Oregon and Hawaii as part of their testing.

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39 From the U.S. Army UAS Roadmap, p. 31.
grounds) and is closely tied to austere industrial sites such as the Alaska oil pipelines and drilling sites which could greatly benefit from RPAs, both for surveillance and resupply. Other sites included Griffiss International Airport in New York, which will be used to test RPAs in congested airspace among other issues (Associated Press, 2013).

Tactical RPAs could potentially fill a number of domestic roles beyond government surveillance. Aerovironment, one company which develops small RPAs for government and military users today, touts the potential of small RPAs in the future for public safety providing local situational awareness to first responders in all weather conditions, wildlife and environmental monitoring for resource management, infrastructure management, and scientific research such as monitoring volcanoes, sinkholes, and other areas which would be either difficult to reach or hazardous for human operators (Aerovironment). Similar small RPAs have been used by sheriff’s offices in the U.S. to assist in search and rescue missions already (Ban, 2012). Larger RPAs such as Predators drones were used in the aftermath of the hurricane Katrina, while rotary-wing RPAs equipped with radiation sensors, infrared thermometers and cameras assisted at Japan’s post-tsunami Fukushima nuclear facility (Drones to the Rescue!, 2012). Armed with thermal imaging, electro-optical sensors, and potentially threat detection systems to monitor for surface-to-air threats, tactical RPAs could be well suited for a variety of non-military humanitarian missions in environments such as Syria.

**Arming the Predator**

Predator had been developed by a government agency, with little input from the armed services, and at the time of its inception largely lacked a mission. It was of limited application for potential war plans in Europe or Asia, and fell between the Air Force and Army requirements
for reconnaissance aircraft. Circumstances in the 1990s would create the need for such a platform, and drive its development from a tactical ISR collector to an armed strategic platform. Yugoslavia demonstrated the need for a medium altitude collector with extended loiter time, and extending those capabilities to the monitoring of emerging adversaries in Afghanistan and elsewhere would open the door for weaponizing of the RPA platform.

Following the attacks on U.S. Embassies in 1998, the Clinton Administration launched cruise missiles in retaliatory strikes against al Qa’eda targets in Afghanistan. Their failure to successfully hit bin Laden led to an increased ISR effort to find and monitor his whereabouts. Per Clark’s account, bin Laden was found in Afghanistan in October of 2000 with a Predator, but the lack of arms aboard the Predator prevented a strike. This experience led to orders to find a way to arm Predator, and quickly (Clarke, 2012). There are varying accounts of the exact sequence of this process. Clarke (2012) recounts an occasion in October 2000 when a Predator operating in Afghanistan sighted Osama bin Laden but was unable to strike as the armed Predator did not exist at that time. In this account, he and several others advocated for the arming of Predator should such a situation arise in the future, a proposal which was met with resistance by both CIA and the Pentagon until after the September 11, 2001 attacks.

A separate account, provided by Boyne (2009), shifts the timeline to the left, with the Pentagon playing a greater role in the decision to arm Predator. In Boyne’s account, then-Air Force Chief of Staff Michael Ryan contacted Colonel James Clark, who had in 1996 served as...

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40 The 9-11 Commission Report substantiates this to a degree but with far less certainty, noting that on two occasions, Predator spotted a “man in white” at locations associated with bin Laden, and that intelligence community analysts determined that he was ‘probably bin Laden’. This particular detail is a common thread in all accounts of the decision to arm the Predator and thus likely played a key role in the decision, the reaction of various parties to the decision remains the critical question to the path for arming Predator and its initial operational use.

41 This represents the first U.S. development of RPAs, which is the emphasis of this paper due U.S. RPA activities elevating the policy debate. The U.S. is not alone in their development of strike RPAs, with Israel and the U.K. known to possess armed RPAs.
lead evaluator of Predator’s effectiveness in Bosnia, on 2 April 1999 to task Clark with an urgent requirement for the Predator to ‘provide precise geographic locations of the subjects it was observing so that they could be targeted.’ This requirement was generated by Lt Gen Michael Short, the Combined Forces Air Component Commander for Operation Allied Force, based on conversations with his son on the difficulty he experienced being cued to targets based on descriptions from RPA operators. Within 38 days, Predator’s sensor camera was replaced with a separate sensor consisting of both a camera and a laser designator, facilitating the relay of targeting information direct to F-16 and A-10 platforms. Sensing that making the sensor platform the shooter as well would dramatically reduce the “kill chain” and increase the effectiveness of strike operations, General Jumper advocated for the arming of Predator shortly after his arrival as Commander of Air Combat Command in February 2000. Under Clark and working with Big Safari\textsuperscript{42}, the Air Force initiated a program to arm Predator in mid-2000, with the first successful operational test of a Hellfire launched from a Predator on 16 February 2001 (Boyne, 2009).

The first public report of a U.S. RPA being used in an attack role came on 4 November 2002, when CNN reported that a CIA-operated Predator armed with hellfire missiles struck a vehicle in Yemen, killing six people including a man wanted for the October 2000 bombing of the U.S.S. Cole. The circumstances surrounding this strike would set the precedent for many future strikes. Both Pentagon and CIA sources refused to discuss the event, with President Bush and Secretary Rumsfeld merely acknowledging that the U.S. was continually hunting international terrorists and that, if reports were true that Qaed Senyan al-Harthi had been killed, it “would be a very good thing if he were out of business” (Sources: U.S. kills Cole suspect,

\textsuperscript{42} Big Safari is an office at Wright-Patterson Air Force Base, Ohio, famous for its scientific analysis of weapons systems integrated with acquisition and logistics (Boyne, 2009).
This was not the first use of the RPA in an attack role, as reporting around that time would indicate that the strike that killed Muhammad Atef in November 2001 (previously simply reported as an allied airstrike) had in fact been a Predator as well (Anwar, 2012), but the nature of the strike and it taking place in Yemen elevated the debate over the roles of RPAs in the war on terrorism.

From 2004 through 2010, open source reporting indicates a steady increase in the use of Predator and other attack RPAs, notably the newer Predator B/Reaper, in U.S. air operations. Of those operations, reports of U.S. RPA operations in Pakistan garnered the most media attention. Initially targeting key al Qa’eda leaders, reporting indicates a shift to lower level figures and an increase in “signature strikes,” with some citations reporting as few as 2% of attacks target HVTs (Living Under Drones: Death, Injury and Trauma to Civilians from US Drone Practices in Pakistan). Figure 8 shows the data compiled by the New America Foundation on deaths from airstrikes in Pakistan and Yemen. The data shows that as time has progressed, the rate of civilian casualties has declined with the exception of one significant strike in 2011. On the surface, this supports proponents who advocate RPAs as the preferred weapon due to their precision and improving collections capability identifying militants. Critics, however, maintain that the data is inaccurate as casualties are identified as militants after the fact, with little process available to cross-check their actual status. As attacks have declined in Pakistan since 2010, reported airstrikes have increased in Yemen. Though the number of strikes is declining, the RPA appear to remain the weapon of choice in the U.S. global campaign outside of theaters where a significant ground presence exists.

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43 Raw data is provided by the New America Foundation.
While RPA activity in Pakistan and Yemen receive the bulk of media attention due to the controversies over military strikes in these states, they are in fact a small percentage of the overall employment of RPA strikes. The overwhelming majority have occurred inside Afghanistan, likely receiving less attention in the United States because their use in a universally recognized war zone where the United States has the clear legal authority to operate. Similarly, RPAs were extensively used during Operation Odyssey Dawn, the first phase of the air campaign involving the U.S. which led to the overthrow of the Qaddafi regime (Ackerman, Libya: The Real U.S. Drone War, 2011). Even though RPA strikes in Afghanistan receive less attention in the United States than similar strikes in Yemen and Pakistan, they still receive criticism from the international community as well as from factions within Afghanistan. ISAF airstrikes are responsible for an estimated 35% of civilian casualties from pro-Afghan Government forces (UNAMA, 2013), and a series of incidents have led to the suspension of coalition air strikes in Afghanistan. UNAMA’s annual report showed a dramatic increase in U.S. RPA activity in 2012 over previous years, combined with a total decline in the number of civilian casualties associated

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44 Data on Pakistan and Yemen derived from New America Foundation and include through the end of 2012; Data on Afghanistan taken from US document obtained from the Bureau of Investigative Journalism
with airstrikes overall. Figure 8 depicts RPA operations from 2009-2012 for Afghanistan, Pakistan, Libya, and Yemen based on public reporting.

Even though RPA strikes in Afghanistan receive less attention in the United States than similar strikes in Yemen and Pakistan, they still receive criticism from the international community as well as from factions within Afghanistan. ISAF airstrikes are responsible for an estimated 35% of civilian casualties from pro-Afghan Government forces (UNAMA, 2013), and a series of incidents have led to the suspension of coalition air strikes in Afghanistan. UNAMA’s annual report showed a dramatic increase in U.S. RPA activity in 2012 over previous years, combined with a total decline in the number of civilian casualties associated with airstrikes overall.

Recalling the four limitations on precision targeting (mechanical, intelligence, timeliness, and employment lag time), the argument in favor of the attack RPA is that it enables dynamic targeting by extending the strike window for operations to near infinity (versus a piloted system like a bomber would be time constrained or would need to deploy to a target location) and by reducing the time to strike enabling real-time operations (as opposed to a cruise missile which can lag from 1 to 6 hours from the time the intelligence is received to the time the warhead could be placed on target, which is why we missed getting bin Laden in 1998). The platform in isolation does not have significant bearing on the reliability of the weapon employed nor of the reliability of intelligence, which require infrastructure and investment above and beyond the RPA platform. That is a key limitation for diffusion, but even in advanced states with the capabilities to address all four issues the issues are reduced, not eliminated. Mechanical failure, intelligence failure, obstacles to persistence through basing and flight restriction, and delays of even seconds both in release of weapons and in reaction time of operators to sensors
(compounded by data link delays) all can mean the difference between a successful strike and failure with negative strategic implications.

**Tactical Attack RPAs – Task Force ODIN**

While the Air Force retained control of Predator beginning in the late 1990s, the Air Force was unsuccessful in asserting itself as the executive agent for all services for RPA technology. The Army developed and maintained a number of tactical ISR RPAs beginning in the mid-1980s, notably the Hunter and Shadow RPAs, and sought to retain a basic tactical surveillance capability that likely would not be maintained by the Air Force given the Air Force’s theater-wide perspective. The Air Force and Army worked closely on RPA projects, notably in the creation of Warrior Alpha, an RPA based on the airframe of the I-GNAT but upgraded with some of the sensor capabilities of the Predator, but doctrinal differences and operational requirements of war in Iraq and Afghanistan led to splits in the organization and employment of RPA missions. The Army focusing on tactical, unit controlled RPAs as opposed to the Air Force’s move toward larger, more capable RPAs (Shanker, 2008).

In the context of the Iraq War, no case illustrates the philosophical and operational divide on the employment of RPAs better than the Army’s development of Task Force ODIN (acronym standing for ‘Observe-Detect-Identify-Neutralize’). This task force came about in 2006-2007 as a result of a perception in the Army that the Air Force leadership was out-of-touch with the ISR needs of army units fighting insurgents in Iraq, a problem that had been rising steadily since

45 During the Bush Administration this was the subject of intense debate that General Deptula noted “became an emotional issue.” Deputy Secretary of Defense Gordon England ultimately opted against the Air Force as a single component to oversee the programs (Tirpak, The RPA Boom, 2010).

46 Generally Brigade-level and below.
2005. While the Army saw a need to locate roadside bombs and track the insurgents planting those devices, the Air Force saw the need to optimally allocate a limited strategic asset with requests from throughout the country for support (Shanker, 2008).

The Army’s vision for ISR support entailed a mix of ISR assets, from the C-12 aircraft\(^ {47} \) with advanced sensors to the aforementioned Warrior Alpha. Operating below the Division-level, Task Force ODIN would provide ground commanders an organic ISR capability to supplement operations. This would be used to affect the IED battle “left of the boom”\(^ {48} \) by using ISR sensors to sweep future convoy routes for potential IED emplacement sites, both in advance of a mission when IEDs could be placed and to monitor activity on roads immediately preceding active convoys to identify signatures of potential IED emplacements (suspicious vehicles, lack of foot traffic where it would otherwise be expected, possibly even insurgents themselves operating command-wire and remote-detoned IEDs in lookout positions). This capability in turn could be used to broaden the counter-IED focus away from IED emplacements and towards a focus on the IED network itself. By identifying patterns of IED emplacements as they occurred and monitoring patterns of IED emplacers, the Army could analyze the network in detail to identify bomb-making locations, financiers, and logistics/supply chains necessary to run large scale IED campaigns (Miles, 2011). Beyond the counter-IED mission, these assets could be data-linked to armed air assets in the region such as the Apache helicopter to facilitate strike missions, both as part of the counter-IED mission and in support of raids on suspected insurgent locations.

The divide between the Army’s vision of mission requirements and the Air Force’s desire for advanced capability RPAs with strategic effects illustrates a divide in Army/Air Force strategy that extends well beyond the RPA debate, to the core of the move toward the Air Force

\(^{47}\) A modified Beechcraft Super King Air 350 (MC-12 Factsheet).

\(^{48}\) Terminology used to describe a shift in focus from a reactive to a proactive IED focus seeking to identify and defeat IEDs before they explode.
as a separate service. The Army saw the need to provide support to ground commanders to achieve operational success, which would eventually lead to strategic effect. The Air Force, meanwhile, saw it as an inefficient misallocation of airpower. While the Army could use Task Force ODIN to guarantee ISR support to commanders, this meant a significant redundancy in capabilities with many sitting idle. A unit not engaged in operations on a given day would retain its ISR assets, leaving them sidelined while other commanders may find their ISR assets overtaxed. In many cases, units that were not forward deployed retained their ISR assets at home stateside, further reducing ISR assets available within the theater.

The Air Force, in contrast, saw the need to develop a smaller force of more capable RPAs that would be controlled at the level of the theater commander. This would enable its tasking to high-priority missions and assure that ISR assets were not being underutilized. Gen. Deptula, the commander of the Air Force’s ISR programs in the late 2000s, noted "[I]f I can provide a tenfold increase in what the warfighter wants... why would I want to buy a lesser platform? That’s why the Air Force is moving to the MQ-9 (Tirpak, The RPA Boom, 2010).” The central divide came in understanding warfighter requirements, with the Air Force opting for quality over quantity in order to maximize the efficiency and effectiveness of the weapons systems, and ground commanders in some specific missions asking for the opposite.

Ultimately, given the magnitude of the IED problem in the Iraq counterinsurgency and the budgets being spent on counter-IED efforts, the Pentagon opted for an ‘all of the above’ approach, with Pentagon Press Secretary Geoff Morrell noting that Defense Secretary Robert Gates “wants to make sure that we are looking at not just top-down solutions, but ground-up

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49 Observers of the Iraq effort often made the analogy that the Pentagon was investing in a “Counter-IED Manhattan Project,” with one counter-IED organization, the Joined IED Defeat Organization (JIEDDO) spending over $25 billion on various counter-IED technologies (Sapolsky & Schrage, 2012). JIEDDO represented just one of many counter-IED organizations in this campaign, others included Task Force Troy (Iraq) and Task Force Paladin (Afghanistan).
solutions. We need to pay attention to anything that works (Tirpak, The RPA Boom, 2010).”
This difference in philosophy and mission requirements has led to a variety of armed RPAs in the current U.S. inventory.

Unlike armed Predator missions, the Warrior Alpha’s role in Task Force ODIN was largely to exploit ISR capabilities to cue other platforms for targeting purposes, requiring integration in a close air support network as opposed to a strategic attack network. As Shanker reported, “One clip from a remotely piloted vehicle shows an insurgent using palm fronds to smooth dirt over a bomb he had buried late at night along a major convoy route. Moments later, he disappeared in 30-millimeter fire from an Apache that was alerted by the remotely piloted Army surveillance craft overhead.” This operating concept, while similar to those employed early by Air Force assets for using Predator to cue strikes from fighter bombers, relies on close connection to helicopter gunships and troops on the ground for tactical strike data. Also, in uncontested air environments, such missions appear to offer no significant benefit to unmanned vice manned aircraft. The C-12 variants were viable alternatives to many missions, and came at lower cost making them more ideally suited to the mission. Persistence was not as significant a requirement to tactical missions of limited time duration. As a result, the RPA in this environment worked, but was of little added value over manned alternatives, if it was of added value at all. The standup of Task Force ODIN-Afghanistan suggests lessons learned in Iraq moved it more towards an Air Force-style theater wide asset, rather than an organic tactical command asset, may have been adopted as Task Force ODIN-A is referenced as a single aerial ISR unit networked nationwide for collection, analysis, and dissemination (Sutherland & Carlson, 2012). It would, however, remain under Army control and thus subject to the Army’s mission requirements rather than the Air Force’s concept of operation.
Experimental, Developmental, and Recently Cancelled Programs

Beginning in 1999 and increasing through 2002, Kuwait-based Predators flew regular ISR surveillance missions over Iraq. As rhetoric and tension increased in advance of the 2003 Iraq War, Saddam Hussein began to challenge these overflights with Iraqi Air Force fighters. At this time, the Predator was a limited, high value asset\textsuperscript{50} that General Jumper hoped would play a key role in the event of war hunting Iraqi scud missile sites – one critical area where the Air Force had no success during the 1991 Gulf War. Working with Clark and Big Safari, Jumper agreed to a plan to arm Predators operating in Iraq with Stinger missiles, dubbed the AIM-92 in an air-to-air role (Whittle, Predator's Big Safari, 2011).

The Stinger missile was initially devised as a hand-held surface-to-air missile, possibly most famous for its use being supplied to Mujihadeen fighters in Afghanistan as popularized in \textit{Charlie Wilson’s War}. Targets in this role would include low-flying rotary-wing aircraft or fixed-wing aircraft on takeoff and approach (when operating at lower airspeeds and at low altitudes). The Stinger had already been adopted by this time for use aboard Army and Marine Apache aircraft, but not for higher altitude missions aboard fixed-wing aircraft targeting other fixed wing aircraft. Tests performed in 2002 were “less than impressive” in Whittle’s words, but Jumper and Clark ultimately reached the conclusion that, even if it was highly unlikely that a Predator could actually shoot down an Iraqi aircraft, the mere fact that it was able to fire might achieve the effect of pushing Iraqi fighters away from future Predator missions and thus preserving the remaining aircraft.

\textsuperscript{50} A CBS News Report from the time frame stated the US had just 20 operational Predators.
On December 23, 2002, one Predator engaged an Iraqi MiG-25. The video of this engagement later released by CBS News\textsuperscript{51} shows the MiG-25 engaging the Predator, with the Predator firing a single missile in reaction. The AIM-92 never appears to acquire the MiG-25, and possibly locks on to the air-to-air missile that the MiG had fired before it fell out of the sky. Although the engagement was a tactical loss, Gen Jumper regarded it as a strategic success as never again did an Iraqi MiG challenge a U.S. Predator before the beginning of the Iraq War in March 2003. As he related to Whittle, “Although the chances of hitting him were miniscule, we knew it would scare the hell out of them to have somebody shoot back. And that’s exactly the effect it had.”

The Predator has since been used exclusively in permissive environments absent an air-to-air threat, which in turn led to the removal of the AIM-92 from Predator and Reaper, though both airframes retain the capability to carry that system should it be required in the future. This appears unlikely; however, as potential adversaries are more likely to have adapted and incorporated the prospect of the (minimal) threat posed by the AIM-92. Predator and Reaper lack the speed and maneuverability that would enable them to be in a first shot position in most cases, and the AIM-92 is, for a number of reasons, not well-suited for air-to-air combat against even most obsolete fighter aircraft. It was specifically chosen due to its compact size, low weight, and infrared sensor, all of which were requirements for use on Predator. Reaper likely could carry both the AIM-92 and a compliment of Hellfire missiles for air-to-ground missions, but would still likely fail in an air-to-air engagement.

To develop an RPA with a true air-to-air capability would require an advanced RPA beyond those currently in development, to include the Predator C Avenger. The Avenger

\textsuperscript{51} Video available on Youtube at the following URL: http://www.youtube.com/watch?feature=player_embedded&v=WUR3sgKUV8
represents a dramatic increase in performance capabilities for airspeed and power, but likely lacks the sophisticated radar systems required for most air-to-air missiles. The AIM-9X Sidewinder would be a dramatically more capable missile aboard an RPA than the AIM-92, retaining the IR sensor and thus with less need for advanced radar, but such an RPA would likely still require the support of other aircraft to identify and target air-to-air threats. Further, its size would necessitate either a reduction in air-to-ground munitions or a significant increase in the size of the RPA, and in any of these scenarios a significant increase in cost.

In 2005, DARPA teamed up with developers in the Air Force and the Navy to jointly oversee the development of the next generation of RPAs, dubbed the Joint-Unmanned Combat Air System (J-UCAS or UCAV for the vehicle). DARPA had worked with Boeing since 1999 on developing demonstrator platforms, with the X-45A completing its first flight in 2002 (X-45 J-UCAV, United States of America). The goal of this process was to create a stealthy multi-service RPA capable of carrying guided munitions, conducting suppression of enemy air defense, and other similar operations against a near-peer competitor state in the early phases of combat operations. Importantly for naval operations, taxiing, takeoff, and landing operations can all be conducted autonomously, but a sensor operator has the ability to take those responsibilities on if it was desired.

Following the Quadrennial Defense Review in 2006, the Air Force terminated its role in the Joint-UCAV program in order to pursue development of a new long range bomber capability. This planned next-generation bomber had been in the planning for the Air Force well in advance of the decision, but the 2006 review accelerated the date of the program from 2037 to 2018 (Sherman, 2006). Initially, the Air Force suggested that the next generation member may be related to its service-specific UCAV development, however current indications suggest a primary
manned role (many details of the program remain classified). A series of other demonstration RPAs have been developed since the cancellation of the Joint-UCAV program, but have often been led by companies rather than military procurement, such as Boeing’s Phantom Ray.

The Air Force’s development of the next generation bomber with a potential RPA variant has been controversial from the outset. The prospect of increasing the roles of remotely piloted aircraft to include nuclear strike led to an uproar among opponents of RPAs and other weapons initiatives, with Hans Kristensen of the Federation of American Scientist’s nuclear information program decrying such a move as dangerous because a theoretical RPA could diminish the role of human judgment or control over nuclear weapons (Grossman, 2012). It may ultimately be higher costs that may lead to the cancellation of a remotely piloted long range bomber. Under the budget limitations services are currently facing, the added cost to explore a remotely piloted bomber variant might be sufficient to cancel the entire program, leading Air Force officials to opt only to pursue the manned variant. In discussing the prospects of an unmanned mission for the long-range bomber, Lt. Gen. Charles Davis emphasized the need for developing the manned capable aircraft first with an unmanned variant second. "Very rarely should we be out maturing new technologies in new platforms…Once we are certain that a technology is at a usable level, then our acquisition programs can do the hard work of integrating. We have a hard enough time integrating engines, air frames, sensors; we should not be inventing things that have not been developed (Osborn, 2013)." Regardless, the new Long Range Bomber isn’t expected to reach operational status until 2025 at the earliest, suggesting no major RPA programs in the immediate future for the Air Force beyond new variants of the existing fleet.

The Navy, meanwhile, has proceeded with testing their variant of the J-UCAV program, the Northrup-Grumman X-47. As argued by Tom Ehrhard and Robert Work in 2008, the move
toward an increased aircraft carrier-based RPA capability appears the most logical move for a future navy which will require increased capabilities of range, persistence, stealth, and networking among other gaps identified in the 2006 Quadrennial Defense Review. These capabilities “will likely help to transform the aircraft carrier and its air wing from a power-projection system with outstanding global mobility but relatively limited tactical reach and persistence into a key component of a global surveillance-strike network (Ehrhard & Work, 2008, p. 11).” Ehrhart and Work argue that such a transformation of aircraft carriers to a global strategic strike role could be revolutionary in much the same way this piece argues ground-based strategic RPAs are for power projection. Whether this would represent a unique revolution or a basing element for the existing RPA revolution is debatable, as are the merits of the relative cost of ground-based aircraft versus naval aircraft.\textsuperscript{52} Despite a historical aversion to RPAs similar to that of the Air Force, the Navy has made visible strides in the past year on development of the X-47 UCAS. On May 14, 2013, an X-47 made the first catapult takeoff from a naval carrier, which was followed in early July with the first landing, both taking place aboard the U.S.S. George H. W. Bush (Subbaraman, 2013).

\textbf{Automation and Autonomy}

In the current debate over advancing RPA technology, one area that remains highly controversial that is purely within the realm of technological advancement is that of automation of the weapons systems. This study has been careful in its selection of the term RPA to emphasize that, although various functions of RPAs can operate autonomously, they are

\textsuperscript{52} See Michael O’Hanlon’s \textit{The Science of War} for a detailed discussion of the relative costs associated with land-based and carrier-based aircraft (O’Hanlon, \textit{The Science of War}, 2009).
ultimately under the control of a significant team of operators and analysts, and the ultimate decision to use offensive force rests with a manned operator. However, the RPA’s use today is heavily scrutinized in popular culture as the beginning of a slippery slope to a machine takeover of warfare, as illustrated by the title of Turse and Englehart’s book *Terminator Planet*, a not-so-subtle allusion to the *Terminator* series of movies confirmed by the opening sentence of the book.

Automation has been a reality in a number of weapons systems for the past century, and is in fact directly related to the Information Revolution, for just as the Industrial Revolution automated mechanical processes, the Information Revolution has automated decision-making processes. The perception of autonomy as a catch-all for the evils of the computers taking over, however, hinders the debate on advancements of RPAs in combat. As defined by the DOD’s Defense Policy Review Board, “Autonomy is a capability (or a set of capabilities) that enables a particular action of a system to be automatic or, within programmed boundaries, ‘self-governing (The Role of Autonomy in DoD Systems, 2012, p. 1).’” Critical to this definition is the phrase ‘a particular action,’ noting that automation does not refer to the entire system at all times. At some level, all systems will be controlled by human operators, and as a result the DoD task force recommended that “[i]nstead of viewing autonomy as an intrinsic property of an unmanned vehicle in isolation, the design and operation of autonomous systems needs to be considered in

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53 The Unmanned Systems Roadmap states “current DoD UAS are remotely operated and capitalize on automation in extreme circumstances, such as a lost link condition, to automatically perform a preprogrammed set of instructions. This distinction is important because our community vernacular often uses the term ‘autonomy’ to incorrectly describe automated operations... research and development in automation are advancing from a state of automatic systems requiring human control toward a state of autonomous systems able to make decisions and react without human interaction. DoD will continue to carefully consider the implications of these advancements. (U.S. Department of Defense, 2013, p. 15).” Process automation in turn leads to the capability of autonomous operations today, but with many constraints. Future autonomous operations based on a true autonomous capability is under study and likely technically feasible in the future, but with constraints from normative, legal, and behavioral reasons as the Roadmap noted. Focusing on autonomous operations based on automated processes for the medium-term better describes autonomy as applies to RPAs.
terms of human-system collaboration (Ibid., pp. 1-2).” The real question for the future of RPAs is not whether or not they should function autonomously, but which aspects of their missions should be automated and to what extent.

Table 6: Levels of Automation

<table>
<thead>
<tr>
<th>Maybury Classifications</th>
<th>Sheridan &amp; Verplank Level</th>
<th>Automation Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Autonomy</td>
<td>1</td>
<td>Computer offers no assistance: human does the whole job up to the point of turning it over to the computer to implement.</td>
</tr>
<tr>
<td>Partial Autonomy</td>
<td>2</td>
<td>Computer helps by determining the options.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Computer helps determine options and suggests one, which the human need not follow.</td>
</tr>
<tr>
<td>Supervisory Autonomy</td>
<td>4</td>
<td>Computer selects action and the human may or may not do it.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Computer selects action and implements it if the human approves.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Computer selects action, informs the human in plenty of time to stop it.</td>
</tr>
<tr>
<td>Full Autonomy</td>
<td>7</td>
<td>Computer does the whole job, tells the human what it did.</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Computer does the whole job, tells the human what it did only if the human explicitly asks.</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Computer does the whole job, tells the human what it did if it decides he should be told.</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>The computer decides whether or not to do the whole job. If it decides to do the job, it can determine whether or not to tell the human about it.</td>
</tr>
</tbody>
</table>

A 1978 article by Thomas Sheridan and William Verplank represents one of the first efforts to define a spectrum of autonomy, rather than defining platforms as either autonomous or not. This spectrum would pertain to specific processes which could be automated to enable the human operator to focus on other procedures, with the software design dictating the level of control for the human operator. Mark Maybury, building on this foundation and placing it in the context of RPA development, refined these levels of automation into four broad categories: no

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54 Table modified version of table originally appearing in Embracing Autonomy (Lee C. H., 2011), derived from Human and Computer Control of Undersea Teleoperators (Sheridan & L.Verplank, 1978), modified to include current Air Force definitions of autonomy as well.
autonomy, partial autonomy, supervisory autonomy, and full autonomy. Table 6 shows these two systems for classifying levels of autonomy, with a corresponding description of each level.

Not only does a framework for understanding autonomy as Table 6 demonstrates show the potential problems with viewing the development of autonomous RPAs as an all-or-noting proposition as noted by Caitlin Lee (Lee C. H., 2011), but when viewed through the lens of processes rather than platforms the issues with such a bipolar classification become more clear. Aircraft, and indeed all modern technology-based systems, perform multiple functions with varying degrees of autonomy throughout automated processes. Cars represent one example, with traction control and other features run by an on-board computer representing autonomous operations, overriding the commands of the operator demonstrating Level 7 autonomy. This does not make the entire vehicle autonomous or not, though as the technology continues to develop and the automation of certain functions are normalized by the population, the potential to expand similar automated functions to the vehicle grows. The vehicle operator’s situational awareness is thus allowed to be focused on other areas of operating the vehicle, such as increased awareness of other vehicles. Manned aircraft perform a number of operations autonomously, from basic auto-pilot functions to the potential to program entire routes. As Dave Blair noted in several of our conversations, a modern C-17 is likely capable of more autonomous operations than a Reaper even though the C-17 is an aircraft with a pilot on-board.
With RPAs, examples of differing levels of autonomy can be seen at work in the operations of the RQ-4 Global Hawk.

Figure 9 is a schematic of the RQ-4’s automated profile drawn from an unclassified RQ-4 mission briefing, enabling autonomous operations in the event of a loss of communications. The RQ-4 is programmed by a pilot to fly to a series of waypoints as part of its mission profile. The RQ-4, using combinations of on-board sensors and data links to other assets to include satellites, determines the best route to reach the next designated waypoint, demonstrating Level 8 full autonomy. Upon reaching each waypoint, the aircraft decides between a series of options based on its status at the waypoint, whether to proceed with the mission, land, return to base, etc. As the mission progresses, the aircraft runs a full mission profile based on its pre-programmed
settings, with aircrew monitoring its flight and able to alter the flight path based on changing mission requirements or to override the Global Hawk’s decisions.

This example illustrates autonomy at work in existing platforms, and in a way that few would likely see as controversial given it pertains to navigation and timing given a pre-programmed route. Autonomy can play a similar role in future RPAs for issues such as collision avoidance in congested airspace, adapting to weather conditions given the loss of some Predators and Reapers to weather, and evasive action to avoid threats in contested airspace. The Navy will likely need to rely on autonomous systems for both takeoff and recovery of RPAs on aircraft carriers given the movement of the carrier deck and the likely reduced real-time situational awareness of operators which could delay both the processing of changes in the flight deck and the relay of the signal from the operator to the aircraft. These and other advancements to automate various aspects of RPA missions will not inherently serve to overtake the role of the human operator, but will instead take over what can be characterized as routine matters of airmanship, freeing up the operator to focus more attention on other aspects of the mission.

The levels of automation identified in Table 6 provide a useful and easy to understand methodology for comprehending automation in RPAs. However, several recent reports have questioned their overall utility in advancing the argument for the need for greater autonomy for RPAs. The Defense Science Board, in their report on automation, recommended moving away from a levels approach to understanding automation and toward a three facet framework to assist program managers and acquisitions officers in shaping programs, designing future technologies, and evaluating future systems. These three facets would look at the cognitive echelon (the relationship between the system and operator and scope of control), the mission dynamics echelon (using mission analysis to determine what aspects of the mission would be better if

55 See Chapter 6’s discussion of the costs of RPA operations for a discussion of several of these incidents.
automated), and the complex-systems trade echelon (recognizing inherent tradeoffs across a number of measures of performance when considering automation versus human operator). This framework is illustrated in Figure 10.

**Figure 10: DoD Framework for the Design and Evaluation of Autonomous Systems**

Another alternative approach to the levels of analysis recommended by Caitlin Lee is one that breaks out the levels of automation across two additional dimensions, mission complexity and environmental complexity. This system incorporates many of the aspects of automation covered by the DoD framework, modeling the results on a 3D representation to compare the requirements of various circumstances. Figure 11 illustrates this approach.
Regardless of the analytical lens for understanding autonomy, the key takeaway is that the RPA represents a complex platform which performs multiple processes, all of which will be subject to different levels of automation. As some aspects of the RPA increase in autonomy, the capabilities of the RPA increase as the operator’s reactions are enhanced. As RPAs grow larger and more complex, more systems are likely to be added with potential for new degrees of automation. The C-17’s automation comes in large part from the fact that it is a larger and in many ways more complex aircraft than most current RPAs. The question for the future development of RPAs, then, should not be whether or not to automate, but what functions are we comfortable with automating, and to what level of automation.

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Understanding the Move to RPAs to Date

In permissive environments, where the U.S. can secure air supremacy theater-wide or where the host nation permits flights, the RPA’s loiter time allows for extended coverage throughout the battle space. When combine with multiple intelligence sensors enabling cueing to a target and the ability to strike, this reduces the time from identification and authorization to strike a target to seconds, vice minutes, to re-task more limited manned aircraft to the area or potentially hours which may be required for a cruise missile strike. Further, it enables an aircraft to monitor a potential target for extended periods of time, even weeks, before a decision must be made whether or not to strike a target. This can enable waiting for a human target to be in isolation from populated areas (in a vehicle, for example) limiting collateral damage. A manned platform, in contrast, would have a limited time on station and thus may be forced to act faster, without the ability to wait for a better targeting environment to emerge. This combination allows the RPA to overcome the historical obstacle to bombing as a weapon for small wars, the intelligence barriers to effective targeting and the transient nature of aircraft.

Safety is likely the most cited benefit, but is minor compared to the other perceived advantages when the discussion is on the strategic RPA. While the risk of accidents remains, few fixed wing aircraft have been lost in the areas RPAs operate due to enemy fire. Dave Blair, himself an RPA pilot, even went as far as to suggest that given the realities of the global war on terror RPA pilots may in fact be more at risk to enemy fire than their manned flight counterparts to adversary attack (Blair, 2012). These RPAs fly at altitudes and in missions similar to bombers and fighters with an air-to-ground capability. This generally puts them out of range of small arms and man-portable surface-to-air missiles (akin to the Stinger missile). Global Hawk, meanwhile, flies flight profiles similar to the U2. This is not to say there is zero risk to pilots, as aircraft
regularly crash due to mechanical issues, pilot error, and other factors, but to date in the war on terror no similar attack aircraft has been lost to enemy fire.

The main safety advantage in most engagements comes in comparison to the risks for a ground operations, or for tactical ISR missions using cheaper, more expendable RPAs in environments where aircraft would be vulnerable to ground fire and MANPADs. These tactical RPAs can be procured relatively cheap compared to a manned helicopter (the more likely alternative for a tactical environment) and operate in a high threat environment given potential surface-to-air threats at lower altitude. Long-term, however, there are higher costs associated with these RPAs due to their higher use, operations in dangerous environments leading to more aircraft losses, etc. Thus, while they are far cheaper per unit for ops, the costs of fielding an effective force for an extended period of time will still be costly.

Overall, the key advantage to RPAs today is persistence in permissive environments or expendability in hostile environments. These are generally mutually exclusive roles as strategic RPAs are generally not expendable given their high value payloads. When considering the benefits, it is vital to understand the limitations of the aircraft as well. In addition to the problems posed by network warfare in terms of infrastructure costs to support global operations, the RPA as it exists today have a number of technological shortcomings which limit their employment in military operations. This book and others have eluded on a number of occasions to the vulnerabilities of RPAs to hostile air forces in contested airspace. Predators are slow, are capable of limited air-to-air assets but lack the speed and maneuverability to engage as well as the radar to acquire targets, and are noisy to the point where civilians on the ground have criticized the sound itself as intimidating. They are reliant on a global network which itself may be vulnerable to attack resulting in loss of aircraft (or at least termination of the mission), or
which may be lost due to weather and other natural factors. Some of these issues may be a product of the maturing technology and requires the development of future UCAVs, but beyond this limitation the RPA has potential vulnerabilities in its network, and is not immune to the laws of aerodynamics which limit payloads based on the size and range of the aircraft.

**Summary**

The Air Force MQ-1 Predator and MQ-9 Reaper represent the culmination of the targeting revolution by providing a persistent, precision weapons platform capable of strategic reach, allowing for effective targeting of both fixed and non-fixed targets. The Navy’s experiments with the X-47 point to a future carrier-based capability that will provide naval aircraft with a similar capability capable of global mobility independent of the need to secure basing rights to support operations. While RPAs and robotics in general have the potential to alter the tactics and composition of forces in all forms of combat, this new capability demonstrates the impact of the changes in doctrine, technology, and organization on systems of warfare.

The RPA platform itself predates the targeting revolution and saw action as an ISR collector in the Cold War. In the era of AirLand Battle, the tactical RPA was developed to support tactical initiatives in ground combat, which to this day represent the primary extent of RPA development worldwide. Adoption of the strategic attack RPA, however, required adoption of global command, control, communication, ISR, precision munitions, and advanced sensors and data links to create a system capable of persistent coverage and precision strike against strategic targets. Adoption of the RPA by itself is insufficient to adopting the targeting revolution.
As the United States developed the capability, each of these technological advancements occurred in parallel with one another, much as they did in society at large. The impact of the targeting revolution on military systems could have been discounted as advancements on existing technologies largely because, in isolation, that is how the technologies were incorporated into existing systems. Advancements in communication and information were applied within intelligence and operations organizations to process greater volumes of information to increase battlefield awareness and assessments of enemy systems; precision munitions were created by adding first EO, then laser, and finally GPS tail kits onto existing ‘dumb bombs’ to increase their accuracy; and robotics were used to modify ISR collection platforms to extend the duration of missions. The revolution came in 2002, when all elements were brought together to form a single system that added a fundamentally new capability, one that had been long-sought but not achievable given technological limitations.

For the foreseeable future, the RPA’s revolutionary aspects are limited to operations in permissive environments. A future air-to-air role is possible, but given cost constraints and the technological obstacles associated with target acquisition and tracking, situational awareness, and the impacts of a time-delay due to satellite communications relay, such a weapons system appears to be a generation in the future at least and thus likely its own potential revolution. The U.S. and other forces employ a series of RPAs in a variety of tactical environments, in some cases using platforms that mirror strategic RPAs but with separate operational constructs to perform close operations with ground forces.
Chapter 3: The RPA and the Targeting Revolution

How revolutionary is the RPA? The emergence of RPAs as a key weapon of war in the U.S.-led war on al Qaeda has led to a significant debate on that topic, leading some to argue it represents a fundamental shift in the balance of technology and warfare with the potential to radically alter all future conflicts. This perspective argues that the RPA provides such a unique capability that it fundamentally alters the character of war by itself by further removing humans from the execution of war, and thereby the proliferation of cheap RPAs worldwide is potentially the most dangerous threat faced by the world today.

If, however, the RPA represents a major military innovation with more specific application to different types of warfare, the implications for warfare are radically different. I argue here the latter, that the RPA as a platform represents a major innovation that can only be considered revolutionary within a limited set of applications, rather than representing a broader shift across a domain of warfare as usually characterizes an RMA. The bulk of RPAs, tactical RPAs, are likely to be force multipliers functioning within the existing system of war defined by Biddle as the Modern System. Strategic RPAs, combining persistent airspace coverage with global intelligence networks and precision engagement, will have the potential to be revolutionary by expanding the capabilities of the ongoing targeting revolution to the domain of small wars. Precision munitions, cruise missiles, stealth technology, and other related

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57 Examples include Singer and a variety of sources from Popular Mechanics to the New York Times. See “Drone Skies: The Unmanned Aircraft Revolution Is Coming” (Whittle, Drone Skies: The Unmanned Aircraft Revolution Is Coming, 2013) and “How Cyberwarfare and Drones Have Revolutionized Warfare” (Hsia & Sperli, 2013) for two examples.

58 A domain of warfare in this context refers to the air, land, and sea domains at minimum; with many sources to include the U.S. Department of Defense categorizing space and cyberspace also as warfighting domains (Pellerin, 2010).
developments represented the first wave of the targeting revolution, which upended the system for air warfare against traditional states and forced adversaries to adopt strategies similar to insurgents, or insurgency outright, as the only viable counter. The RPA, global communications, and advanced intelligence processing, analysis, and exploitation has the potential to extend the capabilities which previously could only be used against states to the historical challenge of small wars and in doing so revolutionize the systems of war to fight small wars.

After outlining the framework for Revolutions in Military Affairs, I review the evolution of airpower theory as a doctrinal shift that has in most cases led the technological innovations of the targeting revolution. A common critique of the introduction of new technologies to warfare is that practitioners have become enamored with the technology, and they are letting the technology drive the course of warfare with little regard for the implications of the new technology. However, the evolution of airpower theory demonstrates that the underlying desire for the capabilities possessed by modern technological advancements have been desired by theorists almost from the beginning. The works of the airpower theorists of the inter-war years have been largely critiqued since their publication for an overly optimistic portrayal of the potential for airpower, driven largely by an overstatement of capabilities and a failure to anticipate countermeasures. These critiques, however, point to the relationship between the development of airpower doctrine and technological innovation – the theory and doctrine has long led the technology, leading to the high expectations for airpower in the policy realm. The RPA’s utility in modern warfare came about through the recognition of a capabilities gap in existing airpower theory, which had long been an accepted truth of the limits of airpower since the British first identified the shortcomings of strategic airpower theory in fighting small wars in the 1920s.
This section builds on the work of Phillip Meilinger and other scholars who have traced the history and development of airpower theory, combined with a detailed examination of the source material designed to demonstrate both the status of airpower theory as it exists today in the macro sense, and refined to show how the RPA innovation fits within the broader theory. Ultimately, the goal is to build a comprehensive model of strategic airpower that spans all levels of conflict, demonstrating the difference in platforms utilized, macro target sets, and mechanisms for influencing adversaries in different types of conflicts. The strategic RPA plays a tailored role within this larger structure, extending the implications of the targeting revolution to small wars.

### Table 7: Potential strategies for kinetic targeting across spectrum of conflict

<table>
<thead>
<tr>
<th>Spectrum of War</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Civilian</td>
</tr>
<tr>
<td>Total War</td>
<td>Coercive Airpower</td>
</tr>
<tr>
<td></td>
<td>Thermonuclear ICBMs</td>
</tr>
<tr>
<td></td>
<td>Strategic cruise missiles</td>
</tr>
<tr>
<td>Limited War</td>
<td>Coercive bombing</td>
</tr>
<tr>
<td></td>
<td><strong>Industrial Web/Warden’s Rings</strong></td>
</tr>
<tr>
<td></td>
<td>Cruise missiles, manned bombers</td>
</tr>
<tr>
<td></td>
<td>Mix of precision and cluster munitions</td>
</tr>
<tr>
<td>Small Wars</td>
<td><strong>Signature Strikes</strong>$^{59}$</td>
</tr>
<tr>
<td></td>
<td>RPAs, manned fighter-bombers, CAS assets</td>
</tr>
<tr>
<td></td>
<td><strong>Personality Strikes</strong>$^{60}$</td>
</tr>
<tr>
<td></td>
<td>Strategic RPAs, precision bombs</td>
</tr>
</tbody>
</table>

Table 7 illustrates this larger structure of the evolution of airpower theory and the conditions under which RPAs are likely to be most effective. The targeting revolution and its many innovations, to include the RPA, provide technological capabilities that cumulatively fill

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$^{59}$ Signature strikes are those strikes which are based on ‘signatures’ associated with military operations, which include the profile of those observed (age and gender), observations of military training, the presence of arms and other military supplies, intelligence linking the location to known militants, etc.

$^{60}$ Personality strikes are strikes aimed at a specific, identified individual, generally vetted up to the level of the President for inclusion on a “kill list.”
many of the capability gaps that airpower theorists have envisioned over the past century. This has led to the modification of doctrine as new technologies have emerged and previous notions were demonstrated to be insufficient, and will likely continue to be modified as counter-technologies emerge\(^6\) and platforms which currently provide a capability are rendered obsolete against emerging threats. However, the underlying characteristics of versatility, mobility, and reach govern a unique air mentality that drives technological innovation, not the other way around. The ‘nuclear revolution’ and deterrence theory enables a variant of Douhet’s model of overwhelming airpower aimed at civilian centers to deter hegemonic war, air superiority fighter-bombers capable of precision strikes against fixed targets provide critical capabilities in other state-on-state conflicts, and the persistent coverage of RPAs combined with small, precision strike munitions enable engagements of sub-national actors and mobile leadership targets in permissive air environments, providing the air arm with potent capabilities across the spectrum of warfare.

**Military Innovations and Revolutions in Military Affairs**

Beginning in the mid-1970s, analysts in the Soviet Union debated the prospects of a late-20\(^{th}\) Century Revolution in Military Affairs centered on advancing technical capabilities in the West. Some in the Soviet Union foresaw innovations in microelectronics, decision-support systems, communications, sensors, lasers, and accurate non-nuclear munitions capable of the kinds of operational effects previously only attainable with tactical nuclear weapons (Keaney & Cohen, 1995, p. 188).” Andrew Marshall, the Pentagon’s Director of Net Assessment, reached

\(^6\) Much as radar in World War II rendered many of the existing assumptions about airpower obsolete as it enabled air-to-air intercepts in ways that Douhet and others would have seen as impossible and thus unworthy of devoting significant resources to pursuit aircraft.
the conclusion that those Soviet analysts were largely correct in their analysis by 1987, and by 1992 worked with Andrew Krepinevitch to produce a report on the prospect of a Military-Technical Revolution. As Krepinevitch noted, “The Soviets (and now the Russians) assert that advanced technologies, especially those related to informatics and precision-guided weaponry employed at extended ranges, have brought the military art to the point where quality is becoming far more important than quantity, revolutionizing the nature of warfare (Krepinevitch, 1992).” Defense Secretary (later Vice President) Dick Cheney, Defense Secretary William Perry, and numerous outside observers heralded the demonstration of American airpower as examples of “a revolutionary advance in military capability (Keaney & Cohen, 1995).”

Two years after the Office of Net Assessment report, Krepinevitch further expanded on his Revolution in Military Affairs hypothesis with the article “from Cavalry to Computer; the pattern of military revolutions.” In this article he elaborated a broad theory of the pattern of military revolutions which largely guides advocates of military revolutions, defining Revolutions in Military Affairs similarly to how Jervis had defined them in 1989 as “what occurs when the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptation in a way that fundamentally alters the character and conduct of conflict (Krepinevich, 1994).” Building on Krepinevitch’s work, in 2005 Michael Vickers and Robert Martinage defined Military revolutions as “periods of discontinuous change that render obsolete or subordinate existing means for conducting war. They are often, though by no means always, linked with broader political, social, economic, and scientific transformations, and are brought about by changes in militarily relevant technologies, concepts of operation, methods of organization, and/or available resources (Vickers & Martinage, 2005).”

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62 Under President Bill Clinton
Krepinevitch listed ten historic Revolutions in Military Affairs since 1300 in the process of framing his thesis that a new technological Revolution in Military Affairs was under way (Table 8). Some of these revolutions were brought about as a result of changes in technology; others saw their origins in changes in the social order leading to organizational changes. The infantry revolution resulted from the introduction of the English longbow, leading to tactical innovation followed by organizational change. The Napoleonic revolution was brought about as a result of changes in society enabling larger militaries as more were willing to fight for an emerging sense of nationalism than they were for loyalty to the monarch. These larger armies comprised of more loyal (and thus reliable) soldiers enabled the development of new tactics to overcome fortification and engage in new structures of warfare with the creation of the division and scout tactics. Omitted from Krepinevitch’s list is Biddle’s Modern System, a doctrine-driven revolution roughly concurrent with the Mechanization Revolution that emphasizes mobility and small unit tactics as the means for overcoming entrenched positions – force employment, rather than technology, is decisive in this Revolution in Military Affairs.

Table 8: Krepinevitch’s Revolutions in Military Affairs

<table>
<thead>
<tr>
<th>Timing</th>
<th>RMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hundred Years War (1337-1453)</td>
<td>Infantry Revolution</td>
</tr>
<tr>
<td>Late 1500s-1600s</td>
<td>Artillery Revolution</td>
</tr>
<tr>
<td>Late 1500s</td>
<td>Sail and Shot Revolution</td>
</tr>
<tr>
<td>Thirty Years War (1618-48)</td>
<td>Fortress Revolution</td>
</tr>
<tr>
<td>Early 1800s</td>
<td>Gunpowder Revolution</td>
</tr>
<tr>
<td>Late 1800s</td>
<td>Napoleonic Revolution</td>
</tr>
<tr>
<td>Early 1900s</td>
<td>Land Warfare Revolution</td>
</tr>
<tr>
<td>1919-1939</td>
<td>Naval Revolution/Battlefleet Warfare</td>
</tr>
<tr>
<td>1960s</td>
<td>Mechanization Revolution</td>
</tr>
<tr>
<td>1980s-2020</td>
<td>Nuclear Revolution</td>
</tr>
<tr>
<td></td>
<td>The Revolution in Military Affairs</td>
</tr>
</tbody>
</table>
Technology is a central focus in Krepinevitch’s work, but Michael O’Hanlon emphasizes the other elements Krepinevitch mentions as being the decisive factors in bringing about a revolution. “What made these revolutions happen? In some cases, a technical innovation was so important that it virtually transformed warfare singlehandedly. More commonly, innovative militaries needed to devise new and complicated organizational concepts and tactics to make use of weapons that could not be easily integrated into existing formations or battle plans (O’Hanlon, Technological Change and the Future of Warfare, 1999, p. 21).” A new technology might be the catalyst, but the change to the overall system resulting in a change in the character of warfare defines a Revolution in Military Affairs.

In examining the diffusion of military power, Michael Horowitz shied away from the Revolution in Military Affairs language and looked instead at what he classified as major military innovations. He defines major military innovations as “major changes in the conduct of warfare, relevant to leading military organizations, designed to increase the efficiency with which capabilities are converted to power (Horowitz M. C., 2011, p. 22).” Horowitz further delineated the potential universe of major military innovations based on his views of consensus based on an overview of scholars at the time (Horowitz M. C., 2011, p. 61). This universe of major military innovations is largely reproduced here in Table 9 with several modifications.

While Horowitz appears to use major military innovation as a term approximating a Revolution in Military Affairs, I see the terms slightly differently. A major military innovation is an innovation in military doctrine, technology, and/or organization which is a necessary condition for a Revolution in Military Affairs, but is usually insufficient to change the character

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63 This appears to be a late change in Horowitz’s work as the concepts of RMAs specifically are not referenced until page 214 of his book, and then to note that the terms have fallen out of favor at the Pentagon which may have shifted his choice in terminology. However, his table outlining possible cases (Table 2.4) is labeled “revolutions” within the table. This suggests major military innovation and RMA should be synonymous in Horowitz’s account.
of warfare. They increase the relative power of a state which may shift the overall balance of power and calculations of probability in conflict. Much as Steven Biddle notes, increasing lethality through technological change has been a key aspect of warfare since 1900, with most innovations since then having a role in increasing lethality and range but not radically altering the underlying calculus (Biddle, 2004, pp. 2-3). In military terms, this is generally called a force multiplier. Major military innovations can consist of organizational change as was the case with Napoleonic Warfare and *levee en masse*, they could be technological change as are the cases with many of Horowitz’s other examples, or they could be doctrinal as was the case with blitzkrieg.

**Table 9: Horowitz’s Major Military Innovations**

<table>
<thead>
<tr>
<th>Timing</th>
<th>MMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nineteenth century</td>
<td>Napoleonic Revolution/ levee en masse</td>
</tr>
<tr>
<td></td>
<td>Strategic communications/mobility</td>
</tr>
<tr>
<td></td>
<td>Professional staff personnel and procedures</td>
</tr>
<tr>
<td></td>
<td>Prussian open-order tactics: railroads/rifles/telegraph</td>
</tr>
<tr>
<td>Nineteenth to twentieth century</td>
<td>Tactical fires (machine gun and artillery)</td>
</tr>
<tr>
<td></td>
<td>Medical</td>
</tr>
<tr>
<td></td>
<td>Fortifications (trenches)</td>
</tr>
<tr>
<td>Early twentieth century</td>
<td>Battlefleet warfare</td>
</tr>
<tr>
<td></td>
<td>Chemical weapons</td>
</tr>
<tr>
<td></td>
<td>The Modern System</td>
</tr>
<tr>
<td></td>
<td>Tactical air attack</td>
</tr>
<tr>
<td></td>
<td>Air warfare</td>
</tr>
<tr>
<td>Twentieth Century</td>
<td>Total industrialized war: blitzkrieg/strategic bombing</td>
</tr>
<tr>
<td></td>
<td>Carrier warfare</td>
</tr>
<tr>
<td></td>
<td>Submarine warfare</td>
</tr>
<tr>
<td></td>
<td>“The nuclear revolution”</td>
</tr>
<tr>
<td></td>
<td>Mao Tse-tung’s “people’s war”</td>
</tr>
<tr>
<td></td>
<td>Suicide terrorism</td>
</tr>
<tr>
<td>Late twentieth century</td>
<td>Precision/robotics/processing</td>
</tr>
</tbody>
</table>

64 To illustrate the difference between the innovation and the revolution, large armies emerged at the time of Napoleon as he was able to raise large armies and other states did so in turn to counter the threat, but they were still motivated by the existing system of loyalty to the monarch or emperor. It was over the following decades that nationalism emerged as a motivating force to shape these armies.
A Revolution in Military Affairs, in contrast, is a shift in the character of warfare fueled by a transformation of military systems brought about by new technology, new doctrines, and new organizational structures to implement new fighting systems. The Infantry Revolution shifted war from a smaller domain of specialists such as knights to larger fielded forces. With this shift the goals changed from capturing key adversaries to negotiate a truce to decisively defeating a force on the field, rendering territory vulnerable to capture. Douhet and Mitchell saw the airplane as revolutionary because it enabled states to bypass fielded forces and render a state vulnerable from the onset of conflict, again altering the objectives of warfare. The essence of the nuclear revolution is that vulnerability, speed, and magnitude of reliable destruction fundamentally alters the calculus for states to go to war by assuring unacceptable losses. The new fighting systems that are created by such revolutions fundamentally alter strategist’s understanding of the dynamics of conflict, reshaping theories of victory either by changing the mechanisms of achieving military objectives, or redefining the military objectives themselves.

The Revolution in Military Affairs Debate

Defining a Revolution in Military Affairs is contentious. There are multiple definitions and variations of the phrase, and there is a broader debate over whether or not such revolutions actually occur, much less which innovations constitute “revolutions.” The term had long been applied to the changes in the character of warfare and international relations which accompanied the advent of the nuclear era, and also was applied freely to specific innovations within the broader nuclear revolution.\(^6\) Writing in the closing years of the Cold War, Robert Jervis defined

\(^6\) Robert Jervis references as an example Albert Wohlstetter who in 1985 spoke of revolutionary changes in targeting accuracy for nuclear weapons allowing for increased discrimination. “The average yield of the nuclear weapons we might "fit to targets" was 15 times larger in 1957 than in 1982, and "the best accuracy" we expected then has seen revolutionary improvement (Wohlstetter, 1985).”
it more broadly than simply a significant improvement in a capability. “I mean the term quite literally – a change that turns established truths about the relationship between force and statecraft on their heads (Jervis, 1989, p. 15).”

The 1990s and 2000s saw a number of technologies arise, each of which were at one point considered ‘revolutionary’ by various observers. The Gulf War saw the introduction of new precision guided munitions in the form of conventional cruise missiles and more accurate laser-guided bombs, which was examined in that period by Krepinevitch, Cohen, and Kenney among others. Despite these bold pronouncements, a debate ensued through much of the 1990s over the scope of the changes in warfare resulting from changes in American airpower, resulting in a consensus that a revolution had not yet occurred, but that key innovations marking the initial phases of such a revolution were in fact underway. These advocates emphasized that the Gulf War represented but the first phase of a nascent revolution. “Over the next several decades, the world is destined to experience a revolution in the character of warfare. Indeed, the way in which the United States and its allies won a quick and overwhelming victory in the Gulf War suggests to many that we are already in the early stages of such a military revolution. But if so, there is much more to come (Krepinevich, 1994).” Thomas Keaney and Eliot Cohen largely agreed, but with greater hesitation. “True revolutions in war may take decades and require not merely new technologies but new forms of organization and behavior to mature. It is probably too soon to

66 Biddle and others doubt the status of the nuclear innovation as revolutionary because it continues the trend of increased lethality and because it has not been employed in actual battle (his unit of analysis is the operation). I argue that although the fact of increasing lethality was a constant, the impact of nuclear weapons and global strike platforms was revolutionary because it crossed a key threshold of assured unacceptable losses. This revolutionized the calculus for initiating conflict by rendering the prospect of victory virtually meaningless, and with it brought about a period of limited warfare and desire to avoid direct engagements between global powers. Biddle’s model, by focusing on the outcomes of actual military operations, may omit this fundamental shift in the strategy of war that frames when battles will even occur. Such calculus in initiating and limiting conflict is arguably a greater revolution in warfare than one that merely alters the tactics of ground combat.

67 The examples of Krepinevitch, Keaney & Cohen, Marshall, and Watts cited throughout this work are examples of this position.
conclude without reservation that we have entered a new era of warfare. But as we consider the war, some signposts of change surely stand out (Keaney & Cohen, 1995, p. 211).” Others such as Stephen Biddle and Michael O’Hanlon see the Revolution in Military Affairs literature as overstating the case. “The events that RMA advocates see as radical changes in fact display as much continuity as change – and these underlying continuities suggest a very different set of prescriptions for future U.S. military policies (Biddle, 2004, p. 197).”

Biddle is skeptical of claims that precision guided munitions represent a new Revolution in Military Affairs, as he sees increased lethality at long range as a continuation of the trend from the industrial era. Military innovations during the industrial revolution altered the character of war by reshaping battlefield tactics. The innovations of the industrial revolution produced a trend of increased lethality tactics and organization lagged behind technological innovations increasing lethality. Force employment and adaptation under fire marked the key change to overcome this technological innovation with the Modern System in World War I. A combination of suppression and maneuver would enable smaller units to advance on positions as significant, but short-term artillery barrages suppressed enemy fire long enough to advance. Weapon lethality, Biddle argues, has grown much faster against massed targets in the open than against dispersed targets under cover. “Because RMA advocates misunderstand warfare prior to the 1990s, they misread the 1991 Gulf War as a radical departure; by projecting their mistake forward into the twenty-first century, they derive a case for radical restructuring of U.S. defense policy that is neither necessary nor desirable (Biddle, 2004, p. 4).”

68 Biddle noted, “A Napoleonic infantry battalion of 1,000 men with smoothbore flintlock muskets could project 1,000 rounds to an effective range of 100 yards twice a minute...by 1916 an infantry battalion with 1,000 magazine rifles and 4 machine guns could project over 21,000 rounds to distances over 1,000 yards every minute. An assault by a comparable unit could absorb over 210,000 rounds in the time needed to close, or more than 200 per targeted soldier – an increase of more than two orders of magnitude (Biddle, 2004, p. 29).” By 1914, “firepower had become so lethal that exposed mass movement in the open had become suicidal (Biddle, 2004, p. 2).”
The early phases of the targeting revolution led many to see the potential promise for new technologies to reshape warfare, but critics remained unconvinced as by their own admission the early phases consisted largely of increases in capability rather than a restructuring of systems of warfare. Biddle lists three main reasons why precision targeting did not constitute a Revolution in Military Affairs in 2006, based on the notion that it still had greater impact on open targets than it did on concealed modern-system forces. These factors consisted of:

1) The ability of modern forces to exploit cover,

2) The fact that aircraft are (were) transient observers, and

3) The interaction of natural and technical cover (Biddle, 2004, pp. 54-55).

This is an enduring critique of air warfare in general, which finds its origins in the earliest critiques of airpower in small wars. While the targeting revolution was in its initial phases during the Gulf War and throughout conflicts in the 1990s and early 2000s, this criticism was largely correct, and generally acknowledged by advocates from Krepinevitch to Cohen. Indeed, the ability of stealth and missiles to achieve breakthrough and precision munitions to exploit breakthrough shows how, to an extent, the first phases of the targeting revolution largely resemble an adaptation of Biddle’s Modern System for the air. The challenge to a direct application of the Modern System to incorporating the targeting revolution is the balance of breakthrough and exploitation, with the bulk of the Modern System focused on breakthrough while the targeting revolution is almost wholly about exploitation. The current phase of the targeting revolution focuses exclusively on exploitation as it operates solely when control of
airspace is a given, and with it dramatically limiting the adversary’s ability to exploit cover and maneuver.

Like Biddle, O’Hanlon is skeptical of the Revolution in Military Affairs literature, noting that many of the “revolutionary” technologies associated with the Revolution in Military Affairs literature predate the information revolution, highlighting the Israeli use of precision guided munitions in the Yom Kippur War and laser guided bombs in Vietnam, and their inability to date to significantly change the underlying character of warfare, or for the foreseeable future. “New technology and associated tactical and operational innovations clearly have considerable potential to make important contributions to warfare by 2020. But it is equally clear that many fundamental limitations will be hard or impossible to overcome. That means combat will, in many ways, be similar in 2020 to its current nature (O’Hanlon, Technological Change and the Future of Warfare, 1999, p. 139).”

Taken in isolation, innovations like precision-guided munitions and new weapons systems like the Predator behave exactly as Biddle states, and why each, individually, likely do not represent a revolution. However, when combined with the other innovations of the targeting revolution, the emphasis of precision targeting has shifted not just from the ability to precisely hit an identified target coordinate, but the ability to identify those coordinates absent visible identification in open formation. Indeed, most of the reported failures of RPA targeting resulting in collateral damage appear to have come from so-called ‘signature strikes’ attacking what appeared to be mass formations rather than specific, hidden individuals. Further, the capability to target concealed and/or covered\(^69\) targets has a deterrent effect on the opposition, potentially rendering them unable to carry out operations for fear of compromising their position, producing

\(^{69}\)‘Concealed’ references targets that are hidden but not protected, such as camouflage netting; ‘covered’ indicates reinforced protected positions such as bunkers that are protected from indirect attacks and to varying degrees from direct strikes. Potential targets could be either, or could be both.
strategic effects whether lethal force is employed or not. To advocates like Lieutenant General Deptula, this potential to paralyze an adversary through the persistent threat of strikes represents as great an impact on the operating environment as would a successful kinetic strike. Evolutionary changes in technologies at the micro-level have culminated in a series of revolutionary systematic changes for strategic air warfare, marked by the precision revolution of the mid-1990s and the strategic RPA innovation, which came about in approximately 2007.

The prospect of global networks of information, intelligence, and near-real-time precision strike fundamentally alters the warfighter’s view of the operating environment, bringing the emphasis of strategy to focus more on ends rather than means; desired effects versus platforms and units to be employed. Within the ground warfare operating environment, the implications of the information revolution thus far are limited to increased battlespace awareness and greater communications between forces, while the system fundamentally remains unchanged from the Modern System. Above the operational level of war is where the information revolution has truly led to a Revolution in Military Affairs, with its primary impact being on the system of precision strategic targeting it has enabled. In other words, ground warfare and tactical/operational considerations are still in Biddle’s world, but this is a subset of a larger strategy increasingly defined by Krepinevitch’s world.

Finally, a common critique from Biddle and others of claims of a Revolution in Military Affairs is that the targeting revolution has failed to be decisive alone in winning wars, thus leading critics to question whether a revolution has even taken place. Or, at the more extreme, because some of the early Revolution in Military Affairs visionaries predicted the Revolution in Military Affairs might make war itself obsolete, their failure to eliminate warfare proves the flaws in the

70 Peter Bergen has included anecdotal accounts in *Talibanistan*, while Johnston and Sarbahi study this impact in their paper on the subject.
Revolution in Military Affairs. This takes too narrow a view of Revolutions in Military Affairs and expects too much from them. Previous revolutions, from infantry to gunpowder to fortresses, radically altered the appearance of the battlefield and strategies for both offense and defense, but each new revolution did not render the previous one completely obsolete, nor did it necessarily revolutionize all forms of warfare. The fortress and infantry revolution had profound effects on conventional wars between states, but were of limited application in what today would be classified as small wars. The revolution of sail and shot radically reshaped the character of naval warfare, which in turn impacted events on the land but did little to change the actual conduct of land warfare. Warfare has multiple incarnations, and a radical change in capabilities sufficient to completely alter the character of a form of warfare, especially one that renders a form of warfare obsolete as with the nuclear revolution and its impact on hegemonic warfare, is sufficient to constitute a Revolution in Military Affairs. The Nuclear Revolution may not have made the Modern System obsolete in limited warfare, but it revolutionized the way states view war as a tool of policy and in so doing revolutionized war itself at a higher level. The targeting revolution similarly alters war above the operational level by fundamentally reshaping the decision to go to war, the strategies for shaping the operating environment, and redefining what fundamentally constitutes the battle space.

The common theme of proponents of historical Revolutions in Military Affairs is the confluence of three factors: technology, doctrine, and organization. A Revolution in Military Affairs can be initiated by any of these three factors, but will result in all three shifting to accommodate a new system of military operations that reshape the character of warfare. The gunpowder revolution was not marked by the introduction of a new technology specifically but

71 Biddle makes a variation on this argument (2004) pp. 198-199. Pape makes a similar critique of strategic bombing in questioning the effectiveness of coercive strategies.
the introduction of new tactics that allowed existing technologies to be effectively used.\textsuperscript{72} The introduction of a major innovation has often spurred talk of a Revolution in Military Affairs, with the RPA being only the latest in a long line of examples of new technological innovations in recent history, to include precision munitions, cruise missiles, GPS guidance, and night-vision among others. The key question for observers and policymakers today is whether the changes brought about by technologies associated with what in the non-military world is generally referred to as the technological revolution have significantly changed the character of modern warfare to constitute a new Revolution in Military Affairs. The technologies are all key parts of the revolution, but the revolution lies not in any of its individual components, but in the military system it produces, which often can only be seen in hindsight once the pieces come together.

**Technological Revolutions, RPAs, and the Targeting Revolution**

The phrase ‘revolution’ is thrown about in the literature fairly regularly and with a variety of meanings given the context. The term often is meant to invoke an Revolution in Military Affairs, which as previously defined changes the character of war through the innovation of new systems for waging conflict. A technological revolution, by comparison, denotes a radical change in technology with widespread effects across all sectors of society, and which may or may not have military application. Technological revolutions have been defined by Nick Bostrom as “a dramatic change brought about relatively quickly by the introduction of some new technology,” a largely ambiguous definition which he elaborates through historical examples such as Sputnik, the Manhattan Project, the printing press, and agriculture (Bostrom, 2006). A technological revolution may result in multiple major military innovations, or may result in an

\textsuperscript{72} See Krepinevitch (1994) for summary of each revolution and how all were brought about by the integration of tactics/doctrine, technology, and organizations.
RMA; the nature of the innovation is the revolutionary component, its impact on warfare is a different matter.

As with many previous revolutions in military affairs, the significant innovations on the battlefield did not occur in isolation but were tied to broader changes throughout society at the time. Advancements in micro-processing and global communications technologies have spearheaded the advancement of the targeting revolution, beginning in the 1970s and coming to fruition in military operations in the late 1980s/early 1990s. These advancements have manifested themselves in a series of technological revolutions, with impacts well beyond the military domain. The targeting revolution can be seen by the adoption of a new system of war, commonly referred to in a number of ways from Network-Centric Warfare to system-of-systems analysis, which is characterized by prioritizing information superiority through the integration of sensors, decision-makers, and shooters to increase combat effectiveness by striking at the enemy’s vital centers utilizing system-of-systems targeting methodologies.

The information revolution was the impetus for the technological change enabling the targeting revolution, and its impact is broad to include what others have at various points in time considered revolutions in their own right. The initial literature on the Revolution in Military Affairs focused on increases in ability to track and target an adversary with speed and precision. This was closely related to a significant advancement in targeting capabilities, which Krepinevitch identified based on increased tracking and processing abilities as the ability to better understand complex systems and their relationship to operational and strategic objectives. These include global data links for communication infrastructure, data analysis and processing leading to what some have called the ‘big data revolution,’ and advancements in design software which have enabled the development of advanced weapons systems. Taken together,

73 See Mayer-Schonberger and Cukier as one example (Mayer-Schonberger & Cukier, 2013).
these technological revolutions enabled the analysis of adversary systems necessary to enable precision strike on key centers of gravity, and through design programs enabled another of the more visible and popular major military innovations of the early targeting revolution – stealth aircraft. Design innovations aided by supercomputers enabled the creation of stealth aircraft in the late 1970s, with their public unveiling in the early 1990s. Stealth enabled penetration of adversary defenses (breakthrough), and precision enabled economies of force for strike against air defenses and identified centers of gravity (exploitation).

The information revolution had a significant impact on military planning, information and intelligence processes, and design. This technological revolution was likely the one with the most crossover appeal to society at large, with the growth of the internet, personal computers, and private sector data analysis and processing; to modern innovations in smart phones. The impact of these systems for both military and civilian uses is readily apparent and requires little elaboration here aside from the observation that it is ongoing and continually evolving with new innovations such as ‘the cloud’ and ‘big data’ continuing to alter the way the military views the information domain. As Elliot Cohen noted, “The variety and ever-expanding capabilities of intelligence-gathering machines and the ability of computers to bring together and distribute to users the masses of information from these sources stem from the information revolution. Small wonder that a group of senior Marine Corps officers, led by the assistant commandant of the corps, visited the New York Stock Exchange recently to learn how brokers absorb, process, and transmit the vast quantities of perishable information that are the lifeblood of the financial markets (Cohen E. , 1996).”

In 2002, Michael Russell and James Hasik built on the work of Krepinevitch and other RMA advocates in detailing the ‘precision revolution,’ which they emphasized as “the most
well-understood, and hence, the most well-liked, element of the emerging RMA (Rip & Hasik, 2002, p. xi).” This revolution was a technological revolution with application beyond the battlefield, to civilian navigation among other uses. Militarily, Rip and Hasik recognized it as a quantum leap forward in terms of military capability, but simultaneously warned that sufficient organizations did not yet exist to fully exploit the capability and that policymakers should be aware of the limitations of the precision revolution. “Aerial bombardment, even if incredibly accurate, cannot solve difficult geopolitical problems. Without a healthy respect for what precision bombing generally cannot accomplish, the rush to launch yet another cruise missile will overwhelm good judgment, with little to show for the efforts in the long run (Rip & Hasik, 2002, p. xii).”

The robotics revolution, documented extensively by Peter Singer (Singer, 2009), builds on other innovations of the Revolution in Military Affairs by allowing for new military platforms capable of operating in missions which are broadly defined as the ‘three Ds’ of RPAs, ‘dull, dirty, or dangerous.’74 ‘Dull’ consists of mission sets that last for long periods with relatively low operations tempo for the bulk of the mission, allowing for automation to relieve the operator of duties and allowing the operator to exercise ‘supervisory autonomy’ for much of the operation. ‘Dirty’ allows for operations in contaminated environments such as chemical and nuclear environments that would be inaccessible to human operators without significant protective measures that would in turn hinder operations. ‘Dangerous’ pertains to those environments with high risk due to enemy threats. Manned aircraft historically have faced and for the foreseeable future will face all these environments, the key distinction is the tradeoffs involved. The UAS Roadmap notes that the bulk of a B-2’s mission from Whiteman AFB

Missouri to a target area is “dull,” but the key part of that mission within the combat zone requires at this point the capabilities of a manned operator. In contrast, an MQ-9’s reaper is the same duration and roughly the same amount can be classified as “dull,” but the timing of operations is sporadic throughout the duration of the mission necessitating a far different crew approach. Similarly, 179 reconnaissance pilots were downed during the Cold War, clearly making it a “dangerous” mission potentially making RPAs preferable in those environments (Unmanned Aircraft Systems Roadmap 2005–2030, 2005, pp. 1-3).

Singer appears to argue that robotics alone have the potential to constitute a Revolution in Military Affairs, but I argue for the reasons previously listed that robotics independent of other advances of the Revolution in Military Affairs represent a modification of an existing capability or increased capability, rather than a fundamental change in the character of warfare. The vast majority of RPAs in use today globally represent either a substitution for a manned aircraft which may change the calculus of employment but does not fundamentally add a new capability, or are purely tactical in nature supplementing existing systems of warfare with either added intelligence collection or added firepower. ‘Unmanned’ systems operating in what would otherwise be dangerous environments for the purpose of intelligence collection yield a moderate increase in situational awareness often at a great economic cost and provide information that might change the level of information available but not likely to the point of overcoming the fog and friction of war. For intelligence collection, a technological revolution has produced a major innovation, but not a revolutionary one in this role.

Dividing RPAs into two classes based largely in this data link capability helps to illustrate why the RPA in isolation is not a revolutionary capability, and at the same time illustrates the difference in the views of Revolution in Military Affairs between Biddle and
Revolution in Military Affairs proponents. Tactical RPAs, controlled by line-of-sight means and generally smaller, cheaper airframes will be limited in their use to the conventional military battlefield, able to perform a number of missions from tactical ISR, to limited close air support, to logistics and communications. Of the ‘three Ds’ of RPA mission sets, these lean towards the ‘dirty’ and ‘dangerous’ mission sets because they are small and relatively expendable airframes. In each of these roles the RPA can be a significant force multiplier, but is unlikely to revolutionize the battlefield by significantly altering military systems. Tactical RPAs will complement existing systems and increase capabilities in some areas, but ultimately Biddle’s Modern System still commands this environment with respect to these RPAs. Cover, concealment, small-unit independent maneuver, and combined arms at the tactical level remain dominant at the operational level of war, with the tactical RPA being but one new technological means of surveillance that must be factored into the calculus.

Once air superiority is established, strategic RPAs and similar technological assets capable of long-term coverage, precision targeting, and data linked to a global network for collection and analysis does represent a new system of warfare. This has applications within the operational level of war, but its essence is extending the fight to the core leadership and logistical infrastructure of the adversary, beyond Biddle’s operational framework in a way that in turn shapes the military capabilities within the operational level of maneuver. This war is fought in parallel with the traditional operational campaign, multiplying its effects by reducing the capabilities of the adversary. In the case of Predator and Reaper as operated in Iraq, Afghanistan, and elsewhere, the RPA is far more than a robotic aircraft. It is a system comprised of forward operating bases for launch and recovery, global networked communications for command and control, the integration of multiple advanced intelligence and targeting sensors,
and precision-guided munitions (often GPS-guided which require an additional satellite network for support). The ability to operate an aircraft remotely is just one piece of this puzzle. Further, most of the discussion of the RPA as revolutionary focuses on the lack of a human on-board reducing the combat risk as being critical. But, Predator and Reaper are operating in permissive environments with no military threat.\textsuperscript{75} Persistence, overcoming the historic obstacle of the transient nature of aircraft, is the major capability increase of these aircraft. This make them potentially revolutionary in small wars, but employing this capability still requires a traditional air force capable of gaining and maintaining command of the air.

Because of the difference in characteristics of tactical and strategic RPAs, I argue that the RPA platform constitutes a major military innovation by itself and not a Revolution in Military Affairs. This innovation has a number of applications within the operating environment that have the potential to reshape conflict by magnifying the power of those who adopt it, from increased situational awareness, to lower cost tactical air support, to increased communication capabilities. These capabilities, however, fall short of revolutionizing warfare in the sense that they are incremental leaps to existing technologies and capabilities, which primarily increase efficiency by either lowering cost or reducing risk to the operator. The revolutionary aspects of the RPA come into play today primarily with strategic assets, which consist of the application of multiple innovations associated with the targeting revolution beyond simply the RPA. The integration of the persistent platform with networked intelligence, precision targeting, and information operations represents a Revolution in Military Affairs. Or, as Major General (ret.) James Poss stated more succinctly, “[i]t’s about the data link, stupid (Bowden, 2013).”

While much of the discussion of RPAs focuses on the ‘unmanned’ aspect of these weapons systems being a revolutionary aspect by removing the ‘skin in the game’ of states

\textsuperscript{75} Accidents and other threats to aircraft remain.
employing such forces, I argue that the first trait of RPAs, their ability to maintain operations for sustained periods of time or ‘persistence’ is what makes the strategic RPA revolutionary when combined with the other elements of the targeting revolution. Persistent coverage, increased targeting capabilities through information analysis and precision strike, and the ability to penetrate cover move the strategic effects of military operations from increased lethality to the limited but deliberate use of lethal force. Recalling Biddle’s three critiques of precision as being revolutionary, the RPA’s persistent coverage directly negates Biddle’s second critique as the duration of flight over a fixed area enables air cover to no longer simply be transient observers. Persistent air power, much like a fortification in the sky, becomes a permanent high ground for monitoring and engaging adversaries. This position, combined with advanced intelligence sensors and a global network for analysis of data and advanced munitions (either carried by the RPA platform or relayed in near real time to other platforms for targeting) negates the first critique of the MTR, the continued ability of the adversary to exploit cover and concealment. Modern weapons systems such as “bunker buster” munitions and thermobaric warheads dramatically reduce, if not eliminate, the impact of cover in defending a known target location. This leaves the adversary either vulnerable to destruction, or near permanently fixed in a safe location, not vulnerable to attack but effectively neutralized as a fighting force. Even if the adversary can survive, they are effectively paralyzed leaving the force controlling the sky positioned to fully exploit the ground environment with other tools of national power in order to achieve strategic objectives.

The third factor remains in play as technology and tactics will always interact, the tactics being developed to counter the targeting revolution are significantly different from simply altering battlefield tactics. They extend to new domains such as cyberspace to decrease the
effectiveness of intelligence and targeting systems, rely heavily on information operations as a means of thwarting attacks, and closely related to that require significant operational changes in organization to allow forces to blend in with civilians. These changes represent a shift in tactics significant enough to change the underlying character of the war itself, as counters to technology extend beyond the tactical operating environment to an information campaign against the country employing the technology. To define the Modern System in such a broad fashion as to incorporate such changes in war is to render the concept of a Revolution in Military Affairs meaningless by creating an all-consuming definition for a single conceptual shift that can incorporate any future changes in warfare. Indeed, Krepinevitch, Cohen, and others have noted from the beginning that the superior fighting positions gained by the ability to exploit historic Revolutions in Military Affairs are fleeting, and the targeting revolution will likely be no different.

The Limits of RPAs and the Targeting Revolution

RPAs as they exist today are the optimum weapon for particular conditions in war, most notably when the state employing them has what would today be deemed air superiority, or what Italian Air Marshall Giulio Douhet referred to as ‘command of the air.’ For the specific category of small wars where airspace control is not in doubt, the capability of persistent coverage, networked intelligence, and precision strike is revolutionary. This is however a small subset of the spectrum of warfare. Given U.S. interventions in Iraq and Afghanistan, support to operations in North Africa, and the increased emphasis of counterinsurgency on military planning and security studies in recent years, this potentially warps the perceptions of observers magnifying the perceived potential of RPAs.
The strategic RPA would be of limited utility in the initial phases of a major war against a near-peer competitor, one that is capable of controlling its own airspace and waging offensive air operations. The early stages of such a conflict would rely on other aspects of the targeting revolution to achieve breakthrough, from long-range precision strike assets such as cruise missiles which can target fixed locations, to stealth aircraft designed with the aid of advanced systems and reliant on encrypted and concealed data link for increased operational awareness to exploit maneuver. These, among other innovations, are necessary to gain control of the air sufficient to utilize the strategic attack RPA. It is conceivable that advanced RPAs in the future could fulfill some of these roles as the technology evolves, but the system-wide capabilities exist today independent of such innovations. The U.S. Air Force, in evaluating future airframe acquisition, is pressing for future RPAs to function within contested environments through increased speed, stealth, and other mechanisms for survivability, but as my research shows this will often trade the risk of loss of life of pilots for higher costs per airframe with minimal capabilities change.

RPAs other than strategic RPAs would play a role throughout operations, both for reconnaissance and surveillance to support a strategic air campaign as well as smaller, tactical ISR RPAs that support ground units with tactical intelligence. RPAs can also play a role as communications relays, and as logistics resupply to austere or hostile environments. These RPAs, like strategic RPAs such as Predator and Reaper, will generally fill roles for which there is no true manned alternative and will supplement, rather than supplant, manned systems. Unlike

76 These innovations will also likely require significant tradeoffs of costs for safety. An advanced RPA capable of long-range strike in a hostile air environment might be feasible and preferable to the risk of loss of an aircrew, but would likely come at extraordinary high cost sufficient to limit mass deployments, as the increasing costs from the Predator, to the Reaper, to the Avenger appear to demonstrate.
Predator and Reaper, however, they are most likely to amplify existing capabilities rather than fundamentally alter the underlying system of warfare, which at the operational level will still be dominated by the Modern System.

The greatest challenge for policymakers wrangling with the implications of the targeting revolution is recognizing its primary role as the ability to suppress or destroy an adversary, not to fill a vacuum of sovereignty. RPAs as employed in Afghanistan and elsewhere have been effective in destroying insurgent networks and disrupting adversary organizations, creating challenges of organization and leadership. This is only part of the equation of solving such challenges. If policymakers prefer a failed state to a rogue state, a strategy reliant on airpower alone is feasible, but for what should be obvious reasons is undesirable. Any efforts to move toward such a strategy must be balanced with the broader costs and challenges of capacity building to fill the leadership vacuum which created the initial crisis, for which there is no technological solution, only tools to aid in the process.

The Evolution of Air Warfare and the Targeting Revolution

Technology and doctrines have developed on evolutionary parallel paths for nearly a century, but have culminated in an overall systemic revolution which appeared in two phases, the 1990s with precision and stealth, and the 2000s with persistence. The focus of the targeting revolution has been on technological innovations beginning in the 1970s, but the origins of the targeting revolution can be traced to the earliest doctrinal writings of the age of airpower. Though the history of manned flight can be traced to the Montgolfier brothers first hot-air balloon flight in 1793, the era of airpower theory largely begins in the post-World War I era, with the writings and advancements of early airpower theorists Giulio Douhet, Hugh Trenchard,
and William “Billy” Mitchell. Each saw the potential for airpower to broaden the context of war beyond the military-to-military engagements of the battlefield and toward the centers of what Clausewitz identified as the ‘fascinating trinity’ that dominates war: the primordial violence, hatred, and enmity of blind natural force, which in general concerns more the population of the state; the play of chance and probability, which concerns more the commander and his army; and the subordination of warfare to policy, which primarily concerns the government. Though each interpreted the means and effect of targeting each of these aspects of the triangle differently, each envisioned airpower enabling rapid and decisive strike, as it turns out well beyond the capabilities that existed either at the time or for their foreseeable future.

Over a century of air warfare, the foundational concepts of Douhet, Mitchell, Trenchard, and other airpower theorists have been implemented with varying success in a number of conflicts and refined over time both as the doctrines were found to be ahead of the technology, and as new technological innovations reshaped the implementation strategies. The advent of nuclear weapons fundamentally reshaped the nature of coercive airpower, largely rendering total wars between great powers obsolete as Douhet suspected, but rendering coercion itself useless in scenarios where states were unwilling to risk annihilation. This reality of limited war led first to a move away from strategic bombing and toward CounterLand strategy emphasizing support to ground forces, and later to a re-imagination of Mitchell’s ideas of industrial web theory with the growth of precision guided munitions and the development of John Warden’s Five Rings strategy. Until the advent of the RPA era, however, small wars against non-state actors remained viable for strategic airpower only in theory.

77 This change also reflects a change in strategic priorities; AirLand battle was a response to the Brezhnev Buildup and European fears of being overwhelmed by the Warsaw pact in the event that nuclear deterrence failed.
The advancement of technology in air warfare is best understood through the lens of what the early air pioneers saw as the virtues of the air weapon, how they thought it could be utilized, and what its implications were for the character of war. Focusing on the lessons of World War I and in anticipation of a similar conflict in Europe in their near future, these theorists built doctrines around the capabilities of airpower providing an immediate breakthrough capability which would enable commanders to strike at the vital centers of their adversary. Each saw airpower capable of global reach, decisive engagement against an enemy’s vital centers, and the ability to strike unrestricted by time or ground/naval forces concerns. These ideas were well beyond the technology that existed at the time, and the evolution of air power technology has largely been driven by the desire to fill the gaps to make their vision a reality. Meanwhile, the British experience in Somalia, Waziristan, Libya, and Iraq during the same time period demonstrated what would be a lingering problem for all wars short of total war – the transient nature of aircraft and the difficulties in targeting made the aircraft a poor weapon for counterinsurgency.

**Total War and Great Power Conflict – Coercion and Deterrence**

In 1921, Italian Air Marshall Giulio Douhet published the first edition of *The Command of the Air*, largely regarded as the first writing to transform what had previously been abstract thoughts about air power to what could be called a concise theory of airpower. In this volume, Douhet became the first significant airpower theorist to openly argue for the independence of the air arm in equal stature to ground and naval forces, the offensive nature of air warfare and lack of a need to invest in defenses, the importance of unity of command over all three arms to

78 Per Colonel Phillip Meilinger of Air University (Meilinger, Giulio Douhet and the Origins of Airpower Theory, 1997).
coordinate military operations, and the unique ability of airpower to circumvent ground defenses to rapidly engage an enemy’s ‘vital centers,’ which range from infrastructure and logistics targets to an adversary’s population centers.79

Douhet is most remembered today for his emphasis that ground war had become seen as an end in itself, rather than the means to the end of destroying the other side’s will to fight. He saw the power of the air weapon in its ability to strike at what Clausewitz defined as the primordial violence, an enemy’s ‘moral centers.’ This moral center included peacetime industrial and commercial establishments, important buildings, transportation arteries and centers, and designated parts of the civilian population (Douhet, 1927, p. 20). “By virtue of this new weapon, the repercussions of war are no longer limited by the farthest artillery range of surface guns, but can be directly felt for hundreds and hundreds of miles over all the lands and seas of nations at war….the battlefield will be limited only by the boundaries of the nations at war, and all of their citizens will become combatants, since all of them will be exposed to the aerial observances of the enemy. There will be no distinction any longer between soldiers and civilians (Douhet, 1927, pp. 9-10).” In this model of war, command of the air would be sufficient to ensure victory as the state which lost control of the air would be “at the mercy of the enemy, with no chance at all of defending oneself, compelled to accept whatever terms he (with command of the air) sees fit to dictate (Douhet, 1927, p. 23).” Billy Mitchell agreed, stating “The menace (of aerial bombardment) will be so great that either a state will hesitate to go to war, or, having engaged in

79 Douhet was not the first to articulate this perspective, as many of the airpower theories articulated in the post-World War I era themselves have their origins in pre-war theorists. Lee Kennett, in his History of Strategic Bombing, notes Amedeo Mecozi questions whether most of Douhet’s ideas were taken from Clement Ader, who in pre-war years wrote of the vulnerability of cities like London and how this vulnerability would reshape future conflicts (Kennett, 1982, p. 57). Lord Montague of Beaulieu made a similar prediction in 1909, stating that in the future a single air attack on London would paralyze the country by destroying Parliament, government ministries, the post office and telegraph (Kennett, 1982, p. 43).79 Despite this, Douhet remains the most passionate, and today well-known of the early pioneers who advocated targeting of an enemy’s psychological centers, and all modern scholarship on the subject generally begins with his work.
war, will make the contest much sharper, more decisive, and more quickly finished (Mitchell, 1925, p. 16).” By losing control of the air, a defeated rational actor should realize the potential for destruction at hand, and should seek a peace as soon as possible to avoid such destruction and suffering. 80

Though most airpower scholars concur with Douhet on many of the broad underlying principles he identified – the need for an independent, coequal air arm; the need to quickly gain control of the air; the ability of air forces to rapidly strike at an opposing nation’s vital centers; and the inherent offensive nature of air power once air supremacy is gained – there are a number of assumptions of Douhet’s that have not stood the test of time, to the point of being problematic in modern warfare. In part, this is due to Douhet’s point of reference being experiences from World War I and planning for a hypothetical World War II, and in part a recognition of the limitations of both airpower and communications technology at the time. As he was envisioning a repeat of World War I between industrialized states and the threat of total war, he specifically recommended against emphasizing precision engagement. “Aerial bombardment can certainly never hope to attain the accuracy of artillery fire; but this is unimportant since such accuracy is unnecessary. Except in unusual cases, the targets of artillery fire are designed to withstand just

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80 Despite Douhet’s predictions of the impact of strategic bombing on civilian morale, wartime experiences have largely shown Douhet’s predictions to be overstated. Morale has proven stronger than anticipated in the face of military campaigns, and signaling of intentions is difficult when relying on an air arm alone. In contrast to Douhet’s visions of morale collapse, he notes the Soviet experience in World War 2 which during Operation Barbarossa lost much as 40% of its population (likely just in the affected areas), 63% of its coal, and 58% of its steel and yet not only did not collapse, but went on to win the war (Meilinger, Giulio Douhet and the Origins of Airpower Theory, 1997, p. 22). This history complicates Douhet’s planning because defining unacceptable losses is complicated due first to the adversary’s calculations on of the stakes involved in the war and second to the adversary’s ability to absorb damage. This is calculated both in absolute terms and over time as a slower campaign may harden resolve and convince the adversary of their ability to absorb losses. Douhet similarly readily overestimated the damage that early aerial bombardment was capable of producing, with Major Oliver Stewart writing two years after Douhet’s publication that a bomber “can hit a town from ten thousand feet – if the town is big enough (Kennett, 1982, p. 49).” In contrast, during the Cold War Robert McNamara implied a nuclear strike capable of destroying one third of the population of the Soviet Union was likely sufficient unacceptable losses in an instant strike so as to constitute effective deterrence (McNamara, 1967), though it could be argued Douhet anticipated this in his calls for swift action although it was in fact unattainable with the weapons of the era.
such fire; but the targets of aerial bombardment are ill-prepared to endure such onslaught. Bombing objectives should always be large; small targets are unimportant and do not merit our attention here (Douhet, 1927, pp. 19-20).” Thus, Douhet’s lessons are most applicable to the potential of total war and great power conflict rather than limited wars, which by definition should exclude coercive bombing to limit the threat of escalation.

The atomic bombing of Hiroshima on 6 August 1945 ushered in the nuclear era and with it a marked change in strategic warfare. 1949 saw the Soviets detonate their first nuclear warhead, and Great Britain followed suit in 1952. In the 1950s, fusion weapons were introduced, along with long-range missiles capped by the intercontinental ballistic missile (ICBM), which became a reality with the launch of Sputnik in 1957. By the 1960s, a new state of affairs was becoming reality in the Cold War dynamic, the nuclear revolution and ‘mutually assured destruction’ or MAD. To an extent, the doctrines of nuclear deterrence would validate many of the ideas underlying Douhet’s theories, but the period of limited war it would usher in would add new challenges to strategic airpower theory. The stability-instability paradox and the limits of coercive bombing in campaigns throughout the period would demonstrate the gap between air capabilities and expectations of resolve and willingness to inflict pain to achieve a political objective in military operations short of total war.81

The nuclear revolution changed the dynamics of warfare in two important ways, the speed in which that damage could be inflicted and the ability of all parties possessing such capabilities to punish their adversary from the outset. Destructive power is important, but not because the level of destruction brought by nuclear weapons was new or novel. Schelling notes that Japan was largely defenseless by August 1945, and a combination of blockade, bombing, 81 Evaluations of coercive airpower have shown its limited effectiveness historically and posit various reasons why beyond what are discussed in this passage. These arguments, most notably those put forth by Pape and Gentile, will be discussed in greater detail in Chapter 6.
and eventual invasion could ultimately have destroyed Japan even without the atomic bomb (Schelling, 1966, p. 19). The firebombing of Tokyo, which preceded the atomic bomb by five months, killed more people and caused more destruction than the bombing of either Hiroshima or Nagasaki. Timing, vulnerability, and credibility of the use of destructive power is critical to nuclear strategy and is what makes it different from the threat of large-scale conventional bombing. The use of missiles as a delivery platform vice a bomber is also important, as it ensures the bomb, if not the bomber, will almost always get through. Nuclear weapons and long-range delivery systems change the calculations of leaders considering war as an instrument of policy because their destructive power can be released in hours, not months or years, and could be done with a smaller force that wasn’t vulnerable to existing air defenses. “Deterrence today rests on the threat of pain and extinction, not just on the threat of military defeat….something like the same destruction always could be done. With the nuclear weapon there is an expectation that it will be done (Schelling, 1966, p. 23).” Not only would such destruction be done, but the expectation was that it would be done rapidly at the onset of hostilities.82

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82 This interpretation of the risk of nuclear war is not without controversy, as there has been recent scholarship downplaying the impact of nuclear weapons on international politics, doubting the implications of Schelling’s model of nuclear brinkmanship, and questioning the need for modern air forces independent of land forces. Robert Pape represents Schelling as different from Douhet in that Douhet called for immediate destruction whereas Schelling called for gradual escalation, quoting “To be coercive, violence has to be anticipated….It is the expectation of more violence that gets the wanted behavior, if the power to hurt can get it at all (Pape, 1996, p. 67).” Building on Pape’s line of reasoning combined with scholarship suggesting the obsolescence of nuclear weapons, Robert Farley has gone as far as to advocating for the abolishing of the Air Force, arguing that “What it (the USAF) does on its own -- strategic bombing -- isn’t suited to modern warfare. What it does well -- its tactical support missions -- could be better managed by the Army and Navy (Farley, 2007).” Others, like Ward Wilson, have built upon Pape’s contention that the atomic bomb was not decisive in winning World War II in the Pacific to arguing almost to the opposite extreme, that it was irrelevant both to the outcome and to 70 years of nuclear deterrence policy based on the outcomes of the war (Wilson, 2013). Despite these contentions, the broader story of the nuclear era is better encapsulated by Zbigniew Brzezinski, who wrote in 1970 “Since the appearance of nuclear weapons, relations between the superpowers have been governed by a rudimentary code of restraint forged by trial and error in the course of confrontations ranging from Korea through Berlin to Cuba. It is likely in the absence of these weapons war would long since have broken out between the United States and the Soviet Union. Their destructive power has thus had a basic effect on the degree of prudence in the behavior of the most powerful states (Brzezinski, 1970, p. 9).” This is the essence of the nuclear revolution as outlined by Schelling and later by Jervis.
Douhet’s vision of coercive bombing didn’t anticipate the implications of mutual vulnerability when such powerful weapons were at work, largely because he didn’t follow his recommendations toward their logical conclusions. He recognized the prospect of mutual vulnerability, but although he believed air warfare would be brutal, it would be less than total. “Viewed in this true light, aerial warfare admits of no defense, only offense. We must therefore resign ourselves to the offensives the enemy inflicts upon us, while striving to put all the resources to work to inflict heavier ones on him (Douhet, 1927, p. 55).” As Douhet viewed defense as useless, this concept represented the tragedy of future wars as only a willingness to sustain losses would allow an enemy to survive as “there is no doubt that nations who find themselves unprepared to sustain them will be lost.” Douhet thus implies that nations must prepare for aerial warfare by working to raise their thresholds of acceptable loss. Following this reasoning, if civilians can normalize the new form of warfare and in so doing raise their pain threshold, this would suggest the need to continually build arsenals and progressively make war worse, until eventually arsenals are reached sufficient to cause losses which would be unacceptable under any circumstance. Nuclear weapons and MAD represent the logical conclusion of this chain of reasoning, with nations possessing both sufficient weapons stockpiles and delivery platforms to ensure reliable second strike.

This state of MAD in turn leads to the stability-instability paradox and the problem post-World War II of limited wars. The threat of Douhet-style total war on civilians stabilizes the system at the strategic level by reducing the risk of direct conflict between major powers due to the high costs associated with conflict, but when conflict appears to present fewer risks than those associated with such war, major powers are more free to intervene in lower levels of

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83 This poses some challenges of logical consistency for his underlying theory which is based around the weak morale of civilians.
conflicts recognizing no power would want to escalate to nuclear war by initiating direct confrontation. Wars remain limited because states choose not to expand the goals or means of conflict so as to infringe on the stakes of other world powers, and this ensures those other powers recognize their limited goals.

**Limited War - Industrial Web and Warden’s Rings**

Short of total war, military confrontation remains a regular occurrence with limited military interventions throughout the Cold War and in the years since the fall of the Soviet Union. For these conflicts, the experience of history and the logic of air warfare illustrate that coercive airpower aimed at civilians is unlikely to achieve results in such limited confrontations. The experiences of nearly a century of air warfare have led to significant changes in our understanding of how civilian morale is impacted by air warfare, and the recognition of the likelihood of civilian casualties from such attacks has raised the threshold of violence required to inflict damage sufficient to lead to the collapse of societies once hostilities begin. Great Powers have the capability to inflict pain on largely indefensible civilian populations, but lack the credibility to threaten such attacks in cases where their own vital interests, if not survival itself, are at stake.

The roots of the modern air campaign can be traced to Billy Mitchell’s writings and the Air Corps Tactical School’s formulation of the air campaign as encapsulated in AWPD-1 and

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84 This is, however, not absolute as if there was a clear dividing line between the ‘stable’ strategic balance and instability at lower levels, deterrence would be nonexistent and as useless /on/ [for] the understanding of war as Meilinger implied. The potential for escalation, the paradoxical prospect of irrationality on the part of parties to a conflict, and the varying stakes involved by the players that threaten escalation shapes the bargaining process that is the ultimate goal of warfare (Jervis references Prospect Theory as a driving force in nuclear crises: states will be more risk averse if they fear loss than if they seek to gain (Jervis, 1989, pp. 168-170); thus defining the status quo becomes critical to the game of nuclear brinkmanship). “When the adversary’s vital interests are not at stake, the state may be able to reach most of its objectives because the other side will tolerate the outcome...But some sort of compromise if not stalemate is much more likely when both sides have a stake (Jervis, 1989, pp. 237-238).”
AWPD-42, which served as planning guidelines for the air campaign in Europe during World War II. The shift to strategic nuclear doctrines in the Cold War era saw a decline in planning for conventional war during the period, which led to the misuse of airpower during much of the Vietnam War in what air historian Benjamin Lambeth classified as ‘mixed at best.’ The lessons of the war did however reshape the emphasis on air tactics and the effective use of air power. The 1970s and 1980s saw the rise of AirLand Battle as the dominant doctrine of airpower application, but at the same time theorists such as John Warden and David Deptula re-examined the implications of strategic airpower and the notion of the air campaign for state-on-state conflicts. Like Mitchell and others, Warden saw the enemy as a system that could be struck well beyond the battle lines in ways that could paralyze military forces.

Early airpower theorists divided most sharply on what constituted ‘vital centers.’ Douhet’s work largely implies the threat of large scale bombing against civilians is sufficient to win, which is clear in the means of targeting but is ambiguous in the mechanism for destroying an enemy’s will to fight. The British, owing to their history as a naval power, recognized the importance of applying pressure on commerce and the economy on the outcome of war. Like Douhet, Hugh Trenchard would see airpower’s virtue as its ability to focus on the will to fight.

In the United States, Mitchell was similarly agitating for increased emphasis on air power based on experiences from World War I which proved to him the need for an independent air force to control the development of airpower strategy and more effectively use the air weapon. Mitchell’s works share many common elements with Douhet, to include Mitchell’s call in World War I for a division between “tactical” air aligned with ground forces and “strategic” airpower which could penetrate targets deep behind enemy lines not tied directly to ground commander’s

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85 AirLand Battle was largely an Army-centric doctrine emphasizing integration of air and land assets for close air support and interdiction of targets that pose a threat to fielded forces.
objectives (Clodfelter, 1997, pp. 84-85). Mitchell aimed to make Americans an “air-going people” ready to conduct “war at a distance” as the aircraft could defend the interests of the United States more effectively, and at lower cost, than land or naval forces (Clodfelter, Molding Airpower Convictions: Development and Legacy of William Mithcell's Strategic Thought, 1997, p. 99).

As Meilinger noted, “[t]he object of war was to force an enemy to bend to one’s will, accomplished by breaking either his will or his capability to fight.” Within this context, Douhet and Trenchard focused on will, while Mitchell focused more on capability. Airmen would “determine an enemy state’s vulnerabilities and then mass bombers against those weaknesses (targets) (Clodfelter, 1997, p. 79).” Severing the population from production, rather than destroying civilian morale, was critical to Mitchell’s view of strategic bombing in population centers. “Heretofore, to reach the heart of a country and gain victory in war, the land armies always had to be defeated in the field and a long process of successive military advances made against it. Broken rail lines, blown up bridges, and destroyed roads, necessitating months of hardships, the loss of thousands of lives, and untold wealth to accomplish. Now an attack from the air using explosive bombs and gas may cause the complete evacuation of and cessation of industry in those places. This would deprive armies, air forces, and navies even, of their means of maintenance (Mitchell, 1925, pp. 5-6).”

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86 Raymond R. Flugel's doctoral dissertation on the subject of Mitchell and Douhet’s influence on American strategy suggests that Mitchell may have plagiarized much of his work from Douhet, but their similarity is more likely due to Mitchell’s meeting and discussing ideas on airpower theory in 1922 given Mitchell’s employment of airpower predating Douhet’s publication.

87 Like Douhet, Mitchell was prone to overstatement on a number of issues, probably most notably his downplaying of the importance of ground and naval forces to support air operations (and for air operations to support their operations; this position evolved over time as he appeared to grow more political in making the case over time in contrast to earlier work which suggested a more joint approach with an air-centric service at the table). This is likely in part due to Mitchell’s objective of selling air power to Congress and the public over the objections of the existing military bureaucracy, but nonetheless was problematic as it raised the expectations for what airpower could accomplish in World War II and which to a large extend linger to this day.
Mitchell’s ideas would be to large extent put to the test in World War II, to mixed results. Shortcomings in technology and production, an overestimation of the ability of strategic bombing to destroy a state’s morale, and failure to anticipate impediments to strategic bombing played a significant role in preventing the bombing campaign from playing the decisive and cost-effective role that its early theorists envisioned. The lessons learned from that war, and new technologies that would emerge, would reshape the post-war world in some cases in ways that these theorists anticipated, and lead to new types of war that air power theorists writing in the interwar period did not anticipate. Limited wars in Korea and Vietnam against non-industrialized states challenged the utility of strategic bombing as commonly understood, leading it to be cast aside or misapplied until the late 1980s.

Figure 12: Warden's Rings (Smith R. J., 1999)

As a key architect of the 1991 Persian Gulf War, Warden modeled a potential adversary as consisting of five concentric rings, comprised of fielded forces, the population, infrastructure, system essentials, and leadership (Smith R. J., 1999). In the run-up to the 1991 Gulf War, Warden led a team that devised a plan to incapacitate the Iraqi military by striking at 84 strategic
targets at the outset of the war. Dubbed Instant Thunder to contrast the methods of the campaign with Vietnam’s Rolling Thunder, the plan was ultimately heavily modified by the Air Component Commander Lt Gen Charles Horner for insufficient emphasis on the key mission objective of the defense of Saudi Arabia. Warden himself left the theater after briefing it to Horner, but his deputy, then Lt Col Deptula, was retained by Horner on his staff to implement the plan, ensuring the principles of Warden’s original plan were largely implemented into the Gulf War’s air campaign.

Traditional aerial targeting focused primarily on fixed targets which constitute critical nodes in an adversary’s organization, and ideally striking at the enemy’s critical center of gravity. Warden further elaborated this concept by demonstrating the traits of the five rings in the context of the human body, the state, a drug cartel, or a complex system such as the electric grid (Table 10). Under Warden’s air campaign model, when facing a state actor traditional ground-force centric operations would be forced to wage an outside-in campaign, defeating the enemy’s fielded forces before being able to threaten a state’s core. Airpower, meanwhile, would be capable of simultaneous attack on all functions of the system from the time air superiority was established, what is referred to as parallel warfare. As Deptula defined it: “The object of parallel war is to achieve effective control over the set of systems relied on by an adversary for power and influence—leadership, population, essential industries, transportation and distribution, and forces (Deptula).” Target selection within the other rings -- with the goal of producing results that will accumulate to achieve the state’s strategic objective -- becomes critical to winning war.
Table 10: Application of Warden’s Rings

<table>
<thead>
<tr>
<th>Leadership</th>
<th>Body</th>
<th>State</th>
<th>Drug Cartel</th>
<th>Electric Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brain</td>
<td>Government</td>
<td>Leader</td>
<td>Central Control</td>
</tr>
<tr>
<td></td>
<td>- Eyes</td>
<td>- Communication</td>
<td>- Communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Nerves</td>
<td>- Security</td>
<td>- Security</td>
<td></td>
</tr>
<tr>
<td>Organic Essentials</td>
<td>Food and oxygen</td>
<td>Energy (electricity, oil, food) and money</td>
<td>Coca source plus conversion</td>
<td>Input (heat, hydro) and output (electricity)</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Vessels, bones, muscles</td>
<td>Roads, airfields, factories</td>
<td>Roads, airways, sea lanes</td>
<td>Transmission lines</td>
</tr>
<tr>
<td>Population</td>
<td>Cells</td>
<td>People</td>
<td>Growers, distributors, processors</td>
<td>Workers</td>
</tr>
<tr>
<td>Fighting mechanism</td>
<td>Leukocytes</td>
<td>Military, police, firemen</td>
<td>Street soldiers</td>
<td>Repairmen</td>
</tr>
</tbody>
</table>

Warden’s model presents a simplified version of an adversary based on concentric circles. More recent, advanced models illustrate the adversary instead as sets of complex, often overlapping and interdependent networks. Likewise, while targeting in the traditional sense refers generally to kinetic strikes with the goal of destroying targets, effects-based planning models view targeting more broadly and visualize an array of both kinetic and non-kinetic means to influence the battle space through targeting. Rather than targeting the population of an adversary with force, information operations to undercut their support for the regime is generally

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88 Chart adopted from John Warden’s work “The Enemy as a System” (Warden, 1995)
89 There is a complicated history to the use of the terminology “effects-based operations.” The Air Force uses effects-based operations as a central tenet, while the Army and Navy eschew the term based on its recent associations with quantifiable metrics and methods of planning for strategic effects that aren’t as readily apparent in the tactical battle space. Despite this, the basic principles of effects based operations are regularly employed by all services. Rather than applying a strict doctrinal definition based on quantitative methods of effects based operations, I rely on the definition used by the Command and Control Research Program, which defines it as approaches characterized by a focus on: (1) the human dimension of collaboration, competition and, conflict, (2) the full peace-crisis-war-postwar spectrum, (3) integrated national or coalition power, and (4) the complex nature of problems and solutions (Smith E. A., 2006). Effects-based operations are those that focus on the desired impact in the battle space toward achieving objectives, rather than focusing on the tools employed.
preferred by planners as one example. Joint Publication 5-0 takes a similar approach to this concept in a system-of-networks framework (Figure 13) which in turn can be used by planners to identify centers of gravity, critical nodes, and critical vulnerabilities for the purpose of target selection.

**Figure 13: System of Systems Analysis**

![System of Systems Analysis](image)

**Figure 14: Targeting Cycle Phases and Notional Air Tasking Cycle**

![Targeting Cycle Phases and Notional Air Tasking Cycle](image)

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90 From Joint Publication 5-0, Joint Operation Planning (Joint Publication 5-0: Joint Operation Planning, 2011, pp. III-10)

91 Graphics derived from Joint Publication 3-56.1 (Joint Publication 3-56.1, Command and Control for Joint Air Operations, 1994).
The process of target selection, weaponeering (determining the appropriate means of effecting the given target), and engagement is defined by the targeting cycle. As illustrated in Figure 14, the process begins with the commander identifying the goals for the operation, followed by analysis of the adversary’s systems for target selection in the Target Development phase. Identification of suitable munitions and delivery platforms to achieve the desired effect on the identified target then takes place in the Weaponeering Assessment phase, followed by Force Application, and Execution Planning/Force Execution. The cycle concludes with a combat assessment, to include battle damage assessment (BDA), changes to the battle space following the engagement (political ramifications, efficiency and strength of the adversary subsequent to the attack, etc.), which in turns leads to refinement of the Commander’s Objectives and Guidance as the process begins again. For Air Campaign planning (a macro-level approach), this cycle manifests itself in the Air Tasking Cycle.

The Air Tasking Cycle was designed for what could be considered a traditional wartime scenario against an adversarial state, with a focus primarily on fixed targets. This was the case in the Gulf War in 1991, in campaigns in the former Yugoslavia and in Iraq throughout the 1990s, and in the first phases of the Iraq War of 2003. The process envisions a 72-hour process for assignment of targets and weapons to specific aircraft for strike operations under the ATO (in addition to aircraft allocated for offensive and defensive counter-air, logistics and support among other missions). This process is most effective against infrastructure, military bases, air defense sites, etc., whose location can be plotted and analyzed well in advance of a mission. In the example of a potential strike on nuclear assets in Iran, such a process could be utilized as the location of potential targets are fixed and pre-identified, significant intelligence can be derived from human and imagery sources identifying the nature of the target (is it buried or reinforced to
require a penetrating warhead, is it better to attack it with a blast or fragmentary munitions, what size warhead will be required, etc.). However, the process becomes more difficult once all fixed targets have been destroyed and the critical nodes are primarily mobile, as is the case with many terrorist and insurgent organizations.

During this period of warfare, the U.S. relied on the innovations of the first phase of the targeting revolution, with innovations such as stealth and cruise missiles playing a key, though often overstated, role in the 1991 Gulf War which increased throughout the 1990s in campaigns in the former Yugoslavia, Iraq, and eventually attempted against non-state targets in Afghanistan and Sudan. The perceived overwhelming success of precision munitions\(^{92}\) and the nascent targeting revolution that it foretold in the eyes of many observers at the time was not without its downsides as those latter campaigns would demonstrate.

The Kosovo Campaign of 1999, Operation Allied Force, was arguably the first war in which airpower alone was decisive in winning a conflict, but this is a subject of intense debate. Advertised in advance by the Secretary General of NATO, Javier Solana, as a campaign that would last “days, not weeks,” the campaign instead lasted 78 days from May 24th through June 10th. Further, the campaign ran out of purely military targets just three days after the initiation of the campaign, leading to an ad hoc approach to targeting and a steadily expanding list of targets (Van Creveld, 2011, pp. 327-330). Serbian forces remained largely concealed from transient airstrikes, terrain and weather limited the ability of U.S. forces to strike military targets, all of which drove the campaign towards a coercive campaign against Serbian leadership rather than military targets.

\(^{92}\) As Keaney and Cohen note when discussing the media emphasis on precision munitions, “From all appearances, a new age of precision bombing had supplanted years of employing less accurate, unguided bombs. In fact, the new age had only partially arrived: laser-guided bombs achieved dramatic success in the war—in some measure because of the early neutralization of Iraqi air defenses—but overall, they comprised just a small fraction of the munitions expended during the war (Keaney & Cohen, 1995, p. 191).”
Milosevic eventually conceded, but this can only in part be attributed to the resolve and
destruction of the 78 day campaign. Airpower enthusiasts trumpeted the decisive role of
airpower, with Brigadier General John Corley possibly being the most emphatic when he
declared in 2000 “We were able to take on Milosevic and vanquish him. We were able to meet
this objective through the hard leverage of aerospace power (Cooper, 2003, p. 5).” Other
mitigating factors include Milosevic’s indictment for war crimes by the International Criminal
Tribunal in late May 1999 (Amanpour, King, Dougherty, & Rodgers, 1999), which in turn likely
influenced the international community, especially Russia, to persuade Milosevic that continuing
resistance would be futile. Ultimately, analysts have argued that any number of causes could
have led to the allied victory in the Kosovo campaign, from the air campaign decision to “go
downtown” rather than engaging strictly military targets, a resurgent Kosovo ground campaign,
the threat of ground intervention by NATO, NATO solidarity, and wavering Russian support all
playing a role (Mokhiber).

If the 1999 campaign in Kosovo represented an example of possible success of airpower
alone, the August 1998 cruise missile retaliatory strikes against al Qa’eda targets in the Sudan
and Afghanistan are largely viewed as a spectacular failure. Following attacks on the U.S.
Embassies in Nairobi, Kenya and Dar es Salaam, Tanzania, the U.S. government reacted with a
series of missile strikes against targets in Afghanistan believed to be associated with al Qa’eda
and in hopes of decapitating al Qa’eda leadership, as well as a chemical plant believed to be
associated with a nascent al Qa’eda chemical weapons program, code named Operation Infinite
Reach. The failure of cruise missiles to hit bin Laden and questions over the accuracy of
intelligence on targets in Afghanistan and Sudan undercut the credibility of airstrikes against
non-state actors. “National Security Adviser Berger and others told us that more strikes, if they
failed to kill bin Laden, could actually be counterproductive—increasing bin Laden’s stature…. There were no occasions after July 1999 when cruise missiles were actively readied for a possible strike against bin Laden. The challenge of providing actionable intelligence could not be overcome before 9/11 (The Military: Staff Statement #6).” This operation, combined with air campaigns against Iraq in retaliation for violations of the No-fly Zones and other UN obligations, led some critics to derisively accuse the U.S. of engaging in “Cruise Missile Diplomacy.”

In the aftermath of the September 11th attacks, President George W. Bush summarized a wider accepted philosophy on the matter by stating "When I take action, I'm not going to fire a $2 million missile at a $10 empty tent and hit a camel in the butt (Fineman, 2001)."

The Dilemma of Airpower in Small Wars

The contrasting results of the air campaigns in Operation Desert Storm, the U.S. Campaigns in Yugoslavia, and the cruise missile strikes against al Qa’eda illustrate the long-standing challenge posed to air warfare by small wars such as counterterrorism and counterinsurgency. Coercive strategies, weak at best when facing conventional adversaries short of total war, are largely non-applicable to counterinsurgency environments where the goal is to separate insurgents from the population and destroy the insurgency, not engage in activities that

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93 Michael Rip and James Hasik devote a full section of their book on the precision revolution to the topic, and with longtime adversary Moammar Qaddafi stating in 2000 "America relies on cruise missiles for conducting its relations with the rest of the world. These are outdated methods and bankrupt programs that have no future (Hundley, 2000)."

94 Despite this rhetoric and although cruise missiles played a lower visibility role in the war during the Bush Years, cruise missiles were still extensively used by the Administration in the early years of the war on terror, particularly in Somalia. Daniel Klaideman observed “Tomahawk cruise missiles could be fired from warships off the Somali coast, the least dangerous option in terms of U.S. casualties. Such missile strikes had been a hallmark of the Bush Administration. For all its ‘dead or alive’ rhetoric, the Bush White House was surprisingly risk averse when it came to antiterrorist operations in lawless areas like Somalia. But the missile strikes were not always effective. Sometimes the missiles went astray, killing civilians, and even when they hit their targets they didn’t always take them out (Klaidman, 2012, pp. 123-124)."
might drive the population to the insurgents. Leadership and counterforce targeting is also complicated by the challenges of distinguishing between civilians and military forces, and by the ability of smaller forces to exploit cover and concealment. For decades, the prospect of using airpower in a counterinsurgency role was a theoretical possibility, but precluded by technical shortcomings of detection, tracking, and targeting. A cruise missile strike in the 1990s required actionable intelligence with 4-6 hours of lead time in order to program targets, and even with actionable intelligence on a camp location, successfully targeting an individual like bin Laden would be difficult given the blast radius of a cruise missile relative to the large size of the training camps in Afghanistan. This left ISR collection as the primary utility of airpower in these years, or attempts to shift the unconventional war to one against a conventional enemy by targeting the backers of insurgent campaigns, often with poor results.

The Italian experience in Libya from 1911-1934 represents one of the first significant uses of airpower in a guerilla campaign. Due to the range from Italy and the limited capabilities of aircraft at the time, aircraft played a minor role in the initial phase of the campaign against major cities, but following the ‘liberation’ of the country from already weak Ottoman control, most of the military’s attention turned to pacification of the vast expanses of the country. As Martin Van Creveld recounted, Arab tribes quickly lost their fear of Italian bombers as they were readily able to exploit cover in daylight hours and move at night to evade attack and detection. Aircraft, as they would be for much of the century, proved best at gathering intelligence, but even this was insufficient for the war effort (Van Creveld, 2011, pp. 339-342).

Britain’s Royal Air Force, afraid at the time that it might be re-absorbed into the army and navy due to post-World War I cuts, made a greater effort to exploit the possibilities for airpower in counterinsurgency environments with their well-documented use of “air policing” in
colonies/mandates beginning with Somalia and then moving towards the Middle East in areas we know today as Iraq, Israel and the West Bank, Jordan, and Yemen. “In all these areas its aircraft, first what had been left over from World War I but then increasingly modern models coming into service, reconnoitered, bombed, strafed, and provided liaison over what were often very long distances…..To quote one historian, ‘in terms of saving British lives and treasure, the success of the new method was quite spectacular (Van Creveld, 2011, p. 343).’”

Despite the advertised success of the aircraft in these campaigns, there were many shortcomings as well. The British left the Royal Air Force to cover peripheral territories, but did not trust the cover of critical areas such as India and Singapore. Further, critics at the time noted the long-term problems with reliance on airpower in terms of achieving strategic success, arguments largely echoed by critics of airpower today. At about the same time Giulio Douhet and Billy Mitchell were formulating their theories on strategic bombing, largely with an eye for a repeat of the Great War in Europe, the British Naval Review was documenting what would become a truism for the role of airpower in counterinsurgency for the next century as reflected by Biddle’s critiques of precision warfare. “In all these small war operations, the limitations which to us appear to be the most permanent are: the transitory influence of aircraft attack, due mainly to the shortness of time the aeroplane can remain in the air; its lack of power to occupy a disturbed district; the difficulty of providing it with landing grounds and the danger of indiscriminate slaughter of friend and foe, of women and children as well as armed men. Such a slaughter is an action which does not harmonize with British traditions, and which ethically has again and again proven to be unsound (The Fiends of the Air, 1923, p. 90).”

The United Kingdom was the lone country to rely significantly on air forces for waging counterinsurgency/guerilla campaigns in the early 20th Century. The United States, like many
other states, entrusted such missions primarily to smaller forces with organic air assets for close air support. This was the pattern employed by the Marines in Nicaragua and elsewhere in Central America. As Van Creveld noted, in this capacity air power was effective in thwarting what later Maoist Insurgent Doctrine would characterize as a transition from phase one to phase two of insurgency, the building of safe havens from which to operate and build towards the third phase of open warfare (p. 349). Airpower, owing to technical, targeting, and other limitations remained unable to significantly influence campaigns aside from assisting ground operations in the first phase of insurgency, leading countries that relied heavily on airpower facing what today might be characterized as failed or failing states, with large active insurgencies but strategic stalemate between insurgents deeply imbedded in the population and an increasingly weakening central government.

The most visible case of this limitation of airpower came for the United States during the Vietnam War, which is today remembered for the largely ineffective Rolling Thunder bombing campaign of 1965-1968, followed by the more effective Linebacker and Linebacker 2 operations of 1972. In popular Air Force culture, these operations are taught as examples in how effective planning and target selection drawn from basic airpower principles can lead to effective campaigns while indiscriminate bombing is doomed to failure, but the reality is more difficult.

The failure of Rolling Thunder is a nearly unanimous point of Vietnam literature. Robert Pape asserted that its failure “extended the war by four years, during which approximately twenty thousand Americans and hundreds of thousands of Vietnamese lost their lives, whereas the success of the linebacker bombings finally enabled the United States to escape the unpopular war (Pape, 1996, p. 174).” This quote is representative of much of the literature, but there are sharp disagreements as to why Rolling Thunder failed and what lessons should be drawn from
the Rolling Thunder v. Linebacker comparison. To Pape, Rolling Thunder failed because it focused on civilian vulnerabilities while Linebacker focused on military capabilities (p. 176), in line with his central thesis. Dennis Drew, echoing a common U.S. Air Force critique, notes that the original Air Force plans for Vietnam focused around what was called the 94-target list, designed to destroy North Vietnam’s capacity to continue as an industrially viable state, much akin to the air strategies developed prior to and the lessons learned from World War II. Political constraints, fear of escalation, and the potential for nuclear confrontation led policymakers to reject this plan in favor of a “slow squeeze,” which resulted in the Rolling Thunder campaign. Given this backdrop, Drew notes many airpower theorists argue Rolling Thunder does not qualify as a test of airpower theory as it rejected its central lessons (Drew, 1997, p. 334).

The true cause of failure of Rolling Thunder and the success of Linebacker and Linebacker 2 likely owed as much to the character of the war during the time of the campaigns as the strategy for bombing. Even had the Air Force pursued its 94-target list and done so in a manner where outside actors would not have intervened (which is unlikely), it is unlikely that the goals of the American mission in South Vietnam would have been obtained. The mission was not to destroy the regime of North Vietnam, and as Drew notes the aim of destroying their infrastructure as an industrial state was absurd as North Vietnam at the time could hardly be characterized as an industrial state even before the bombing took place. The primary opponent the U.S. faced in the 1960’s was the Viet Cong insurgency within South Vietnam, who required little in the way of support from the North.⁹⁵ Coercive bombing against North Vietnam would

⁹⁵ As Mark Clodfelter noted, “The Vietcong (and their North Vietnamese allies) fought an average of only one day a month and hence needed a meager 34 tons of supplies each day from sources outside South Vietnam—an amount that just seven two-and-a-half-ton trucks could deliver (Clodfelter, Forty-Five Years of Frustration: America’s Enduring Dilemma of Fighting Insurgents with Airpower, 2011).” Attempts to interdict such meager supply chains in the jungles of Vietnam, Laos, and Cambodia over such a broad expanse of territory would have been futile given the technology of the era.
have had minimal effectiveness, and counter-force bombing would have been nearly impossible given the character of the insurgent force.

If the lesson is that the U.S. should have focused on North Vietnamese military strength in 1965 as it later did in 1972, it is difficult to see the results being any more successful given the limited conventional power of North Vietnam involved in the war at the time. The shift in strategy post-Tet from a guerilla campaign to a direct military intervention by North Vietnam altered the impact air power could have on influencing the war effort by the direct link between coercing the government of North Vietnam and the conduct of the war in the South. In Vietnam, the use of airpower became easier as adversaries evolved from a Phase 1 up to a Phase 3 Maoist insurgent group, while in the 1990s the U.S. reliance on airpower saw diminished results as adversaries effectively reversed this process in order to outlast the U.S. campaigns.

The use of bombers in counterinsurgency within South Vietnam further demonstrated the challenges of relying on airpower in a coercive role to attain productive results. Kocher, Pepinsky, and Kalyvas (2011) found strong empirical evidence of the counter-productivity of aerial bombardment in South Vietnam. “Higher frequencies of bombing correspond unambiguously to higher levels of downstream control by the VietCong (Kocher, Pepinsky, & Kalyvas, 2011, p. 2).” As with prior counterinsurgency campaigns, air power in Vietnam during the 1960s was best served in intelligence, supply, and close air support roles to prevent the insurgency from moving from Phase 1 to Phase 2. The challenge for those who advocate that, given the successes of Linebacker, the Vietnam War could have been won with continued U.S. air support for an ARVN by continuing similar punitive missions is that the war in the South would have simply continued reverting to a Phase 1 insurgency, rendering the use of airpower virtually useless while the government of South Vietnam continued to atrophy. Airpower
performed adequately against conventional targets in the 1972-73 period, but Robert Jervis noted “[t]he American conventional offensives that worked well when the North Vietnamese thought they could win by large scale battles failed when the latter reverted to guerilla warfare….the return to unconventional war forced the south to disperse its army and thus facilitated the success of the North Vietnamese offensive of 1975.”

The main lessons for the Air Force post-Vietnam was largely to avoid such campaigns in the future, focusing first on AirLand Battle in planning for air support to major ground maneuver operations in a potential war in Europe, and later toward what has since come to be known as the “Powell Doctrine” –clear objectives, overwhelming force, and a clear plan to end hostilities/exit strategy. This was also present in the run-up to Vietnam, as most airpower literature observing the rise of insurgencies in Southeast Asia focused on the limited applications of airpower in such conflicts and the need to emphasize the key strategic points of the Cold War, Berlin and Western Europe in particular (Drew, 1997, pp. 327-328). Post-Vietnam scholarship for airmen, much like for the army, emphasized the lessons that are encapsulated in today’s counterinsurgency manuals: the importance of Civil-Military relations, the non-kinetic aspects of fighting an insurgency, and the need to focus on the causes of insurgency rather than on the insurgents themselves. However, by the mid-1970s frustration with the conduct of the air war in Vietnam led the Air Force to turn its attention largely away from examining the lessons of the conflict and instead towards other Cold war topics.

Outside scholars who continued to write on the subject, from David Dean and William Olsen to Dennis Drew emphasized the similar themes of the role of airpower that had been learned by the British years before: airpower is most useful in reconnaissance, troop transport, resupply, and presence for close air support. Further theorists on counterinsurgency emphasized

96 Quoted in The Transformation of American Air Power (Lambeth, 2000, p. 52).
the need of counterinsurgents to “interdict inputs, disrupt conversion, reduce outputs, and build a government’s capability to resist.” The military being most effective in reducing outputs (insurgent forces).” David Parsons and Dennis Drew accept this position, with airpower supporting that role best through reconnaissance, maintaining air lines of communication, and performing close air support (Drew, 1997, p. 343). Drew mentions the degradation of leadership as part of this process, but offers no specific air roles in this process. Psychological Operations and maintenance of lines of communication can also support the building of government legitimacy and degrading of adversary conversion, but little in terms of specifics were provided in terms of the mechanisms.

Officially, the Air Force released Air Force Manual 2-5: Tactical Air Operations Special Air Warfare in 1967, which emphasized the different roles of airpower in various phases of insurgency and the challenges posed by identification, but this was alone in the Air Force’s official review at the time. By 1971, even before the end of the campaign, the official Air Force doctrine was moving away from the language of counterinsurgency, substituting the phrase “foreign internal defense” in its 1971 update (Drew, 1997, pp. 338-339), a term that would continue to be used as a euphemism for all forms of intervention in other states for the remainder of the century.97

Air manuals and experiences for the remainder of the 20th Century followed these lessons and limited both the use and development of air power theory as it related to small wars. Field Manual 100-20/Air Force Publication 3-20 devotes only a few sentences to the use of airpower in counterinsurgency missions in its appendix on counterinsurgency operations, emphasizing close air support and lines of communication. “The task force makes maximum effective use of

97 From this early interpretation, the role of foreign internal defense operations have grown to focus primarily on building allied air capacity as a preventive, rather than interventionist, tool of airpower.
air power by assigning Air Force liaison parties to the lowest organizational level possible and making maximum use of forward air controllers…. Air power can assist by supporting the establishment of efficient communications means with other government controlled sectors. These provide for the movement of goods and services to bolster institutional and infrastructure development… Aerial resupply and close air support reaction forces must help sustain remote area operations.” (Field Manual 100-20, 1990). As Drew notes, advancing technologies in the post-Vietnam era significantly impacted the development for airpower theory in conventional wars, particularly with the publication of Warden’s *The Air Campaign* in 1988, but none of these volumes expanded theorizing and application of the role of airpower in protracted insurgencies, leaving the Air Force to play catch-up with the initiation of the Global War on Terrorism in 2001.

Post-Operation Infinite Reach, military planners began developing contingency plans for special operations raids to capture bin Laden and associates should the opportunities present themselves, meanwhile the sighting of a figure assessed to be bin Laden appearing on several occasions on video feed from an overhead Predator intelligence collection RPA led many members to see adding precision munitions to this platform as the key step to achieving what had been attempted in August 1998- successfully decapitating the leadership of al Qa’eda through an airstrike. Only an air platform with persistent coverage of the area could fuse real-time intelligence and capability to strike, as well as battle damage assessment, overcoming the major obstacles presented by a cruise missile strike.
Kill or Capture – Human Targeting and Airpower in Iraq and Afghanistan

The initial phases of Operation Enduring Freedom (OEF) in Afghanistan served as a critical proving ground for transitioning the airpower role in small wars from support to direct intervention. The early air campaign, consisting of planned strategic bombardment of fixed targets, was largely ineffective and in some cases counterproductive as stories of collateral damage threatened support for the U.S. operation (Conetta, 2002). As the war progressed, however, the U.S., Special Operations teams, and allies in the Northern Alliance learned the art of pairing dynamic re-tasking with precision engagement. Naval assets provided air supremacy over the theater while Air Force B-1s and B-52s coordinated with ground teams, who found, fixed, and tracked targets for engagement. Then-Army Vice Chief of Staff John Keane credited this combination with the fall of the major cities of Afghanistan in very short order (Grant, 2009). Following initial successes, however, the adversaries in both Afghanistan and Iraq changed from a largely state-centric adversarial model to a traditional insurgency model, limiting the historic targeting strategies of airpower and forcing innovation in strategy.

In the early phases of the war in Afghanistan and the beginnings of Phase 4 operations in Iraq, the greatest emphasis of U.S. efforts was re-learning the lost lessons of counterinsurgency. The bulk of public discussion of this strategy focused on the population portion of counterinsurgency, the need to engage the population for purposes of support and legitimizing the government. The flip side of this, the other side of the COIN as it were, is the kinetic engagement of the leadership infrastructure of the insurgency to destroy its strategic reach, limit its recruiting capabilities, and destroy its financial networks. Prior to 2008, much of this work had been done by special operations forces conducting raids which came to be referred to as
‘night raids.’ Post-2008, airpower in the form of the Predator and Reaper RPAs would play a greater role in disrupting and destroying non-state leadership networks.

**Figure 15: Surface and Subsurface Elements of an Insurgency**

![Diagram](image)

The U.S. army field manual defines counterinsurgency as an “organized, protracted politico-military struggle designed to weaken the control and legitimacy of an established government, occupying power, or other political authority while increasing government control (Kilcullen, Counterinsurgency, 2010, p. 1).” Kilcullen further describes the difficulty in fighting counterinsurgency, noting “[u]nlike conventional military forces, which are tied to fixed installations, lines of communications, and key point (cities, vulnerable economic assets or utilities, government offices, and so on) that must be defended, a guerilla force has no permanent installation it needs to defend, and can always run away to fight another day (Kilcullen, Counterinsurgency, 2010, pp. 8-9).” In this passage, which lays the foundation for why population-centric warfare is the key to classic counterinsurgency operations through depleting support for the insurgent organization, Kilcullen also outlines the challenges for the traditional Air Tasking Cycle when dealing with fighting counterinsurgency. Traditional counterinsurgency
manuals model insurgents as an organization of fighters and supporters, modeled per the pyramid in Figure 15 as adopted from Kilcullen’s work. In enemy centric warfare the enemy must be ‘fixed’ to be destroyed, but as they are not reliant on positions or strongpoints it is extremely difficult to fix the enemy. The sole fixed point, in Kilcullen’s model, is the connection to the population, and thus this tie becomes the enemy’s COG. This understanding of counterinsurgency allows us to re-evaluate the structure of the insurgent organization from the perspective of air campaign planning.

**Table 11: Warden's Rings and Insurgent Organizations**

<table>
<thead>
<tr>
<th>State</th>
<th>Insurgency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leadership</strong></td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>Spiritual and Operational leadership</td>
</tr>
<tr>
<td>- Communication</td>
<td>- Communication</td>
</tr>
<tr>
<td>- Security</td>
<td>- Security</td>
</tr>
<tr>
<td><strong>Organic Essentials</strong></td>
<td>Recruiters, financiers, propagandists, bomb makers</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
</tr>
<tr>
<td>(electricity, oil, food) and money</td>
<td></td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Supply lines, mountain passes, internet, cellular phone networks</td>
</tr>
<tr>
<td>Roads, airfields, factories</td>
<td></td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>Farmers, villagers, politically marginalized population</td>
</tr>
<tr>
<td>People</td>
<td></td>
</tr>
<tr>
<td><strong>Fighting mechanism</strong></td>
<td>Insurgent fighter</td>
</tr>
<tr>
<td>Military, police, firemen</td>
<td></td>
</tr>
</tbody>
</table>

Recalling Warden’s Rings as a starting point, Table 11 adds the equivalent pieces of the insurgent network, modeled to parallel the traditional insurgency organization. Through the target development process, insurgent networks can be monitored and analyzed, breaking down the organization at times to the level of the individual fighter. Appendix 3 illustrates a portion of
one such link analysis diagram, looking at an early example of the leadership connections of al Qa’eda. This complex diagram allows the viewer to see some clusters and identify apparent critical nodes, but advanced computer software allows analysts to select individual nodes on the grid and analyze further collection. Through such analysis, reliant on a broad base of human and signals intelligence support and communications reach back to fusion centers in the United States for data sharing, the relative importance of individuals, including those who the casual observer might see as minor figures in the organization, can be identified. While this example is limited to leadership connections as well, similar network analysis diagrams can be made for communications networks, recruiting and training, bomb-making, and fused products combining the key elements of all of the above.

As noted by Kilcullen, the critical distinction between this network and the kinds of networks modeled under the standard targeting cycle is that the potential targets more often than not are individuals rather than fixed entities. This creates the challenge of targets being constantly mobile, and able to change functions. Rather than calculating times and requirements to regenerate facilities and systems to determine battle damage, analysts must factor likely succession of duties, qualifications of those who may take over the position, and amount of training and on-the-job experience required before the network has regained its pre-strike effectiveness. This requires deeper analysis pre- and post-strike of the target, and the decision to strike. What may seem at first like a lower priority target may be more difficult to replace (a supplier of a critical bomb-making material, for instance), leading to a greater battle space effect on the overall organization.
Table 12: Means of Targeting Insurgent Organization

<table>
<thead>
<tr>
<th></th>
<th>Insurgency</th>
<th>Possible Targeting Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Spiritual and Operational leadership</td>
<td>- Special Operations</td>
</tr>
<tr>
<td></td>
<td>- Communication</td>
<td>- Strategic Attack</td>
</tr>
<tr>
<td>Organic Essentials</td>
<td>Recruiters, financiers, propagandists, bomb makers</td>
<td>- Strategic Attack/&quot;Signature strikes&quot;^98</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Supply lines, mountain passes, internet, cellular phone networks</td>
<td>- Information Ops</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Special Operations</td>
</tr>
<tr>
<td>Population</td>
<td>Farmers, villagers, politically marginalized population</td>
<td>- Key leader engagement</td>
</tr>
<tr>
<td>Fighting mechanism</td>
<td>Insurgent fighter</td>
<td>- Rule-of-Law initiatives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Development programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Governance support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Small-unit maneuver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Strategic Attack/&quot;Signature strikes&quot;^98</td>
</tr>
</tbody>
</table>

As with all effects-based targeting models, this does not propose kinetic strikes as the targeting strategy at all levels. Counterinsurgency techniques retain their importance in addressing the population at large with the goal of separating it from the insurgency, some targets may be identified for continued monitoring for additional intelligence exploitation, and some targets may be better isolated through information techniques, through capture, or other methods. In many cases, however, if individuals can be identified as critical to the organization’s structure, kinetic strikes may yield the greatest benefit. This benefit is amplified

^98 “Signature strikes” refers to attacks on low-level fighters, weapons depots, etc., defined as “groups of men who bear certain signatures, or defining characteristics associated with terrorist activity, but whose identities aren’t known (Heller, 2012).” This term is sometimes contrasted with “personality strikes,” where the individual is targeted based on their identity through intelligence cueing.
if targeting methodologies enable strikes that can target the individual with minimal or no collateral damage, such as if they can be targeted when alone in a vehicle, or if the target network is detached from the population base as is often the case with al Qa’eda fighters in Pakistan.

The more the risk of collateral damage can be reduced and the greater the likelihood of striking a key leadership target, the more effective such targeting methodologies can become. Table 12 illustrates how different targeting techniques can be applied under a parallel warfare framework, with strategists weighing the pros and cons of various targeting strategies in different systems while coordinating responses to mitigate the prospects of negative fallout.

The ATO leaves room for this type of targeting through the process of Ad Hoc and Time Sensitive Targeting, where commander’s guidance identifies high priority targets to reallocate tasked assets should the opportunity to strike materialize. Joint Publications further defined targets beyond Time Sensitive Targets (TST) as High Payoff Targets (HPT) and High Value Targets (HVT). The former is a target whose loss to the enemy would contribute to the success of a friendly course of action, while the latter is a target the enemy commander requires for the successful completion of the mission. All of these types of targets can be characterized as

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99 This is one area where distinguishing between al Qa’eda and other allied organizations is critical, as al Qa’eda is largely regarded as foreign fighters who aren’t welcomed in communities, whereas other organizations such as the Taliban and Haqqani Network are more local organizations with deeper tribal ties.

100 In the ATO process, Ad Hoc targeting refers to targets that materialize after the publication of the ATO and take priority over assigned missions thus necessitating a change in the ATO, while Time Sensitive Targets refer to targets that materialize once the ATO day has begun often while planes are in the air. Joint Publication 1-02 defines time sensitive targets as “Those targets requiring immediate response because they pose (or will soon pose) danger to friendly forces or are highly lucrative, fleeting targets of opportunity,” and consist of unplanned and unanticipated immediate targets. Other common terms include emerging, perishable, high payoff, short dwell, or critical-mobile (Commander’s Handbook for Joint Time Sensitive Targeting, 2002). For the purposes of discussion of RPAs, this distinction is minor and thus both mission types, along with HPT and HVTs are simply referenced as Time Sensitive or Dynamic Targeting, with distinctions at times based on the underlying source documents and the changes in terminology based on time and theater (in OIF 1, TST indicated precedence over DTs, which fell above several additional categories that also qualified for mission re-tasking depending upon the priority levels of missions being flown).

101 Were time sensitive targets not prioritized in advanced under a formal planning process, the likelihood of confusion in the operations process reallocating too many aircraft from higher priority planned targets to what seems in the moment to be a higher priority time sensitive target may cause the commander’s plan to break down.
dynamic targets given their changing characteristics over time, with TSTs being differentiated mainly by the urgency of the mission. The process for striking these dynamic targets has been refined by the Air Force as the Find, Fix, Track, Target, Engage, and Assess process, or F2T2EA (Figure 16), which takes place within the Execution Planning/Force Execution phase of the Air Tasking Cycle.

**Figure 16: F2T2EA Process**

Increasingly, dynamic targeting became the norm for air activity in Afghanistan as the initial defeat of the Taliban rather than the exception. Faced with the withdrawal from fixed location to the mountains of Pakistan and the periphery of Afghanistan, the targeting process moved steadily toward opportunistic strikes on dynamic targeting, rather than traditional planned

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102 Similar models for dynamic targeting exist in other services with similar acronyms, such as Find-Fix-Finish, Find-Fix-Finish-Exploit-Analyze, etc. (see Faint and Harris 2012 for a discussion of F3EA from the Special Operations community perspective as one example), all for the most part containing the same underlying characteristics but lumping different processes into the same category. As this work deals primarily with the strategic airpower targeting process, the Air Force nomenclature is used.

103 (John M. Fyfe, 2005).
strikes. At the same time, advanced intelligence, surveillance, and reconnaissance (ISR) techniques fusing Human Intelligence (HUMINT), Signals Intelligence (SIGINT), Geospatial Intelligence (GEOINT) and other sources would drive the F2T portion of the F2T2EA process as coalition efforts shifted to reconstruction and Taliban/al Qaeda targets went into hiding.

In Iraq, dynamic targeting played a key role from the outset. In the run-up to the war, Gen. Franks identified nine potential centers of gravity (COG) of the Hussein regime. Most fell into the category of traditional fixed targets, from command, control, and communication networks to missile production and delivery facilities, but the lead COG identified was the leadership itself, consisting of Saddam Hussein and sons Uday and Qusay (Woodward, Plan of Attack, 2004, p. 56). Planners on the Air Staff identified three target sets which qualified as TSTs in the first stage of the conflict, owing to the nature of pursuit of targets like the Hussein family as well as the pre-war concern over the prospect of weapons of mass destruction (WMDs) being used in the conflict: Leadership, WMDs, and terrorists. Over the course of 16 months of planning, General Franks narrowed the scope of the initial air campaign in Iraq from a five day campaign to nine hours of ‘shock and awe,’ set to begin on the night of 21 March 2003. 24 hours prior to that, intelligence sources reported actionable intelligence on Saddam Hussein, Uday, and Qusay at Dora Farm. This triggered the first overt action of the war, a TST by Tomahawk cruise missiles and two F-117 bombers in the early morning of 20 March (Woodward, Plan of Attack, 2004, pp. 384-394). Although by the next day it was clear Saddam and his sons had survived the strike, TSTs had already altered the course of the conflict.  

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104 Special Operations forces had been inserted into Iraq prior to this strike and Polish forces had taken an oil rig at sea in advance of this strike.

105 In addition to this raid, early examples of critical TSTs include the F-16C attack on the home of General Ali al-Majid (Chemical Ali), and the B-1 attack on the meeting of Saddam Hussein and sons on 7 April (John M. Fyfe, 2005, p. 22).
At the same time the Air Force was adopting F2T2EA as the standard methodology for executing the air war against high value targets, special operations forces were expanding the same effort for covert operations labeled “Find, Fix, Finish, Exploit, Analyze.” Led by General Stanley McCrystal and Major General Mike Flynn, the goal was “to combine analysts who found the enemy (through ISR); drone operators who fixed the target, combat teams who finished the target by capturing or killing him; specialists who exploited the intelligence the raid yielded…by doing this, we speed up the cycle for a counterterrorism operation, gleaming valuable insights in hours, not days (Scahill, 2013, p. 145).” In the run-up to the conflict, special operations forces were inserted into Iraq to track SCUD missile locations and identify potential sites of weapons of mass destruction, develop targets for coalition operations, and hunt down HVTs such as Saddam Hussein. Given the character of counterterrorism and the desired effects of influencing key actors with minimal impact on civilians, the direct-action methods of air forces and special operations closely mirrored one another and likely read one-another’s playbook throughout this period.

The Emergence of the RPA as a central tool

The evolution of dynamic targeting in the U.S. campaigns in Afghanistan and Iraq showed the technological innovations of the targeting revolution were closing the gap in timeliness and accuracy of intelligence required to make airpower a formidable weapon in counterinsurgency campaigns. Successful airstrikes reliant on human intelligence and reachback analysis enabled strikes against numerous key leaders which in turn impacted the capabilities of

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106 Although precision guided munitions, aircraft, and the teams that led the mission in the “finish” phase tended to receive the most attention as the war progressed, Scahill notes that behind the scenes, a massive intelligence infrastructure was growing to facilitate the real-time processing, exploiting, and disseminating of intelligence to enable precision strike. As the use of force became more surgical and smaller, the information function grew larger. This has colloquially in recent years come to be known as “big data,” an increasingly critical component of the targeting revolution significantly impacting organizational structures.
adversaries. However, airpower remained transient in nature and thus successful operations either required proximity to airfields with aircraft on standby, or the reliance on the re-tasking process to place aircraft in the air and have them tasked to targets as they emerged. Airpower remained reactive to ground forces shaping the mission. The strategic RPA, as a persistent air asset equipped with imagery, signals intelligence sensors, and data processors linked to a global network of intelligence sharing would shift the balance in requirements, emphasizing the importance of control of the air vice control of the ground in kinetic engagement of insurgent forces.

In the first phase of major combat operations in Iraq, significant progress was made in the TST/DT portion of air tasking. Secretary Rumsfeld, in the aftermath of the first phase of operations, credited speed, jointness, intelligence, and precision as the key enablers of a transition in America’s posture from “overwhelming force” to “unmatched power.” The evolution of the Air Operations Center to include an expanded Time Sensitive Targeting Cell as well as the expansion of ISR platforms from JSTARS and Rivet Joint to RPAs such as the Predator and Global Hawk enabled the fusion of information with data from ground operators, allies, and other intelligence sources to enable rapid reaction and precision engagement. Fyfe noted specifically the benefits to operators of persistent coverage of Baghdad by the Global Hawk, enabling a dramatic increase of targeting surface-to-air missile batteries. But, as the insurgency ramped up in Iraq and the Taliban re-emerged as a threat to stability in Afghanistan, U.S. airpower was presented with an array of new challenges. The nature of the enemy, combined with the costs of persistent theater-wide air support for intelligence and engagement challenged the traditional models of the air campaign. With few fixed target resembling a
traditional nation-state adversary, attacking insurgent organizations became dominated by Dynamic and Time Sensitive Targeting of high value targets.

Attack RPAs have been utilized for two forms of strike operations, ‘personality’ and ‘signature’ strikes. A personality strike is the older and more widely accepted (though certainly far from universally accepted) means of targeting with RPAs. It involves targeting a known person, usually through an extensive vetting process. A signature strike, on the other hand, involves identifying ‘signatures’ of military activity when the personalities being struck may be unknown. These signatures include the age of individuals, activities that resemble military training, intelligence connections of one location to a known militant group, presence of materials such as those used to make bombs, etc.

Personality strikes began under President Bush and have continued under President Obama. Initially limited to senior al Qa’eda officials such as bin Laden and his immediate deputies, the program has since expanded to a number of lower level operatives who have been assessed to play key roles in facilitating operations, making them potential centers of gravity as explained in the previous section. Per reporting from various sources, the CIA was initially reluctant to expand the list as the military was in favor of expanding ops, but the ongoing debate and expanded operations have since led the two organizations to reverse their previous positions (Entous, Gorman, & Barnes, 2011).

As documented by Gregory McNair, the ‘kill list’ for personality strikes is the result of a multi-step process, which involves identification, vetting, validation, and voting before a name is added to the list. Identification is performed by intelligence agencies through the fusion of a number of intelligence sources which results in a ‘target folder’, an electronic or hard folder
containing the relevant data on the potential target which is regularly updated as new intelligence becomes available and new collection requirements are identified.

Vetting occurs when senior leaders in the intelligence agencies and military begin the process of recommending targets for inclusion on the list, which at minimum includes the significance of the target, collateral damage estimates, impact on overall strategy, environmental concerns, legal considerations, and intelligence gain/loss impact for the strike (McNeal G., 2013). Validation follows vetting, which again examines the impact on overall strategy with respect to national level objectives beyond whether or not the strike will simply succeed. Increased emphasis is placed on compliance with the AUMF and other factors of the Law of Armed Conflict at this stage.

The final process is a vote of the leadership, which in the Obama Administration has generally occurred during Tuesday meetings which Dan Klaidman, Jo Becker and Scott Shane have reported that this was colloquially referred to as Terror Tuesdays (Ibid.). For these meetings, the target folder is condensed to a single slide referred to as a ‘baseball card,’ which summarizes the target, their significance, intelligence sources, and other relevant data. Figure 17 shows a mock-up of such a ‘baseball card.’ Unanimity is not required to add a name to the list, but the President ultimately maintains the final say.

More controversial than personality strikes have been the practice of signature strikes. Rather than targeting identified leadership nodes, these strikes appear more like as close an approximation to ‘counter-force’ targeting as can be accomplished against a covert organization. Controversy over the program, from allegations that signature strikes are responsible for higher numbers of civilian casualties to poor metrics for identifying ‘signatures’

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107 Counter-force is defined here loosely as operations aimed at military infrastructure or fielded military forces, in contrast to counter-value which is aimed at the general population and leadership targeting.
have led to calls for legal prohibition of strikes and debate within the Administration of narrowing the scope of such strikes.\footnote{In 2013, Rep. Jan Schakowsky (D-III) pressed for a bill to ban signature strikes which failed in committee 5-15 (Gerstein, 2013). On the internal debate, the \textit{Wall Street Journal} recounted that “disputes over drones became so protracted that the White House launched a review over the summer, in which Mr. Obama intervened. The review ultimately affirmed support for the underlying CIA program. But a senior official said: ‘The bar has been raised. Inside CIA, there is a recognition you need to be damn sure it’s worth it’ (Entous, Gorman, & Barnes, 2011).”}

**Figure 17: Sample "Baseball Card"**\footnote{Example card originally appeared in Gregory McNeal’s \textit{Lawfare} blog (McNeal G., 2013).}

Although President Obama’s 2013 speech to the National Defense University suggested an end to signature strikes on the horizon, one official was later quoted in the media saying that strikes would continue, with the pace of operations in Afghanistan dictating the use of signature strikes. As one New York Times article on the speech recounted, “[e]ven as he (President Obama) set new standards, a debate broke out about what they actually meant and what would actually change. For now, officials said, ‘signature strikes’ targeting groups of unidentified
armed men presumed to be extremists will continue in the Pakistani tribal areas (Rosenthal, 2013).”

**The Modern Air Warfare System**

Given the history of U.S. air operations and the lessons learned in World War II, the Cold War, Vietnam, the Balkans, and multiple Middle East-Central Asian conflicts, I see the Nuclear Revolution and the targeting revolution combining to define a combined model for the effective use of strategic airpower. This system, depicted in Table 13, is based on the elements of national power derived from Clausewitz’s ‘remarkable trinity.’ The Nuclear Revolution operates at the highest levels of conflict, in essence making direct warfare between major powers nearly obsolete as a tool of war. In all levels of conflict below this, the innovations of the targeting revolution enable precision targeting against military, infrastructure, and leadership targets in order to reshape the calculus for war and the capabilities of fielded forces from the operational level down. This represents the new system for air warfare.

Despite the issues with measuring the effectiveness of airpower quantitatively based on both the limited historic examples and the internal debates over what constituted a proper test of the effectiveness of air power, basic lessons can be derived qualitatively from analysis of the cases at hand. Airpower has historically been unable to effectively target non-fixed targets (generally human targeting) outside of a close-air-support role due to the transient nature of aircraft and the complex problem of actionable intelligence. This has made leadership targeting ineffective in previous conflicts, but there are strong indications that successful ‘decapitation strikes’ even in previous conflicts could be ineffective depending on how closely the personality of the leader was tied to the conflict.
Pape’s work on conventional bombing, while it predates many of the technological advances of the targeting revolution and by focusing on force employment vice deterrence, makes a compelling case for the use of coercive bombing against military forces in conventional
limited wars. This strategy, which he terms *Denial*, focuses on attacking an enemy’s military strategy, rather than its civilian population. This makes intuitive sense almost by definition, the goal of limited war is constrained military action to achieve an objective without expanding the war above the nuclear threshold. Attacking or threatening to attack civilians or national leadership to coerce an adversary in such a conflict would greatly risk expanding the conflict and be politically unacceptable in any case where the level of military power applied is to be effective. Short of civilian vulnerability being perceived as very high, such a strategy is doomed to fail.

At the same time, Pape’s model is problematic for both total wars and small wars, as well as for coercion against leadership when the country being coerced is not supported by a nuclear power.\textsuperscript{110} By limiting the scope to the actual employment of force or clear threats of the use of force, Pape’s model excludes nuclear coercion by definition as part of coercive airpower, which he noted is different than conventional airpower due to its speed and level of destruction. Towards the higher end of the spectrum, with the highest stakes of national survival at stake, nuclear coercion has largely been successful at preventing the escalation of conflict. Pape lists only four occasions where nuclear coercion has been applicable to a conflict (p. 52), but in fact nuclear coercion played a role in many confrontations that did not escalate to conflict in accordance with Douhet’s theory, and which resulted in less than efficient punishment strategies

\textsuperscript{110} The only place in recent history a pure airpower strategy has been tried and was debatably successful was in Kosovo, where Milosevic ended the campaign shortly after losing Russian support. In Iraq (1991), such a plan was recommended but explicitly rejected for failing to meet the overall commander’s objectives, likely because while it might have been successfully the Iraqi army would still be able to operate autonomously for a period of time threatening Saudi Arabia and further damage to Kuwait before withdrawal.
in limited wars in an effort to keep wars limited.\textsuperscript{111} Coercive airpower in this sense works when it can be credibly threatened, and fails when it must be employed.\textsuperscript{112}

For small wars such as counterinsurgency, Pape’s conclusions about the weaknesses of leadership targeting for the purpose of a ‘decapitation strike’ are less applicable as his model assumes the strategy of a nation-state, which he sees as resilient and broader-based than just the leadership.\textsuperscript{113} Applying the lessons of such a model to a non-state actor is challenging as the essence of a counterinsurgency campaign is competition for leadership between rival factions – one or more insurgent groups, and a government with weakened legitimacy. Destruction of the leadership element vying to claim control of a state or territory from the established government is the ultimate objective of a counterinsurgency. At the same time, attacking civilian targets will be unlikely to achieve objectives in this form of fighting as well, as they would be perceived as too vulnerable lacking a military defense and may in cases be likely to sympathize with the over-matched campaign.

Academic scholars and airpower theorists alike remain divided over the true implications of such strikes. I posit an expanded role for airpower in small wars when intelligence and

\textsuperscript{111} In discussing conventional bombing in World War II and later campaigns, Pape largely ridicules Douhet using Schelling’s logic, but by omitting nuclear coercion from the broader model of coercive airpower, Pape largely ignores Douhet’s central point after conceding it was largely correct, albeit indirectly. Pape’s very words echo those of Douhet, when he noted “[t]he willingness to of individuals to bear costs and risks for national goals loses all meaning when large-scale nuclear war endangers not only national interests or fractions of the population but, for all practical purposes, the existence of the nation itself (Pape, 1996, p. 36).” Even if not directly declared by the Soviets, the threat of nuclear retaliation clearly played a key role in the design and implementation of the Rolling Thunder campaign, making it an example of successful nuclear coercion by the Soviet Union.

\textsuperscript{112} In this sense, coercive bombing works much like economic sanctions. Daniel Drezner noted that “imposition of sanctions represents a deadweight loss of utility for both the sender and the target, in the form of disrupted economic exchange. Therefore, the actors have an incentive to reach an agreement before imposition….To test the selection effects argument, the crucial cases to study are those in which coercion is threatened but not implemented (Drezner, 2003, p. 644).” By only studying cases where bombing was employed, and limiting the scope to conventional bombing, Pape doesn’t look at the broader universe of coercion and the places it is likely to be most effective, and simultaneously omits that in order for it to be credible in those cases, it must be used when threatened even if it is unlikely to succeed in isolation in that single case. For similar reasoning, it must also be noted that Pape argued economic sanctions were ineffective in 1997.

\textsuperscript{113} Pape’s model looks primarily at international conflict likely because of the wide consensus to that time that airpower’s kinetic role in small wars was limited.
technology is able to sufficiently separate insurgents, and in particular the key leaders of insurgency, from the population in which they “swim.” Mark Clodfelter is more skeptical, noting “Against such a savvy opponent, those instances of isolation will be rarities. American air commanders today cannot be expected to forgo the bombing option when insurgents attack US troops or when intelligence pinpoints ‘high-value’ targets. Yet, those commanders—and their political leaders—must have a complete appreciation for the potential costs of such bombing and for whether the potential long-term price is worth the desired short-term gain. In certain cases, the costs may appear justified. For most, though, restraint is probably the prudent course of action (Clodfelter, Forty-Five Years of Frustration: America’s Enduring Dilemma of Fighting Insurgents with Airpower, 2011, p. 86).” Certainly valid advice and a reminder that airpower is unlikely to “win a protracted campaign alone.” However, it is I believe rooted on the fundamental assumptions that counterinsurgency is only won by eliminating the causes of insurgency rather than eliminating the insurgent force. I argue ultimately the latter must be a means to the former, and carefully executed, and properly justified, strikes to degrade the organizational capacity are vital to destroying its fighting effectiveness, which is necessary to restoring/building the legitimacy of the counterinsurgent.

The “causes” of insurgency will be almost universally present; the key issue is a collective action problem in mobilizing people to act against a perceived grievance. An active insurgency can and will readily move between causes – economic disparity, religious ideology, physical threat to civilians, etc., all in the name of the true underlying cause, the power struggle between the insurgent organization and the government. Removal of the organizational hierarchy threatening government legitimacy in the near term is the highest priority, while alleviating causes of future insurgencies long-term must be addressed as able. David Kilcullen
has likened insurgencies to a virus, with the key to defeating it being to treat and immunize the population to prevent its spread (Kilcullen, United States Counterinsurgency: An Australian View). I, in contrast, liken it to a wildfire. It must be isolated and destroyed, with efforts to ‘clear brush’ to remove fuel for future fires being a secondary, but long term vital consideration. Trying to end a wildfire by removing the fuel for fire alone will be theoretically possible, but more likely a drawn-out, resource-intensive, and ultimately futile effort, much as many of our historic classic counterinsurgency cases have proved to be.

The challenges posed by hierarchies were summed up best in Jacob Shapiro’s *The Terrorist’s Dilemma*, noting that the preferences of leaders and agents seldom align which leads to agents acting as they would prefer rather than as the principles would like. Due to information asymmetries between principles (who have access to greater information and build the strategic picture) and agents (who are more tactically proficient but focused on particular aspects of the ongoing battle), senior leaders are better positioned to respond in the political environment and to focus efforts to achieve strategic objectives (Shapiro, 2013, pp. 26-29). Delegation is necessary for purposes of efficiency, centralized control is necessary to achieve strategy. Thus, given the covert nature of forces in small wars rendering proactive counter-force targeting difficult, once an organization develops hierarchies, targeting the hierarchy itself becomes the best strategy for defeating the strategic aims of the organization. To an extent, leadership is replaceable if there is a strong and widely recognized succession plan. Absent such a plan, competing interests within the organization can drive leadership apart; I believe evidence points to this occurring within al Qaeda. Targeting of military forces is possible at times when clear indications of forces exist (signature strikes), but these suffer an even greater difficulty than personality strikes in terms of differentiating civilians and military actors.
Historically, airpower has played a support role due to shortcomings of intelligence and target distinguishability, but the innovations of the targeting revolution have shifted this dynamic, allowing for leadership targeting to disrupt hierarchies and planning processes as well as to demoralize forces. Even when not employing kinetic force with strikes, the presence of RPAs can serve a deterrent value by fixing the adversary in place limiting their movements and their operations. In the past this process was temporary as aircraft would eventually have to leave the area and operations could continue, but the persistent nature of the RPA removes this obstacle to sustained operations. Targeting, however, is imperfect as Chapter 5 will demonstrate, and overuse or misuse renders such campaigns susceptible to the same issues as previous campaigns in terms of their overall utility.

**Summary**

A significant shift in the character of warfare has occurred between the mid-1980s and today, largely consistent with what the Soviet planners foresaw as an impending Revolution in Military Affairs. The prospect of such a revolution has been hotly debated in academic literature for the past two decades, with debates concentrated on whether the technology is truly revolutionary or merely an increased capability within existing systems. I argue that an targeting revolution has taken place and is ongoing, with the integration of the RPA into U.S. doctrine representing a significant milestone in the ongoing revolution sufficient to declare its reality as more than a nascent revolution.

The RPA itself provides a revolutionary capability within the context of small wars, but the focus on the platform, a major military innovation and not revolutionary in isolation, misses the true implications of both the targeting revolution and the RPA. The strategic RPA, as part of
a network system which consists of global communications, advanced intelligence processing for targeting, and persistent airspace control represents the most visible manifestation of the revolution by enabling leadership targeting and effective adversary denial of control from the air, akin to the changes brought about by the fortress revolution. The RPA fills a unique capability requirement for fused ISR and targeting that is applicable to a limited type of warfare, and was designed specifically for that role. Its capabilities of persistence and precision engagements are uniquely suited to counterterrorism operations, one facet of a spectrum of operations which have all been impacted by the doctrinal shifts of the targeting revolution.
In reviewing the literature on RPAs, the overwhelming majority of discussion and writing on the subject today focuses on the development of the technology, the moral and ethical concerns regarding their employment, and the questions of overall effectiveness. Critical to the discussion owing to the characteristics that define RMAs, and particularly to the challenges of RPAs, is the issue of organizational capacity for adoption of the innovation. With discussion of new technologies in war, the organizational aspects are often downplayed or overlooked, but in the case of the targeting revolution the wholesale organizational changes required to wage precision war at a distance represents in many cases the greatest obstacle to acquiring the system. The integration of the strategic RPA to the U.S. Air Force’s inventory has been fraught with challenges. The Army, in integrating tactical RPAs, has faced fewer issues as their operators have largely been incorporated into an existing system limited largely to ISR support from within the combat units. The Navy, meanwhile, is beginning to face similar challenges to the Air Force as long range RPAs play an increasing role in maritime defense and power projection.

The targeting revolution poses many challenges to the Air Force, from challenging its historic pilot-centric approach to warfare, to the way it organizes forces for conflict, to where the Air Force fits doctrinally within the joint structure. In this regard, the RPA innovation exemplifies the challenges posed to the Air Force, especially with regard to its force structure, vision, and competencies. However, while the attack RPA represents one of the most visible means by which the targeting revolution threatens to upend traditional power structures within the U.S. Air Force, it is but one component of broader changes in the conduct of war. The advent of the cyberspace domain, the increased reliance on ISR to enable precision strike, and
the importance of space power in both of those ventures suggests that the current organizational priorities of the U.S. Air Force may be ill-equipped for the implications of the targeting revolution.

The targeting revolution, with RPAs as the most visible piece today, poses both short term and long term challenges for military organizations. In the short term, military organizations will see a shift from the conventional paradigm of warfighting – large fielded forces employing significant firepower to achieve military objectives, to a system dominated by the collection, control, and exploitation of information. Warfare before the targeting revolution was dominated by working within the fog and friction of warfare relying on a combination of strength and maneuver to defeat an adversary, post-revolution warfare is likely to be dominated by the ability to reduce the fog and friction of warfare\textsuperscript{114} to achieve decisive engagement with minimal force. This, in turn, will lead to the long term organizational challenge presented by the targeting revolution, changes in the perception of the profession of arms. For centuries, the profession of arms has been defined by risk, sacrifice, and valor owing largely to the means by which war was fought and objectives achieved in battle.

This chapter examines those challenges, from the short-term challenges of fielding a large force of RPAs with crews trained and capable of fighting war at a distance, to broader philosophical questions posed to the Air Force as an organization by the RPA innovation. As the targeting revolution has been incremental, with the RPA innovation in many ways serving as an inflection point in the debate, many of the challenges that the revolution poses have been witnessed in the system long before the advent of the RPA. Some date to the introduction of

\textsuperscript{114} This is not intended to suggest that fog and friction will be eliminated by the targeting revolution. In fact, the targeting revolution expands the battlespace to new domains and with it new forms of fog and friction as one innovation leads to counter-innovation. The fight for information domination will lead to costly forms of collection, data protection, and complex analysis that make warfare costly in economic and organizational terms, but reliant more on information than force.
major air campaigns in World War II, some were highly pronounced in Vietnam but then disappeared from public consciousness as the U.S. went nearly two decades without fighting another major theater war, and some have been a source of inter-service tension for decades but only now have risen to the level of a serious concern.

As the Air Force has moved from bomber-pilot-centric leadership toward fighter-pilot-centric leadership, and as the challenges of the U.S. military as a joint force have fostered a ‘warrior’ culture within all of the Armed Forces, those challenges have only been exacerbated at the very time when the technology and doctrine of fighting far wars have re-emerged as a critical tool in current military operations. As the Air Force today embraces a ‘warrior ethos’ amid renewed questions of why the Air Force should remain a separate service, it could ironically learn from a return to the works of Mitchell and Douhet emphasizing what made airpower fundamentally different from traditional ground warriors and justified it as a separate service. Embracing the RPA and the implications of warfighting at a distance may be necessary to save the Air Force from itself.

“Reachback” and Infrastructure

The most immediate challenge has been reacting to the demands of warfighters in multiple theaters of war combined with an explosion in global communications infrastructure allowing for the Air Force to better manage ISR and targeting support from the Continental U.S. (CONUS). Throughout the wars in Iraq and Afghanistan, U.S. analysts watched in real time as battles unfolded, routes were cleared in advance of a convoy movement, and villages were screened in advance of key leader engagements. Unlike in previous conflicts, where those

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115 Robert Farley has been most outspoken on the subject but is not alone.
viewing the real-time feed were in headquarters at forward operating locations, these analysts were positioned stateside, in various military organizations and civilian agencies, providing real-time analysis by cross-checking other intelligence sources at their disposal. This capability is referred to by the military and government agencies as “reachback” and it has radically altered the deployed footprint and organizational structure of ISR, and in the process redefined the operational environment.

In Iraq, reachback provided tactical operators the ability to access in real-time national experts on insurgent tactics, techniques, and procedures (TTPs) that their units were encountering in the field. This represented a significant improvement over prior conflicts where units had to rely on products locally produced or obtained through a higher headquarters through requests. One key example of the importance of reachback in Iraq was the IED fight and the creation of the Joint IED Defeat Organization, or JIEDDO, and the Counter-IED Operations Integration Center. These organizations combined to allow for the regular sharing of data between national agencies and fielded units through secure connections, facilitating regular reporting on IED TTPs as well as responses to requests for information from those fielded forces (Radzikowski, 2008).

U.S. Air Force RPA data, as with most ISR data collected from Air Force platforms, is processed, exploited, and disseminated (PED) using the Distributed Common Ground System (DCGS). This system is composed of 45 geographically separated, networked sites. Originally built as independent regionally-focused PED sites affiliated with numbered air forces, global network communications today enables a single weapons system with global reach. The key nodes to the DCGS are the Distributed Ground Systems (DGS), with major nodes at Langley AFB, Virginia (DGS-1); Beale AFB, California (DGS-2); Osan Air Base, Korea (DGS-3);  

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116 See Air Force Fact Sheet: Air Force Distributed Common Ground Station
Ramstein Air Base, Germany (DGS-4); and Hickam AFB, Hawaii (DGS-5). Prior to 2003, each DGS was built to forward deploy in support of operations, with DGS-1 deploying to Saudi Arabia in 1996. The activation of the 480th Intelligence Wing in 2003 brought many of the DGSs under the same command for the first time, which combined with technological advances in communication infrastructure in the late 1990s enabled the shift to the current DCGS model. In the first year of Operation Iraqi Freedom, intelligence analysts stationed in U.S. DGSs produced over 30,000 intelligence reports for theater operators and identified over 1,000 targets (Hebert, 2004).

In the first phase of Operation Iraqi Freedom the DCGS was credited with decreasing the “kill chain,” or time associated with identifying, processing, and striking a target. One example provided by Herbert showed that from taking an initial image of a surface-to-air missile site taken by a Global Hawk RPA to a B-2 missile strike took 57 minutes. In a separate case, a Predator identified two tanks behind a tree line. Global connectivity allowed the information to be passed to the Combined Air Operations Center, to re-task an aircraft which was orbiting in the area, reducing the kill chain to 17 minutes. The promise of arming Predator, as noted earlier, was to further reduce the kill chain by enabling the identifying aircraft to also launch munitions, eliminating delays in transit times for aircraft that are either not on station or that must be launched specifically for the mission (or, in the case of a cruise missile launch, potentially longer delays).

The convenience of precision strike and a weapons system capable of shortening the kill chain in such a dramatic fashion comes with a number of organizational costs. The first being the manpower required to fly, oversee, maintain, and analyze the data collected by each RPA. Figure 18 illustrates the manning for one Predator or Reaper Combat Air Patrol (CAP).
standard Predator/Reaper operation requires four aircraft and 61 personnel forward deployed, and 149 personnel operating from the Continental United States. These 210 personnel include 14 pilots, 14 sensor operators, 56 intelligence analysts, and an unspecified number of legal analysts to maintain four sorties for 24 hours (18 for Reaper). The scale of manpower involved and the global telecommunications infrastructure required to support the system dramatically increases the overall cost of achieving the battlespace effect of precision strike beyond a simple airframe-to-airframe calculation of a manned bomber mission.

**Figure 18: Predator/Reaper Manning**

The manpower requirement for nominally ‘unmanned’ aircraft stems from a historic dilemma in intelligence that most ‘intelligence failures’ stem not from a failure to collect, but a

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\[117\] Slide provided in correspondence with Lt Gen David Deptula
The strategic attack RPA, as previously noted, requires multi-source intelligence inputs to effectively analyze adversary systems, from command and control to economic and logistics, assess the critical nodes to strike, find and fix on those nodes, strike, and evaluate the results of those strikes. This type of warfare requires significant collection capability both internal and external to the system, with trained professional analysts overseeing the process of data analysis (even when aided by computer automation for parts of the analysis).

The reachback infrastructure impacts the conduct of the war in a number of ways beyond the straightforward costs of the technology and manpower involved. A weapons system with this long a manpower and infrastructure tail also results in a heavy bureaucratic process for target selection, analysis, and weapons release. The pilot is not alone in making decisions, and in many cases plays one of the most minor roles in the targeting process itself. While most of the focus on RPAs is on pilots and sensor operators during actual strike operations, the RPAs are, in addition, regularly collecting hours of data to be refined into intelligence to support future operations. In early 2012, Air Force Secretary Michael Donley acknowledged that the Air Force RPA program was collecting too much data and it would take “years” for analysts to catch up with the raw intelligence collected via RPA missions globally. “It’s not just the pilots and manning the aircraft. It’s also the [data] processing exploitation behind that…. We’re collecting data at rates well above what we had in the past (Ackerman, 2012 Was the Year of the Drone in Afghanistan, 2012).”

The manpower structure to support RPA operations represents an inversion of the traditional expeditionary nature of military operations. As was the case with the DGS and with

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118 Both the September 11th Attacks and the attack on Pearl Harbor are common examples readily cited where the information was available in advance of the attack to potentially thwart it, but a failure to bring together the necessary information led to the ultimate intelligence failure. See Odom’s *fixing Intelligence* for a discussion of the role of analysis versus collection (Odom, 2003).
ground intelligence prior to the communications innovations associated with the targeting revolution, wars fought prior to 2003 required an extensive forward presence and regional expertise. Air Force ISR support would require the movement of multiple units to the Area of Operations to provide mission support. Today, only a basic force is required to forward deploy to maintain the aircraft in the theater of operations and to execute takeoff and landing, while the bulk of the operational element resides within the continental United States. While this phenomenon has been observed in a variety of career fields in current wars, the RPA provides unique challenges in that its crews are conducting operational missions in a reachback environment, rather than simply operations support.

Beyond the economic costs, the impacts of over 100 personnel regularly involved in combat missions from the U.S. has posed a number of personnel problems. A major unforeseen cost has been the incidents of Post-Traumatic Stress Disorder (PTSD) among RPA operators. In early 2013, the Department of Defense released a study conducted by the Armed Forces Health Surveillance Center indicating that RPA pilots suffer from the same levels of PTSD as their counterparts flying missions in combat zones overseas. Possible causes put forth by the report include:

- Witnessing traumatic experiences, such as those associated with PTSD in traditional combat (possibly increased over piloted aircraft due to screen resolution and loiter for bomb damage assessment)

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119 Satellite datalink results in a two second delay, hence near-real-time footage vice real-time footage, while line-of-sight control has a 0.2 second delay (Neaderhisel, 2010). For this reason takeoff and landing is performed line-of-sight to reduce the risk of an accident due to the delay.

120 RAND has released studies documenting the impacts of reachback on other career fields, with one example being contracting (Ausink, Werber, & Chenoweth, 2011).
- Lack of deployment rhythm and of combat compartmentalization (clear demarcation between combat and personal/family life)
- Fatigue and sleep disturbances secondary to shift work
- Austere geographic locations of military installations supporting RPA missions
- Social isolation during work which could diminish unit cohesion and thereby increase susceptibility to PTSD
- Sedentary behavior with prolonged screen time, implicated as psychological challenges in the adult video gaming community (Otto & Webber, 2013)

Interestingly, while RPA pilots had a slightly higher incidence of PTSD and other mental ailments, the incidence was lower than for other Air Force career fields. This could be attributed to the mental screening processes required for Air Force pilots and may indicate the need to maintain the elevated screening process for RPA pilots as applies to traditional pilot career fields.

The experience of RPA operators, and the incidents of PTSD and other elements of fatigue in the community do, regardless of the causes for the difference between traditional pilots and RPA pilots, illustrate that a common perception of the RPA pilot – the video-game warrior detached from the reality of war – is a myth. As Kenneth Anderson relayed, and I noted as well in my conversations with numerous RPA operators, the persistent nature of RPAs do potentially bring RPA pilots closer to their targets than a bomber pilot flying at 35,000 feet (which has been a similar critique against manned bombers since the dawn of the age of aviation) or a naval missile operator a thousand miles away at sea. “[I]t is not as if one sees the terrible things the
target is engaged in doing that made him a target in the first place; instead, it feels, after a few weeks of observation, as though you are killing your neighbor (Anderson, 2013).

The idea of the RPA pilot being detached from the combat environment is not a new accusation; in fact it has been tied for decades to air warfare in general, even when pilots flew missions in contested environments. In describing the bombing campaigns of World War II, particularly with the introduction of the atomic bomb, Mark Seldon noted “[a]ir power distanced executioners from victims, transforming the visual and tactile experience of killing. The bombardier never looks squarely into the eyes of the victim, nor does the act of destruction have the physical immediacy for the perpetrator of decapitation by sword or even shooting with a machine gun (Selden, 2007).” American pilots were accused of being ‘air pirates’ and terrorists by the North Vietnamese during the Vietnam War. The perception of detachment from combat is a common critique of air warfare, and to a large extent both Giulio Douhet and Billy Mitchell saw this as a virtue, rather than a vice, of the aircraft as a weapon for its ability to wage total war against an enemy that would be incapable of defending itself.

In one sense, the RPA thus represents a continuation of this trend toward offensive air power at a distance with decreased vulnerability, but in another sense the type of targeting that RPAs enable – human targeting given persistent coverage – changes this dynamic. Multiple RPA pilots I spoke with relayed the stresses of the RPA mission due to the high-resolution targeting capabilities the RPA provides combined with the requirements for long-term observation both for target identification and for the development of intelligence with respect to patterns-of-life. By targeting individuals, rather than buildings or abstraction concepts of

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121 This image even permeated U.S. popular culture as in one example a significant portion of a 1976 episode of the T.V. series M*A*S*H was devoted to the story of a U.S. bomber pilot who, having been shot down, was forced for the first time to confront the horrors of a war that he had previously no real connection with given his basing in Japan (Alda, 1976).
‘military targets,’ the RPA pilot can in some ways be more emotionally tied to their target, even if they are at a greater physical distance. This represents a significant obstacle to the training and retention of RPA pilots and over the long-term has implications for the perceptions of airmen within the broader military establishment.

Procurement

The challenges of integration of the RPA into existing operations will manifest itself in the area of procurement, which already appears to be a key issue with the acquisition of the long-range bomber. The National Defense Authorization Act of 2001 set a target for the Air Force of having one third of its “operational deep strike” assets being unmanned by 2010 (Murch, 2008). As August of 2010, the Air Force lists 104 operational MQ-9 Reapers and 164 MQ-1 Predators which would meet this target were it compared solely to the bomber fleet of 85 B-52s, 66 B-1s, and 20 B-2s.\(^\text{122}\) However, given the fighter-bomber roles associated with the F-16, F-15E, and F-22, this would be an inaccurate comparison suggesting the Air Force fell well short of that goal.

The procurement of an unmanned long-range bomber has been stymied primarily by the threat of public opposition and cost. The report to the Congressional Research Service in 2008 noted that a dual-capable manned or unmanned bomber might alleviate public resistance to an unmanned nuclear-capable bomber in the name of “keeping a man-in-the-loop,” but the costs of creating both a manned and unmanned variant will likely be too great in the current economic environment. Given the options available and without a significant community within the Air

\(^{122}\) All information derived from the relevant factsheets assessable online through the U.S. Air Force website.
Force to advocate for a remotely piloted long-range bomber, the Air Force is likely to focus on manned long range strike for the foreseeable future.

**RPA Operators**

RPAs, reachback, and other aspects of the targeting revolution have already significantly impacted military operations as is evident by the organizational and logistics structural requirements necessary to facilitate remote operations. Beyond these immediate impacts, the targeting revolution is already demonstrating the beginnings of long-term organizational challenges for the armed forces at large, from the underlying identity of what it means to be an airman in the context of modern warfare, to promotion and recognition challenges facing these new systems of warfare.

When Tom Ehrhardt wrote his dissertation on the subject of RPAs in 2000, many of these obstacles to RPA integration had not yet manifested themselves due to the limited applications of RPAs at the time. Up to 2000, the limitation for growth of RPAs was not cultural, but as he put it then ‘the low levels of contextual stimuli’ as RPAs were not optimal weapons systems given the threats up to that point, and ‘with weak and conflicting incentives came incrementalism (Ehrhard T. P., 2000, p. 571).’ The rapid growth in RPA usage given the changing mission of airpower, and its implications for the recruitment, organization, training, and advancement of future Air Force officers have shifted this dynamic to the point where today service culture does matter.

Since the 2001 terrorist attacks, each of the services in the U.S. have worked to develop their own version of the ‘warrior ethos,’ reinforcing the values of courage, loyalty, and skills that distinguishes a warrior class. This has created a number of issues when paired with the realities
of the targeting revolution and how it has been applied, through RPAs and other tools, to the war on terrorism. This has in many ways been an issue for air forces from the inception of the aircraft as a weapon of war, but has become more pronounced as airspace has become more secure and those fighting the air campaign have increasingly become separated from the battlefield. A warrior culture, prizing courage based on the tactical experiences of warfare, represents a fundamentally different value set from that needed to wage strategic air warfare.

**Career Progression**

The development of a strong career progression system is vital to the normalization of new technologies and practices within an organization because, as Rosen noted, innovation “only as fast as the rate at which young officers rise to the top (Rosen, 1991).” Existing Air Force organizational structure poses a series of challenges to the normalization of RPA culture within the Air Force, as increased visibility of a “glass ceiling” for RPA pilots has grown in the past year. Part of this is due to existing perceptions of RPAs within the Air Force flying community and the process of rapid expansion of the RPA community, and part of it is rooted in the requirements the Air force places on command position eligibility. The first issue to rise to the attention of both the public and lawmakers was the reported lower promotion rate of RPA pilots compared to traditional Air Force pilots, which emerged in 2012.

One issue with accessing performance and promotion rates is what is sometimes referred to as the ‘three generations of RPA pilots.’ The first generation, comprising the RPA force prior to 2007, represented a small group of pilots who had volunteered for the emerging mission

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123 The term was used in conversation with RPA pilot Dave Blair and I have heard in used on a number of occasions to describe the buildup and transition from the early, small RPA force to the current system with its own Air Force Specialty Code and training path.
and often served with Air Force Special Operations Command. The second generation, who entered the RPA force from 2007-2009, consisted of active bomber and fighter pilots who in many cases were forced to transition to RPAs. The third generation, from 2010 onwards, consisted of those pilots specially trained to fly RPAs from the onset under the Air Force’s new RPA training program and earning the ‘18X RPA Pilot’ designator or of those pilots who had volunteered to transfer to RPAs under the 11U designator. The Air Force has set a goal of 50% of RPA pilots being from the 18X career field by 2016 and 90% by 2022 (Schogol, More unmanned aircraft pilots being promoted, 2013).

Problems with the 2nd generation of RPA pilots color many discussions of the promotion process as relates to RPA pilots. Researching the status of the Air Force’s acceptance of the Predator RPA in 2006, Houston Cantwell interviewed multiple officials that noted issues with the caliber of the RPA force in that timeframe given the selection process. One squadron commander noted that the process of non-volunteering so many personnel to RPAs led to a number of newly reclassified RPA pilots described as “sick, lame, or lazy” in comparison to contemporary pilots in other airframes, while an Air Force personnel officer noted that at the time “[o]fficers assigned to the Predator program are usually non-volunteered to Predator assignments and selected from the least competitive pilots through the Air Force Personnel System (Cantwell, 2006, pp. 24-25).

The observation at the time may well have foreshadowed the problem with RPA promotions that would be noted years later. In late 2012, Senators Carl Levin and Harry Reid demanded an investigation of promotion rates for RPA pilots, stating during the previous five years, “the promotion percentages for RPA personnel to become majors has dropped from 96 percent to 78 percent, compared with a range of 91 percent to 96 percent for airmen in other
career fields (Lawmakers ask review of unmanned promotion rate, 2012).” Lawrence Spinetta, observing the organizational issues faced by RPA pilots, noted “[c]ertainly, low promotion rates are not surprising in light of the Air Force’s initial decision to staff its RPA force in an ad hoc fashion with medically disqualified pilots and nonvolunteers, many of whom were not necessarily stellar performers from other aviation communities (Spinetta, 2013).” Colonel Bradley Hoagland, himself a former commander and currently a Federal Executive Fellow, showed this was his experience during the timeframe as well. “Since very few, if any, traditional pilots actually volunteered for the RPA community, most commanders generally sent Captains that were in the bottom half of the pool of eligible pilots. Some of these pilots had multiple downgrades or failures on their annual checkrides; some were unable to upgrade from copilot to aircraft commander due to below average airmanship; others did not have had the “right” attitude or personality that fit into the weapon system climate; and others had discipline or quality of force issues. It should not be surprising that a few years later the promotion rates to Major were below that of the rest of the AF, especially given the fact that these aviators weren’t high potential officers to begin with as a result of flying or discipline discrepancies (Hoagland, 2013, p. 12).

More recently, the Air Force has released data suggesting this was in fact a temporary issue from which the Air Force is recovering. A report released in November of 2013 showed that promotion rates for RPA pilots have climbed, and in some cases had surpassed that of mobility pilots. For 2012, 89 percent of eligible RPA pilots were promoted to major, versus 87.4 percent of mobility pilots, 90.7 percent of bomber pilots and 94.1 percent of fighter pilots. The 2013 Lieutenant Colonel’s promotion board showed 72.2 percent of eligible RPA pilots for

124 This observation is not intended to categorize all who transferred from fighter and bomber airframes to RPAs in the timeframe, but notes the impact of the non-volunteer process and impacts of selection criteria on the overall composition of the RPA force which was most pronounced in this era.
promotion, compared to 70.8 percent of mobility pilots, 86.5 percent of bomber pilots, and 85.1 percent of fighter pilots (Schogol, More unmanned aircraft pilots being promoted, 2013). Whether this represents a long-term trend or a one-time issue is difficult to say, as the Air Force offered additional Professional Military Education billets (a key factor in promotions) last year in response to the outcry over RPA promotion rates, a benefit which will not continue in future years, which may artificially inflate the numbers in the short-term.\textsuperscript{125} By late 2008, the Air Force recognized the issues with the selection process with RPAs and developed a new process for grooming RPA pilots. In October of that year, the Air Force Chief of Staff announced the pending creation of a new training course designed specifically for RPA pilots. Two years later in 2010, the Air Force announced a new officer career field, 18X, specifically for RPA pilots.\textsuperscript{126}

The main focus of Spinetta’s argument is a bottleneck of RPA pilots at the rank of Colonel, owing to a lack of opportunities for promotion due to few opportunities for Wing Command (generally a necessary stepping stone for promotion to Brigadier General)\textsuperscript{127} and a fighter-pilot dominated Air Force leadership which prioritized manned airframes. While he focuses his argument on RPAs seeking to break into the fighter-dominated Air Force leadership

\textsuperscript{125} While the lower promotion rate for the period evaluated may well be the selection criteria for RPA pilots at the time, there are other potential issues for promotion rates with future RPA pilots as the career field matures. Additional factors include the limited bases for RPA pilots, with most being stationed at either Creech AFB (Nevada) or Cannon AFB (New Mexico) for conducting RPA operations. Limited basing leads to fewer opportunities for Permanent Change of Station (PCS), which in turn leads to fewer opportunities for career-broadening assignments and intermediate/senior professional military education, both of which are generally prerequisites for promotion to senior rank in the current Air Force structure. If this also plays a role in limiting promotion potential, the implications could be felt more broadly in other communities as advanced technologies may lessen the requirements of some fields to PCS regularly to ensure geographic diversity in an officer’s development. If technology and interconnectedness from reachback means that geography matters less, than so might the need for tours to multiple locations for geographic diversity.

\textsuperscript{126} This career field consists of those who are trained under the new Undergraduate RPA Training program, URT. Those pilots who completed Undergraduate Pilot Training (UPT) and transferred to RPAs would be re-designated as 11U (Spinetta, 2013).

\textsuperscript{127} Under current Air Force policy, RPA pilots without recent experience flying fighter aircraft are ineligible to command even RPA wings, as the criteria for wing command in those wings necessitates 50 hours of flight time in fighter aircraft in the previous seven years (Spinetta, 2013).
culture, the implications for the targeting revolution are broader, extending to the pilot-centric model of leadership that drives Air Force leadership. Other career fields and their status within the Air Force hierarchy dramatically impacted by the targeting revolution include intelligence, space, cyberspace operations, and information operations.

The issue of promotion ceilings and the integration of new technologies into the armed forces is not a new phenomenon. Billy Mitchell noted promotion ceilings for pilots in 1925 as one of the key justifications of an independent Air Force; as such restrictions would be devastating to the development of strategic air power. “The personnel situation is very serious in all the air services….Their position on the promotion list is hopeless. Some of our lieutenants can never rise above the rank of major or even captain. They see no future before them and consequently are not in the state of mind in which officers in so rapidly developing a service should be (Mitchell, 1925, p. xviii).” Within the Air Force today, the situation has been rectified to the benefit of flyers, but in some cases to the detriment of other vital fields.

The Air Force’s pilot-centric culture can largely be traced to Mitchell’s advocacy of an independent Air Force, which in focusing on the differing culture of “air-going people” emphasized the pilot at the center of the culture, an understandable position given the character of air warfare at the time. “One starts as a pilot, learns how to fly the machine, then learns how to handle a greater number of machines as rank and experience increases, and last, to handle whole forces of all branches of aviation, including their supply and upkeep (Mitchell, 1925, pp. 161-162).” This vision, however, suffers from some of the same problems faced by other parts of his work when valuing the expediency of pushing a short-term agenda with little regard to negative effects it could unintentionally create. Mitchell did, as previously noted, see a future of pilotless aircraft capable of bombing cities from a distance, but never envisioned how such systems would
be controlled and who would constitute “air-going people” in such a scenario. His writings on the development of airpower leadership focus exclusively on control of pursuit and strategic bomber aircraft, not on a larger aerospace force for which even he sees the ground being paved.

In contrast to Mitchell’s perspective on pilots as well as any of his contemporaries, Douhet’s writings are distinguishable for his lack of nostalgia or romance surrounding airmen and air warfare. Much like modern airpower writers like Warden and Deptula, Douhet’s writings revolve around the ability to inflict strategic effects on the adversary’s vital centers in the form of a systematic analysis. As Meilinger noted, “he did not compare pilots to modern knights - bold, chivalrous, and dashing - but portrayed aviators as stoic professionals who went about their daily business in an unremarkable way. And this business was indeed a deadly one (Meilinger, Giulio Douhet and the Origins of Airpower Theory, 1997, p. 15).” This may owe itself to Douhet’s career as an artilleryman rather than a pilot.128 Although the target set differs as does the character of precision warfare, the ethos of the stoic professional as opposed to the valiant hero places the modern RPA war directly in line with Douhet’s vision for the implications of command of the air – quiet professionals able to achieve strategic effects at will against an enemy unable to defend itself.

Years before the issue of RPA pilot career progression raised the specter of a ‘glass ceiling for RPA pilots,’ the Air Force Intelligence Community raised a similar concern over a glass ceiling for intelligence officers. In 2005, 23 colonels in the intelligence officer career field retired, many stating the cause was the glass ceiling. The trend de-emphasizing Air Force Intelligence dated to the early 1990s, when then Chief of Staff General McPeak began cutting

128 It is unknown whether Douhet ever received a pilot’s license. As of 1918 he was not on the list of licensed Italian pilots, with Kennett noting “It is more than likely that air power’s most eloquent spokesman never learned how to fly (Kennett, 1982, pp. 54-55).” Critics have at times cited his lack of operational flying experience with his gross exaggerations of the capabilities of aircraft at the time.
targeting and weaponeering positions to meet Congressional demands for reduced budgets. By
2001, General Michael Hayden estimated that the U.S. Air Force’s capability to conduct tactical
air reconnaissance had been reduced to four pods belonging to the Virginia Air National Guard
(Socotra, 2006). Since the mid-1990s, senior intelligence billets were readily being filled by
rated officers, and at that time (and for years prior) no J2\textsuperscript{129} at a joint Major Command had been
filled by a member of the Air Force (Gaudiano, 2005).\textsuperscript{130} As with RPAs today, many Wing
Command billets which could have been filled by intelligence officers were instead filled by
pilots, limiting career progression. In a widely cited article from the time, Glenn Goodman
spelled out the issue. “The facts speak for themselves: The Air Force has selected only one
career intelligence officer for promotion to brigadier general since 2001.\textsuperscript{131} Following the
retirements of two generals with intelligence backgrounds two months ago and another planned
on Nov. 1, only three of the Air Force's 274 or so general officers will have come up through the
ranks in intelligence-related positions.\textsuperscript{132} There has been a steady decline in the number of Air
Force intelligence generals from a high of 14 in the early 1990s….The three top intelligence
posts in the Air Force - each a general's billet - currently are held by ‘rated’ officers, not by
career intelligence officers (Goodman, 2005).” In response, the Air Force made significant
revisions to the intelligence career field, enabling greater advancement for career intelligence
officers. The most significant was the creation of the new position of Deputy Chief of Staff for

\textsuperscript{129} Director of Intelligence in a Joint Command; Ground command would be designated G2 and Air would be A2.
\textsuperscript{130} One exception is General Michale Hayden, who at the time was serving as Deputy Director of National
Intelligence having risen through the National Security Agency.
\textsuperscript{131} That officer being Lt Gen John Koziol, promoted to Brigadier General in 2002 and retiring in 2012 at the rank of
Lieutenant General and Director of the Air Force ISR Agency (Lt Gen John Koziol).
\textsuperscript{132} General Hayden was one of those officers in addition to Lt Gen Koziol. Both served as the Director of the Air
Intelligence Agency (AIA, the predecessor to the Air Force ISR Agency, which transitioned in 2005 while then-Maj
Gen Koziol commanded the agency and was promoted to Lt Gen with the change in status. This illustrates the
narrow path that existed at that time, with Gen Hayden achieving additional promotions after AIA through joint
and special assignments, specifically on the National Security Council, as commander of the National Security
Agency, and Deputy Director of National Intelligence (General Michael Hayden).
Intelligence, which would oversee the intelligence field. Up to this point, the senior intelligence official was a Deputy Director of Operations on the Air Staff.

Since these changes were put into effect, some progress has been made in improving career progression for intelligence officers, while in other areas progress lags. The most important shift has been a marked increase in general officers for the intelligence career field, with 14 intelligence officers holding the rank of brigadier general as of June 2013, and 16 total general officers for the career field (see Table 14). Although the number of career intelligence general officers has risen and the ratio of intelligence general officers to intelligence officers have climbed, the pyramid has yet to produce senior leaders with career intelligence backgrounds.

Table 14: Distribution of USAF General Officer Billets\(^{133}\)

<table>
<thead>
<tr>
<th></th>
<th>Pilot(^134)</th>
<th>Space &amp; Missiles</th>
<th>Intelligence</th>
<th>Comm/ Cyber</th>
<th>Other Ops(^135)</th>
<th>Non-Ops(^136)</th>
<th>Non-LAF(^137)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>8</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Lt Gen</td>
<td>34</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Maj Gen</td>
<td>93</td>
<td>12</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Brig Gen</td>
<td>109</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>41</td>
<td>41</td>
<td>17</td>
</tr>
<tr>
<td>Total officers in field(^138)</td>
<td>12,564</td>
<td>2,912</td>
<td>2,746</td>
<td>2,898</td>
<td>7,005</td>
<td>15,829</td>
<td>12,792</td>
</tr>
<tr>
<td>Generals Career field</td>
<td>1:51</td>
<td>1:88</td>
<td>1:172</td>
<td>1:290</td>
<td>1:292</td>
<td>1:247</td>
<td>1:441</td>
</tr>
</tbody>
</table>

\(^{133}\) Data for numbers of general officers in each field/rank derived from online biographies available on af.mil current as of 30 June 2013 for standardization purposes (Leader Biographies). These numbers include Air Force Reserve Mobilization advisers, which may in cases skew perceptions of promotions as those positions are generally independent of the standard promotion process and generally hold the position longer than standard active duty general officer tours, but remain in this count for consistency with Air Force listings of billets.

\(^{134}\) Includes all 11X, 12U, and 18X career fields

\(^{135}\) Includes all other officer career fields beginning with number ‘1’

\(^{136}\) Includes all Line of the Air Force (LAF) career fields not starting with ‘1’, most often represented by Civil Engineering, Logistics, and Acquisitions officers; total numbers difficult to calculate exactly due to some temporary designations that might otherwise be pilots (Aide de Camp, etc.) and all command billets and students omitted from total.

\(^{137}\) Non-LAF includes Judge Advocate General Corps, Medical Corps, Chaplains

\(^{138}\) Numbers current as of 2011, reported in Airmen Magazine (The Book, 2011), minus sum of generals for field
Since its creation in 2006, the position of Deputy Chief of Staff for Intelligence, Surveillance, and Reconnaissance has been occupied by three individuals: Lt Gen David Deptula (Pilot), Lt Gen Larry James (Space and Missiles), and Lt Gen Robert Otto (Pilot). Ben Iannotta, writing on the selection of Lt Gen Otto, noted that his selection was viewed by at least one intelligence officer he interviewed as a sign that though progress had been made, not enough progress had yet been made to put a career intelligence officer at the top of the Air Force Intelligence pyramid, even as Army Intelligence is run by career intelligence personnel (Iannotta, 2013). Lieutenant General Mary Legere, a career intelligence officer, has held the equivalent position in the Army as Deputy Chief of Staff, G2 since April 2012 (LTG Mary Legere). The Army further has a career intelligence officer as a full general, General Keith Alexander, who serves as the Director of the National Security Agency and the Commander of U.S. Cyber Command (General Keith Alexander). In November of 2005, then-Air Force Chief of Staff Michael Moseley stated part of his motivation for re-organizing Air Force intelligence was that he “would like at the end of the day to be able to build a dozen Mike Haydens” (Gaudiano, 2005).” Eight years later, progress to achieve that end have been achieved but continues at a slow pace. Ionnotta noted that emotions in the intelligence community have been mixed on the process, but bitterness has not been one of those emotions as those appointed to the top

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139 Information from Lt Gen Deptula’s biography (Lieutenant General David Deptula).
140 Information from Lt Gen James’s biography (Lieutenant General Larry James).
141 Information from Lt Gen Otto’s biography (Lieutenant General Robert Otto).
142 The delay in appointing a career intelligence officer to the Deputy Chief of Staff for ISR despite the position being created with that outcome in mind is not unexpected. In order for an officer to rise to that grade, they must first be groomed through the requisite commands and experiences at lower levels. This indicates that even with optimal candidates and a trajectory for the position, a minimum of two to three tours of a non-intelligence careerist was to be expected. This also indicates that the prospects of a future intelligence career officer in this position can be evaluated by examining the prospects currently in the rank of Major General. Currently, there are two active major generals in the U.S. Air Force who are career intelligence officers: 1) Maj Gen Jim Keffer, Assistant Deputy Chief of Staff for ISR; and 2) Maj Gen Robert Haire, Mobilization Assistant to the Deputy Chief of Staff for ISR. An additional major general position, the Director of the Air Force ISR Agency, is held by Maj Gen John Shanahan, also a career pilot. Thus, two of the top three Air Force ISR positions today remain held by rated officers.
intelligence billets have been well qualified and increasingly immersed in intelligence operations for at least one to two tours. The feeling in the community, as noted by one officer in the same article stated, is that it will happen eventually.

While the intelligence field faced possibly the most visible crisis of leadership in the previous decade, it is not alone in facing challenges in advancing its people. The character of the targeting revolution suggests that two other Air Force career fields, Space and Cyberspace Operations, will also see an increasingly important role in future battles. A fourth field, Information Operations, is also likely to play a vital role but it at present is not represented by a unique career field, posing challenges to its effectiveness in future air campaigns.

As noted in Table 14, space and missile officers are at present adequately represented in the general officer tier owing to their history of space operations in the Cold War. However, as Spinetta noted, space itself had to fight its way into acceptance as a key career field during the 1950’s, at a time when the “bomber mafia” led by Gen Curtis LeMay dominated the service (Spinetta, 2013, p. 111). Critically for the missile field was an advocate serving as Chief of Staff who was not aligned with the “bomber mafia” of the era, General Thomas White. In pressing for increased spending on ballistic missile development over the objections of many in the Air Force, White noted it “was not good for the traditional Air Force but it was vital for the nation (Spinetta, 2013, p. 112).” To overcome the pilot-centric nature of Air Force leadership, he instituted a new career field for missleers, and turned back a recommendation list for promotions to brigadier general when he felt it was over-stacked with pilots, collectively leading to the stand-up of six missile wings by 1964 and the prevention of a ‘glass ceiling’ for the space and missile career fields (Ibid.).

143 White was a career pilot, as all air force Chief of Staffs to date have been, but served as an air attaché for most of his career (General Thomas Dresser White).
Despite Spinetta’s citation of space as a success in terms of integrating a non-flying career field into the broader Air Force culture, space represents an imperfect case. It has not seen one of its own rise to be Air Force Chief of Staff which would suggest relative parity with the pilot career fields, and in many cases historically its senior positions have also been held by rated operators rather than career Space and Missiles personnel. In March of 2001, the Space Commission released its report on the status of military space programs, finding deficiencies in a number of areas. General Fogleman, former Air Force Chief of Staff and member of the commission, noted that ‘there are fundamental differences between space operations and air operations and that the US needs a dedicated, career cadre of experts to advocate space superiority and focus on technologies and infrastructure necessary to achieve it (Tirpak, Fogleman: Doing Nothing Is Not an Option, 2001).’ The commission found that placing the commander of Air Force Space Command as dual-hatted commander of U.S. Space Command was misguided as the commander should be able to potentially be drawn from any service and that the two positions should be sufficiently large to require separate commanders, and that the armed services needed to dispense with the practice of assigning only combat "operators" to top space posts. "Military leaders with little or no previous experience or expertise in space technology or operations often lead space organizations (Ibid).”

Further, the report stated Air Force Space Command should constitute a single chain of authority for all space operators sufficient to develop a ‘space culture’ within the Air Force, which despite Spinetta’s references to the 1950’s move to protect space, the commission still felt was lacking as late as 2001. In fact, many of the general officer billets occupied by Space

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144 For a period, Space was also considered for an advisory seat on the Joint Chiefs of Staff, which would in effect bypass Air force leadership to provide inputs to the Joint leadership. Those plans were sidelined with the beginning of the Global War on Terrorism in late 2001, and abandoned when U.S. Space Command merged with U.S. Strategic Command in October 2002 (Chambers, 2002).
professionals observed in Table 14 are due to changes in Air Force Space programs since the 2001 report, as observed by Maj Gen Webber in 2007 (Webber, 2007), not due to the changes made in the 1950s and 1960s, suggesting that such safeguarding of a career field is necessary, but insufficient, to normalizing the field.

Finally, even though changes have been made to the space program which in many cases has elevated the status of the space field, the missile field appears to be in decline. In late 2013 and early 2014, a series of scandals rocked the missile force at all levels of command, to include 11 officers accused of using illegal drugs, 34 involved in cheating on missile certification tests, several wing commanders being removed for their units failing evaluations, and a major general who oversaw the entire ICBM force was relieved of duty after investigators found he had engaged in alcohol-fueled misbehavior during an official visit to Russia. This all followed an internal complaint from one deputy Group Commander at Minot Air Force Base that the ICBM group was infested with ‘rot’ (Burns, 2014). While the Air Force officially maintains these are a series of isolated incidents, all appear to be symptoms of a larger systemic problem in the missile force. This may be due at the end of the day with difficulty reconciling a force whose primary mission is deterrence through overwhelming force aimed at civilians is difficult to reconcile with a ‘warrior’ minded Air Force, emphasizing heroism and ‘fly, fight, win.’

While space represents an older career field that has largely integrated and intelligence attempts to expand its leadership roles given the expanded need of intelligence to wage modern wars, the Air Force has also recently added a new career field for Cyberspace Operations to increase focus on this emerging mission set much like the Missile career field in the 1950s. In May of 2010, the Air Force Specialty Code Communications, which had previously been

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145 See counterinsurgency literature from Galula to Kilcullen emphasizing the importance of integrating intelligence and operations for successful counterinsurgency execution, as well as the Army Counterinsurgency Field Manual.
designated a support career field designated 33S and was primarily responsible for overseeing base communications infrastructure, was transformed into the operations mission Cyberspace Operations, designated 17D (Rolfsen, 2010). The change included an increase in training from 26 days to 115 days, an emphasis on communications and network warfare, a new career field badge more similar to pilot wings than traditional support AFSC badges, and a mission qualification process similar to other operations career fields.

Although the Cyberspace Operations career field is new, due to its historic ties to the Communications AFSC and an initial cadre of 3,000 officers making the transition to the job there will likely be lingering issues of promotion opportunities in the future. One issue I observed in reviewing the biographies of current Air Force general officers in compiling Table 14 was the overlap between the Space and Missile career field and the Cyberspace Operations career field for the purpose of identifying general officers. In many cases, career ‘Space’ personnel have served multiple tours in billets associated with communications satellites sufficient to warrant the awarding of the former 33S AFSC. As a result, there is a significant amount of overlap between the two fields, with the prospect for the future of Space and Missile Operators overtaking many command billets that might otherwise go to Cyberspace Operations officers, much like the complaint in the intelligence career field that pilots are harming their career progression by taking their command billets. Indeed, The Air Force has at various times in history separated the Space and Missile career fields, the former focusing on satellites and space operations and the latter starting their careers as missile launch officers and with their careers primarily focused on the missile force. The Air Force in February 2013 formally split the two fields: Nuclear and Missile Operations (13N), and Space Operations (13S) (AF splits space, missile career field for officers, 2013).
This internal dynamic and debate over whether the fields should be separate, which is ongoing, may also play a role in the impact on Air Force culture as the missile field has tended to dominate the Space and Missiles AFSC, while the space field may do so in the future. As Cyberspace Operations is at the early stages of development, the final career field of interest for the targeting revolution, Information Operations, is practically nonexistent as its own career field. Air Force Doctrine Document 2-5 details the Air Force’s doctrinal employment of information operations, consisting of influence operations, electronic warfare operations, and network warfare operations.

The problems faced by Space, Intelligence, and Cyber operators in career progression suggests identifying the problems posed by RPA pilots and their advocates such as Lt Col Spinetta represent only the first phase of an organizational challenge to increasing the number of RPA general officer billets, and in doing so to normalizing the career field and culture within both Air Force and military culture at large. A key subset of career progression is the recognition of such operators and how that factors into career progression, esprit de corps, and identity within the organization.

**Recognition**

In February of 2013, Defense Secretary Leon Panetta announced the creation of a new, Department of Defense-wide decoration to recognize the outstanding contributions of warfighters that were not being recognized in the existing awards structure, the Distinguished Warfare Medal. The Chairman of the Joint Chiefs of Staff, General Martin Dempsey, noted at that time that "This new medal recognizes the changing character of warfare and those who make extraordinary contributions to it" (Garamone, SecDef announces Distinguished Warfare Medal,
The reaction to this announcement was swift and overwhelmingly negative. The Veterans of Foreign Wars (VFW) stated “By placing the Distinguished Warfare Medal ahead of the Bronze Star and Purple Heart it greatly diminishes the significance of the awards that are earned for valor while placing one’s life on the line in direct combat,” arguing therefore it should rank below the Purple Heart in the order of precedence (Davis). Five members of the House of Representatives concurred with the VFW and immediately pressed for legislation that would force the defense Department to lower the status of the medal (Freking, 2013). Just two months after its introduction and facing pressure from nearly all sides and with few outside those who approved of the decoration supporting it, incoming Secretary of Defense Chuck Hagel cancelled the proposed decoration on 2013. Instead, he recommended replacing the medal with a device on existing decorations (Garamone, Hagel Replaces Distinguished Warfare Medal With New Device, 2013).

The debate over the Distinguished Warfare Medal highlights the challenge of recognizing those who perform in exemplary manners using new weapons systems, and how to reconcile that with established perceptions of the ideals of the warrior ethos. The award’s announcement generated a significant outcry from veterans, angry that an award for meritorious service might outrank one earned by valor. This position, while appealing based on the limited framing, ignores the nature of the decoration system as it exists today and fails to account for the role of those decorations in career progression. More interestingly, it speaks to the changing role in the character of war by demonstrating the changing relationship of the connection between strategic effects and valor.

Military awards for heroism exists in a system referred to as the “Pyramid of Honor (About the Medals).” Established by an Act of Congress in 1918, the Pyramid of Honor
provided commanders a means of recognizing bravery in battle for actions that were deemed insufficient to merit the Medal of Honor, which to that point was the only recognized valor award. The first two decorations, established in 1918 with the act, were the Distinguished Service Cross and the Silver Star.\textsuperscript{146} These decorations were followed with the Distinguished Flying Cross in 1926, the Air Medal in 1942, the Bronze Star Medal in 1944, and the Commendation Medal in 1945.

Table 15: The Pyramid of Honor

<table>
<thead>
<tr>
<th>Valor</th>
<th>Achievement</th>
<th>Merit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medal of Honor</td>
<td>Distinguished Service</td>
<td>Distinguished Service Medal</td>
</tr>
<tr>
<td>Cross</td>
<td>Cross</td>
<td></td>
</tr>
<tr>
<td>Air Force Cross</td>
<td>Distinguished Flying</td>
<td>Distinguished Flying Cross (w/V)</td>
</tr>
<tr>
<td>Silver Star</td>
<td>Cross</td>
<td>Legion of Merit</td>
</tr>
<tr>
<td>Distinguished Flying Cross (w/V)</td>
<td>Distinguished Warfare</td>
<td>Distinguished Warfare Medal (cancelled)</td>
</tr>
<tr>
<td>Bronze Star (w/V)</td>
<td>Air Medal</td>
<td>Legion of Merit</td>
</tr>
<tr>
<td>Air Medal (w/V)\textsuperscript{148}</td>
<td></td>
<td>Bronze Star</td>
</tr>
<tr>
<td>Commendation Medal (w/V)</td>
<td>Commendation Medal</td>
<td>Meritorious Service Medal</td>
</tr>
<tr>
<td>Achievement Medal (w/V)</td>
<td>Achievement Medal</td>
<td>Aerial Achievement Medal</td>
</tr>
</tbody>
</table>

\textsuperscript{146} Originally a Citation Star that would be attached to a campaign medal, it became its own unique medal in 1932 (Silver Star).

\textsuperscript{147} Although it has been historically issued for individual achievement rather than sustained meritorious service, I have not found a single case of such an award issued since World War II. As a result, the Legion of Merit today is generally issued to senior military officers (grade O-6 and O-7 primarily) in recognition of command at the Wing or Brigade level.

\textsuperscript{148} The Air Medal is ranked in the order of precedence between the Aerial Achievement Medal and the Meritorious Service Medal. All service branches allocate points toward promotion to enlisted members based on decorations earned, with points allocated based on the level of the decoration. The Air Force, Navy, and Army classify the Air Medal as equal to the commendation medals in their point structure, while the Coast Guard classifies it as equal to the Meritorious Service Medal. As a result, looking at points allocation alone it is difficult to classify based on this structure of a hierarchy and looking at the Air Force system alone it would likely be reclassified lower.
While some opponents of the Distinguished Warfare Medal appeared to oppose any recognition for RPA operators and others who were geographically separated from the traditional battlefield, arguments against the Distinguished Warfare Medal were primarily not with the decoration itself, but with its status in the order of precedence. John Stolz, Chairman of VoteVets, a political action committee for veterans, summarized this argument, saying “I personally don't have an issue with the medal itself. Troops don't set the policy, they just perform their duties. Therefore, if someone is doing a specific job for the military, it should be recognized. What I do have an issue with is this: The new medal ranks above the Purple Heart. For those who served, that doesn't sit right (Stolz, 2013).” Similar arguments were raised by the Veterans of Foreign Wars, the American Legion, and numerous other veterans in editorials.

This argument, however, is greatly weakened when the actual range of military decorations are evaluated in context, to include the numerous non-valor awards that have higher precedence than the Purple Heart and Bronze Star Medal, as well as the historic conditions under which the Bronze Star Medal, and other similar decorations, have been issued. Framing the medals in this regard is to invoke the notion of the warrior ethos tied to heroism, to the exclusion of the recognition of other sometimes more important contributions to military success.

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149 One article in Stars and Stripes, a military newspaper, began by noting that some in the military were referring to the decoration as “the Nintendo medal” or “the Purple Buttocks” (Shane L., 2013). A blog post still visible on the American Legion’s web page depicts a parody of the Distinguished Warfare Medal, showing a golden video game controller suspended from a Bronze Star Medal ribbon, which it notes was an internet joke circulating at the time (Mothax, 2013).

150 Invoking the Bronze Star usually comes with the caveat that it is awarded for direct battlefield heroism.

151 Other examples include John Bruhns writing for the Huffington Post (Bruhns, 2013).

152 Morale and other organizational realities have long played a significant role in the development and issuing of military decorations. Both the Air Medal and the Bronze Star Medal trace their origins to World War II initiatives aimed at raising the morale of combat forces which could not be recognized within the existing system. Airmen at the time were experiencing heavy casualties in the air war in Europe, but recognition under the Distinguished Flying Cross was limited to specific acts of heroism or achievement in flight. Secretary Stimson stated in a letter "The Distinguished Flying Cross is available only for heroism or extraordinary achievement while participating in aerial flight...It is desired not to cheapen the Distinguished Flying Cross by awarding it for achievement not bordering on the heroic. It is, however, important to reward personnel for meritorious service (Air Medal)."
the character of warfare has changed with the targeting revolution, those having great impact on
the operational environment are increasingly geographically separated from actual combat,
causing significant dilemmas in the entire decoration process. The RPA, and its combat role,
only magnifies an ongoing debate that dates at least to Vietnam and has grown during Desert
Storm and the War on Terrorism. The proposition that the status should be lowered to that of a
service award is flawed as RPA pilots are currently eligible for the Air Medal, Aerial
Achievement Medal, and even the Bronze Star medal for sustained service when forward
deployed. Rather than placing the medal in what these critics see as its proper place, such a
move would instead be creating a redundancy. In contrast to framing it against the Bronze Star
with V, the decoration should be framed against the Distinguished Flying Cross, which it is
designed to mirror both for level of accomplishment and as an award for achievement not
inherently connected to valor.

Roosevelt’s authorization of the Air Medal, in turn, was seen as damaging to the morale of ground forces, which
had no equivalent recognition. General Marshall, pleading the case for a new ground medal in 1944, wrote "The
fact that the ground troops, Infantry in particular, lead miserable lives of extreme discomfort and are the ones who
must close in personal combat with the enemy, makes the maintenance of their morale of great importance. The
award of the Air Medal have (sic) had an adverse reaction on the ground troops, particularly the Infantry Riflemen
who are now suffering the heaviest losses, air or ground, in the Army, and enduring the greatest hardships (Bronze
Star)." President Roosevelt then authorized the award of the Bronze Star Medal for any member of the armed
forces who "distinguished himself or herself by heroic or meritorious achievement or service, not involving
participation in aerial flight, while engaged in an action against an enemy of the United States."

The first RPA pilot to receive an Aerial Achievement Medal came in 1997 for the successful recovery of a
disabled RPA which risked crashing in heavily populated areas of Bosnia. The pilot glided his aircraft 30 miles to a
successful landing after engine failure, without the use of the primary on-board camera, and via satellite datalink
which delayed the aircraft’s response (Munro, 1997). In early 2012, the commander of a Marine Corp tactical RPA
unit was awarded the Bronze Star Medal for his command of that unit (Weilenman, 2012).

The valor medals themselves have been critiqued in recent years for “medal inflation,” the perception that they
are being over-awarded in a manner that is itself degrading the decoration. Retired Colonel David Hackworth, a
noted critic of medal inflation, summarized his critique of the award of the Distinguished Flying Cross, referencing
the awarding of the Distinguished Flying Cross for a mission over Baghdad which killed 16 civilians. “In World War
II, when I saw a Distinguished Flying Cross, that meant the guy had made 25 or 30 missions over dangerous places
like Hamburg or Berlin. Those places sometimes had 50 percent casualty rates. Now, they give medals out to guys
who fly bombers invisible to radar whose bombs miss Saddam and kill civilians in a restaurant. It’s an outrage
(Moran, 2004).” General Colin Powell made a similar observation of his time in Vietnam. “The Legion of Merit I
received? It might have meant more to me in a war where medals were not distributed so indiscriminately. I
remember once, as division G-3, attending a battalion change-of-command ceremony at one firebase where the
The Air Force in recent years has experienced several issues with the awarding of the Bronze Star Medal, first for its awarding to staff officers well outside of what were considered war zones, and more recently for the approval of awards for soldiers in support roles. In late 2000, a controversy erupted over the awarding of the Bronze Star Medal to commanders in Missouri and Washington DC., overseeing combat missions but who were themselves not in the combat zone. The 2001 budget authorization act attempted to rectify this circumstance by limiting future awards only to those who were receiving imminent danger pay (Spencer, 2000), but this is itself problematic today as individuals in places like Qatar, far from the traditional battlefield, are eligible for such pay. In 2012, two Air Force Technical Sergeants were criticized after their commanders put them in for the Bronze Star Medal for their accomplishments as finance officers (Schogol, Tech. sgt. take heat after receiving medals, 2012), requiring the Air Force to clarify the policy on the awarding of the decoration. In each case, the overwhelming negative response came due to the perception that these awards should be earned based on valor on the battlefield rather than for doing one’s job while deployed, which runs counter both to the criteria for the decoration and the history of the awards. The debate over departing CO was awarded three Silver Stars, the nation’s third highest medal for valor, plus a clutch of other medals, after a tour lasting six months. He had performed ably, at times heroically. He was popular with his men. Yet, the troops had to stand there and listen to an overheated description of a fairly typical performance….The departing battalion commander’s ‘package,’ a Silver Star, a Legion of Merit, and Air Medals just for logging helicopter time, became almost standard issue (Powell, 1995, pp. 145-146).” These observations speak to a fear that the value of valor awards are being diluted on a wide scale and away from their original purpose, but a review of the records indicate that historically the criteria for all decorations have varied significantly based on commander’s discretion.

Today the Bronze Star Medal seems especially to be mythologized as being largely a valor award that has only recently been broadened to meritorious service, despite a long history that says otherwise. As of 17 July 2013, the U.S. Army reports that it has awarded 4,239 Bronze Star Medals with ‘V’ device for valor in Iraq and Afghanistan, compared to 86,235 Bronze Star Medals for achievement or meritorious service for those same conflicts. This compares to 170,626 medals awarded for valor and 549,342 for achievement during Vietnam (Awards and Decorations Statistics by Conflict, 2013).

Current proposals call for the elimination of imminent danger pay from many locations, but to this point it has been paid and commanders in those locations have received numerous Bronze Star Medals for such service. Retired Major General James Poss notes he received one of his Bronze Star Medals for such service when noting that he felt RPA pilots were doing things far more worthy of such recognition (Schogol, Amid jeers, some cheers for UAV/cyber medal, 2013).
the Distinguished Warfare Medal speaks to one part of a larger cultural debate over who is and is not a warfighter, what the role of decorations should be in the modern military, and what the military values from the warfighter. In practice, such a system advantages what is generally a mythological interpretation of existing decorations in a way that biases the system against innovation.

Given this history, a multi-tiered debate is ongoing over the status of military decorations, with the Distinguished Warfare Medal being offered to new forms of warfare being a bridge too far given the unresolved debate over existing medals. Some medals are for valor alone (Silver Star, etc.) but at times there have been appearances that the criteria have been relaxed. Some can honor valor or achievement (Distinguished Flying Cross), and some can honor valor or merit (Bronze Star Medal). The most controversial awards have come when combat awards often associated with valor have been awarded for merit, and when those controversies have arisen the awarding of those decorations have been largely defended based on the criteria for the decoration.

The message sent by arguments in favor of valor awards alone themselves point to the obstacles with implementing such a rewrite of the awards process, but the issue is further complicated when one factors in the impact of decorations on promotion and career progression. In this light, limiting decorations solely to valor\textsuperscript{157} poses a problem for the dynamics of modern militaries, especially given the previous section’s discussion of the importance of career progression to change in the organizational structure. Although officer promotions are not formally tied to earning decorations as is the case with the enlisted forces, guidance for officer promotion and the visibility of an officer’s decorations in their promotion file indicates a

\textsuperscript{157} Campaign decorations are omitted from this discussion as they do not appear in promotion packages, which consist of individual decorations, achievement medals and above.
correlation. Retired Colonel Terry Stevens, and Air Force Personnel Officer with nearly 35 years of experience, noted his unofficial formula for calculating the prospects of officer promotion the importance of decorations. “Company-grade officers will normally have an Air Force Achievement Medal and a Commendation Medal or two. Majors and lieutenant colonels also should have Meritorious Service Medals and/or Joint Meritorious Service Medals, with clusters. If you do, then you've shown initiative, leadership and above-average performance (Larter, 2011).”

The Distinguished Warfare Medal appears to have been an attempt to both safeguard the distinctions of the valor awards and to recognize significant achievements. This would be achieved by creating a separate and clearly distinctive decoration and to recognize operators outside of the operating environment for outstanding achievements commensurate with those that would earn other operators medals for recognition and promotion purposes. Individuals would be recognized for valor, achievement, or meritorious service at various levels commensurate with their impact. Given the current status of a device on existing medals, it appears that a compromise has been reached in the short term that will satisfy the RPA community as significant RPA achievements can be recognized by a Distinguished Flying Cross with a device. However, the gap for non-valorous combat achievement remains for other career fields to include Space, Information Operations, Cyberspace Operations, and Intelligence remains. This might be solved by affixing the Distinguished Warfare Medal-replacement device to the Legion of Merit, otherwise the cancellation of the Distinguished Warfare Medal represents not an end to the debate, but merely a pause.

The changes in the characteristics of warfare brought about by the targeting revolution suggest a wholesale review of the military decoration process may be required. Issues with
medal inflation, ambiguous criteria, and an at times reactionary process that created many of the existing decorations have led to problems with awards that long predate the specific challenges from the targeting revolution, but those challenges may be so significant as to be the impetus for systematic review and revision. The armed forces must evaluate the broader intentions of the decoration process itself, both in terms of criteria for award and the effects thereof on promotions and career progression, as the issue is larger than simply the debate over a single new decoration. The Distinguished Warfare Medal became an easy target for attack and defeat likely because it had a small community to defend it, because it had a large community who to a degree felt threatened by it, but ironically in another sense because a large share of veterans who had earned decorations like the Bronze Star medal for meritorious service saw those decorations elevated by a rally to attack the new decoration.

Perceptions of Airpower and the Profession of Arms

The Air Force has long suffered an image problem within the U.S. military, owing to its emphasis on advanced technologies leading to a perception that its fighters were less involved in “combat” than those of other services.158 The debates over the Distinguished Warfare Medal, post-traumatic stress for RPA pilots, and promotion rates all served to spotlight that debate by highlighting the desire for recognition of operators even further removed from the battlespace than pilots who faced little in the way of air-to-air threats, at times pressing Air Force pilots to seek to side with ground operators, defending ‘combat’ medals from being devalued by awarding them to personnel not actively threatened by an opposing force.

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158 Referring to the Air Force as the “Chair Force” is one example of an old term of derision aimed at the Air Force, others I have long heard refer to the Air Force as ‘the civilian branch of the armed forces.’
Ultimately, this debate can be traced to a fundamental challenge within the Air Force in the Global War on Terrorism to define itself, and its mission contribution. Though the Air Force’s support role was clear in terms of global mobility and reachback infrastructure, its direct combat engagement role following the initial phases of both Operation Enduring Freedom and Operation Iraqi Freedom was less clear beyond a close air support role for ground forces. Beginning in 2003, the Air Force was tasked to provide airmen to supplement Army operations on the ground in Iraq and Afghanistan, with over 30,000 airmen being trained for such roles \textsuperscript{159} between 2003 and 2007 (Raz, 2007). This originated with a 2003 joint service conference that focused on staffing operations in Iraq and Afghanistan. Lt. Col. Sal Nodjomian, then the Deputy Expeditionary Mission Support Group Commander in Balad, Iraq, stated “The Army recognized that they were lacking some capabilities when it came to convoy support. The Air Force volunteered to help the Army out,” but, over time “[t]hat further morphed into not just driving the [gun trucks], but being the guys who sat in the back,” as Army resources were increasingly strained (Jensen, 2004). The service’s airmen tasked to fill an Army billet were dubbed “Joint Expeditionary Taskings” beginning in 2008 to refocus attention on the Air Force’s “combat-focused mind-set and our joint posture,” in the words of then-Chief of Staff General Norton Schwartz (Scully, 2010).

Further, although airpower theorists have long advocated for platform flexibility as a key benefit of airpower, during the early years of the wars in Iraq and Afghanistan cultural rigidity and doctrine had tied many air platforms to particular roles, with fighters assigned as close air support and Predator RPAs assigned as ISR collectors. The successful use of armed Predators in Afghanistan had already demonstrated that it was capable of filling both roles, and the sensor

\textsuperscript{159} These tours have over time been classified as Expeditionary Combat Airmen (ECA), In-Lieu-of Taskings, Joint Expeditionary Taskings (JET), etc.
capabilities of fighter aircraft made them capable of serving as collectors, but it was not uncommon for calls for ISR to be rebuffed with “I am not a Predator (Brown, 2013).” I personally noted a similar experience in Iraq in 2007 when, requesting Joint STARS support for monitoring potential insurgent villages in northern Iraq, I was rebuffed by a Lt. Col. overseeing the Joint STARS operation who informed me that “J-STARS is a command and control asset, not an ISR collector.”

**The War on Terror and the Warrior Ethos**

As the Air Force increasingly found itself filling ground billets in support of Army operations, a debate raged over the future of the Air Force and what its role was in low intensity conflict. The Air Force played an active role in counterinsurgency in Vietnam through the Special Air Warfare Center, and several unofficial manuals were published in the 1970s and 1980s detailing the tactics of forward air control and air operations involving smaller aircraft in non-traditional roles. However, the principal innovations to survive from that era range from the tactical expertise of forward air control and search and rescue, to technical innovations such as precision munitions. The early period of the War on Terrorism saw the Air Force, much like other service components, rediscovering the lost art of counterinsurgency with a renewed emphasis on non-traditional ISR and other tactics, but much as in Vietnam an Air Force built for a different mission set that face a dearth of airframes suited for counterinsurgency missions, leaving the Air Force wanting to participate but often in a supporting role. Air Force specialties that had traditionally been classified as support rather than operations increasingly bore the

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160 A summary history of the Special Air Warfare Center can be found in David Dean’s 1985 article on the subject (Dean, 1985). In 2013, Air Force Special Operations Command stood up the Air Force Special Operations Air Warfare Center, which it billed as a successor to the Vietnam-era Special Air Warfare Center (Sanchez, 2013).

161 Viewing all aircraft as potential sensors and using sensors aboard aircraft as well as targeting pods in innovative new ways to identify and track ground movements that could be associated with insurgent activities.
casualties and hardships of the conflict, with Major General Hertog noting in 2010 that “[t]he support side of the house has suffered the majority of the casualties. Truly the rest of the Air Force has appreciated what the nonflying community has brought to bear (Scully, 2010).” Despite these words, although the sacrifice was likely appreciated many critics saw danger in the allocation of Air Force assets to such a role.

Airpower historian Robert Dorr noted his objections to “jointness” as deterring from the airpower mission, reacting to calls for a more joint, expeditionary Air Force as reckless when it comes at the expense of strategic air priorities. “Today, the United States faces a formidable military threat from Russia, which has hundreds of intercontinental missiles ready to launch against the American homeland. We may never fight a war with Russia or China, or even near-peers like Iran and North Korea, but all of them have the potential to destroy the United States. No terrorist group, not even al-Qaeda, has ever had the remotest chance of doing that….Ditch the emphasis on jointness. The military service branches are not equal and never have been. We are leaving our nation open to attack by failing to properly and fully equip ourselves with long-range, land-based air power (Dorr, True Airpower Cannot Co-exist with "Jointness", 2013).”

In this passage, Dorr represents the opposite end of a broad reaching debate within the Air Force over where it is and where it should be going in the future as a service, not unlike the debate within the Army between COIN enthusiasts and the proponents of traditional maneuver warfare.

This shift from strategic airpower to a tactical, joint focus with an emphasis on supporting both ground combat and tactical focus can be seen being played out in the evolution of the Air Force mission from the end of the Cold War through the War on Terrorism. As the Air Force’s role in the War on Terror evolved, leadership has increasingly emphasized joint support and the fostering of a ‘warrior ethos’ more traditionally in line with ground combat forces than
strategic airpower. From the 1990s through 2005, the Air Force Mission emphasized control and exploitation of air and space as the primary objective:

"The mission of the United States Air Force is to defend the United States through control and exploitation of air and space (Air Force Red Book)."

In 2005, as the Air Force increased its role in support for counterterrorism and counterinsurgency operations, the mission statement was modified to reflect the flexible responses that the Air Force could offer, the inclusion of Cyberspace into the Air Force mission for the first time, as well as an emphasis on ‘fighting’ in combat:

"The mission of the United States Air Force is to deliver sovereign options for the defense of the United States of America and its global interests -- to fly and fight in Air, Space, and Cyberspace (Gettle, 2005)."

Air Force Secretary Michael Wynne and Chief of Staff General Michael Moseley at the time of announcing the new mission stated "Our mission is our guiding compass, and now more than ever we need it to be clear and precise," as well as noting “The Air Force’s mission statement has evolved over time, but it does not change the nature of who we are or what we do (Ibid).” However, just three years later, this new mission statement was found to be less than clear by General Moseley and Secretary Wynne’s successors, who announced a new mission statement in 2008, which remains the current Air Force mission:

"The mission of the United States Air Force is to fly, fight, and win ... in air, space, and cyberspace (New Air Force Mission Statement, 2008).”
General Schwarz, in announcing the new mission statement along with Air Force Secretary Donley, stated the new mission statement was "simple and easy to understand….This is who we are. It's what motivates us and drives us to serve… This will reduce organizational turmoil as we focus on winning today's fight (Senior leaders meet to discuss, decide way ahead for force, 2008)."

Despite assurances that the change in the Air Force’s mission would not change ‘who we are or what we do,’ the gradual evolution of the mission, which inherently serves as the ‘guiding compass,’ parallels a shift in Air Force culture away from a strategic, long-term mission to a short-term tactical mission, increasingly emphasizing ‘fight,’ and ‘win,’ even to the point where it ignores key Air Force missions such as strategic bombing and the ballistic missile force, whose primary mission is nuclear deterrence against peer competitors.

This cultural shift can also be seen with the adoption of the Airman's Creed. In presenting the newly drafted creed in 2007, Gen Moseley stated that its goal was “to reinvigorate the warrior ethos in every Airman of our Total Force (Moseley, CSAF presents Airman's Creed, 2007).” The creed both begins and ends with the statement that every Airman is a “warrior,” and it emphasizes the mission to fly, fight, and win as well as a legacy of valor. Gen Moseley’s second goal was to move the Air Force away from too much technical specialization. “[O]ver the years, we have become so technically proficient and specialized that we have sometimes drifted from our core essence and let our functions override our mission-focus and warfighting orientation. We must never forget that our Air Force isn't just a conglomeration of diverse specialties, skill sets, or jobs. Ours is the profession of arms. We are Airmen Warriors - dedicated to flying, fighting and winning (Ibid.)."
Though the Air Force has in many ways emphasized technical prowess over the warrior ethos as Gen Moseley describes, and though his goal was to reinvigorate a warrior ethos during an active war, the cumulative effects of the evolving mission statement, the *Airman’s Creed*, and increased tasking in non-traditional roles has pulled the Air Force away from its traditional role. It reads in many ways like the *Soldier’s Creed* modified for airmen, especially with the prominent focus on ‘A Tradition of Honor, And a Legacy of Valor.’ This perspective weds airmen to concept of the ‘warrior ethos’ and further removes the Air Force from the airpower theory roots of Douhet and Mitchell, who extolled the virtues of air power for the ability to achieve combat effects decisively against an enemy unable to defend itself.

The ‘warrior ethos’ is a somewhat ambiguous concept, largely defined in the post-9/11 U.S. military by the attributes of tactical warfare. The U.S. Army moved toward instilling a warrior ethos in its recruits as part of an initiative launched by then Chief of Staff General Eric Shinseki in 2003, which added training to various Army programs to instill an ethos in the Army similar to the Marine’s ‘every Marine a rifleman.’ It further updated manuals and the *Soldier’s Creed* to include a reflection on the values of the warrior ethos: a commitment to victory, an emphasis on mission, a refusal to quit and a commitment to never leave an American behind (Loeb, 2003).’ This version of the warrior ethos is broad and applicable to all military service, but its history and application appears specifically suited to traditional ground combat roles. As the motivation for the Army’s ethos is derived from the example of the Marines, the Marine’s ethos is instructive as well. As First Lieutenant James Ferguson described it, “We are united not only by this iconic emblem (the U.S. Marines Globe and Anchor), but also by the shared experience of the training we all endure aimed at achieving proficiency as warfighters first; everything else is secondary (Ferguson).”
This view of the warrior ethos was expanded upon by Steven Pressfield, who in 2011 wrote a volume dedicated to members of today’s military discussing the origins of the warrior ethos. To Pressfield, the warrior ethos emerges from a sense of fear on the battlefield, as classic war was hand to hand and between roughly equivalent armed forces. “For a Greek or Roman warrior to slay his enemy, he had to get so close that there was an equal chance that the enemy’s sword or spear would kill him. This produced an idea of manly virtue…The ancients’ resisted innovation in warfare because they feared it would rob the struggle of honor (Pressfield, 2011).” Courage represents an essential element of the warrior ethos, which manifests in the Army’s warrior ethos as a subset of the drove for victory and never leaving a man behind.

A Strategic Air Perspective

The emphasis on the warrior ethos poses a significant challenge to the strategic aspects of the Air Force, including the RPA force. While the traits of the warrior ethos have applicability to key aspects of the mission of air warfare, especially tactical aviation and special operations in contested environments, these missions should, as envisioned by Douhet, Mitchell, Warden, and other airpower theorists, be a minor aspect of the air war compared with its ultimate objective – the ability to take the weapons of war directly to the opposing state’s vital centers at will, bypassing fielded forces. This radically alters the military ethos as is applied to air warfare. While the initial phases of conflict to establish air superiority will closely relate to the classic warrior ethos requiring bravery to seize control of the air, the guiding mission and decisive actions will occur once superiority is established, and this is where the real Air Force mission begins. This implies that the airman’s ethos is something separate from the traditional warrior ethos. Rather than bravery being the underlying virtue, understanding of power and restraint is
central. By pressing for a warrior ethos that undermines the central tenets of airpower theory of what makes the air weapon unique and justifies itself as a separate service, the Air Force runs the risk of justifying its own obsolescence and re-integration with ground force. Pre-Vietnam, the Air Force largely overlooked tactical requirements while overly focused on strategic airpower. Today, the Air Force risks obsolescence by overcorrecting in ways that play into Farley’s argument— if airpower today is only good for supporting ground and sea forces within a traditional warrior mindset, there is little justification for it to be independent of the Army or Navy.

The debate over the “combat” nature of RPA pilots and the increasingly technological role that the Air Force is adopting, both to meet the demands of an expanding Air Force-centric model for counterterrorism operations and tech-centric cyber plan for future wars and ISR collection makes this debate increasingly relevant when considering the future of warfare. How does one “fly, fight, and win” in cyberspace? What does it mean to “win” in a war with non-state actors such as the war on terrorism? What does it even mean to be a “warrior” in the era of the targeting revolution? The mission statement and the creed must be ‘guiding lights’ that in turn drive the mission of all subordinate units, but to what extent have they become empty buzzwords aimed at short term motivation, at the extent of the long-term mission? I posit that such an emphasis drove reluctance to embrace the ISR collection missions on the part of traditional operators, and fuels territorial struggles within the Air Force over who qualifies as operators and who does not, as the mission places priorities on flying and fighting over other specialties, and the mission drives the direction of the Air Force.

In defense of the transitioning mission and adoption of the Air Force Creed, it could be argued that the references to being “a warrior” and calls to ‘fly, fight, and win’ should not be
taken as literally as they are and should not be confused with a pilot-centric perspective. Indeed, honoring Air Force heroes and traditions has always been a part of the overall strategy to build an Air Force warrior ethos since the early 2000s. But, the ambiguity over what constitutes the “warrior ethos” in air warfare, or the problems which should have been predictable in light of reinforcing that the Air Force’s mission was to fly first and foremost, rather than to control a domain, would have on overall morale.

One prominent example of the culture clash between pilots and non-pilots came in mid-2012 when a Captain stationed at Cannon Air Force Base submitted a letter to the Air Force Times in defense of pilots wearing flight suits as a status symbol. "A flight suit signifies that individual just as the different insignias of rank. It commands respect…There are two types of career fields — operations and support. If you’re not aircrew,\textsuperscript{162} then you are support. That does not diminish your value as a person, but it clearly defines your place in the military hierarchy. If individuals have a problem with hierarchy, they have no business being in the military….Just remember this — the flight suit that you shun today will be the chief of staff that commands you tomorrow (Schogol, Letter prompts base to change flight suit rules, 2012)." This letter was largely criticized, and resulted in Air Force-wide changes to the wear of the flight suit, with stark reminders from commanders that numerous general officers were in fact non-pilots and that such comments disrespected many other fields, including support fields, that were actively conducting operations in various locations around the world. At the same time, however, it represented the most extreme example of a larger philosophy that still resonated in many quarters.

This philosophical divide can be directly tied to the RPA debate as the RPA pilot’s status within this hierarchy is critical to the issues of promotion, recognition, and broader images of the

\textsuperscript{162} The author makes a leap from “operations” to “aircrew,” demonstrating a perspective that sees the two terms as synonymous when as previously described they are not.
Air Force. As one Stars and Stripes article noted in 2009, “The culture of the Air Force is in many ways like high school. Fighter pilots are the jocks, the cool kids who rule the campus. And drone pilots? They’re the AV club (McCloskey, 2009).” It is the leadership which has defined the mission and the creed, in a manner that conspicuously places their perspective of warfare and warfighting front and center, as a potential rival with a vastly different perspective is increasingly looked to from the policymaking apparatus to fulfill the mission. This inevitably has led to friction within the culture.

The top levels of Air Force leadership say publicly that RPAs are being integrated into the force properly and that the Air Force has fully embraced the mission. Retired General David Deptula stated this was the case in a discussion at Princeton University in April of 2013, and most of the public statements from senior leadership mirror this account. In 2009, the director of the Air Force’s RPA program, Col Eric Mathewson, said it was nonsense for RPA pilots to think they would be entering into a second-tier career field (McCloskey, 2009). Four years later in 2013, the Air Force is still having issues recruiting RPA pilots due to that very concern.\(^{163}\)

However, buy-in for such organizational change is required at lower echelons, especially among Non-Commissioned Officers and Field Grade Officers. A simple review of many of the articles written on RPAs in Air Force publications demonstrates the underlying friction through the comment’s section. Maj Dave Blair’s piece “Ten Thousand Feet and Ten Thousand Miles” was referenced by Air and Space Power Journal editors as one of the most viewed and commented articles in that publication since its inception, and the comments paint a picture of a steep divide between the RPA community and other aviators. One retired enlisted aircrew member noted, “It would seem that you suggest that drone pilots sitting in an office in the states

\(^{163}\) Colonel Hoagland’s paper identifies many of the challenges facing the RPA community that he feels are not being adequately addressed by the Air Force in calling for increased focus on the RPA community (Hoagland, 2013).
that goes home to their family each day are in the same danger as the one who flies a (sic) aircraft over the target. I suggest the Maj is thinking of the perks more than the risk. I believe it’s called "Flight Pay" because you have to fly to earn it. As an enlisted man, I did (Blair, 2012)."

Another was more abrupt. “The fundamental problem with RPAs is that those flying them have no "skin in the game" (read Nassim Taleb for the moral and philosophical idea). OPRs and career advancement don't count as "skin in the game". Combat "risk" or "responsibility" is not the same, and RPA pilots should never be given the same prestige as those who flew and had "skin in the game." I'm not saying their job isn't demanding, difficult, stressful, etc, just like fighter pilots, but there is a clear distinction that even the general public readily understands (Blair, 2012).”

These comments are not unique to this article, but can be seen readily throughout RPA discussions, from articles on RPA missions in Pakistan to debates over the Distinguished Warfare Medal. To extend McClosky’s metaphor, the fact that the school’s staff doesn’t believe the jocks are bullying the AV club is not sufficient evidence to say it is not occurring.

The debate over the mission and creed of the Air Force illustrates that the service today is torn between being a service of “warriors” and a service of “military professionals.” The former focuses on heroism and sees itself as a caste which exists for warfighting and winning battles; the latter sees itself as a profession responsible for the judicious use of force to achieve policy objectives. The targeting revolution promises the ability to perform the latter, but requires an organizational philosophy which is in many ways incompatible with the former without clear delineation between the potential complementary roles of the two functions. This challenge manifests itself with the dilemma over career progression and recognition of RPA operators, but
these are just two visible strains that the targeting revolution poses to modern military services.\textsuperscript{164}

As it relates to RPAs, the cultural conflict within the Air Force over its identity is two-fold – How will the technology and mission sets available impact future cultural dynamics and shape the overall mission of the Air Force, and conversely how big a threat is an Air Force that increasingly takes over the supported role in counterterror operations under the Biden Plan to other priorities like strategic bombers and major theater war planning? In these campaigns, the Air Force faces the challenge of building a warrior ethos based around traditional notions of valor as it increasingly fields a force of advanced technologies which in many cases remove the valor element from war fighting. At the same time, the Air Force of the future must be able to deter against hegemonic war, rapidly gain air superiority against potential nation-state opponents both to deter and fight as necessary in state-on-state wars, and increasingly develop precision engagement and strategic targeting plans in both permissive and non-permissive environments. This is necessary assure full spectrum dominance in future engagements, but each mission comes with cost tradeoffs. Further, this only speaks to air missions, which constitute only one third of Air Force operational domains.

In this light, the targeting revolution poses a significant challenge to the Air Force as it has transitioned from a strategic mindset, toward a tactical combat warrior ethos mindset, and now rapidly back towards a strategic reaction and deterrence force. In doing so, it must both emphasize the active role it plays, but speak more broadly to the range of tools at its disposal. I propose the true mission of the United States Air Force should read:

\textsuperscript{164} The Air Force is spotlighted in this text, but to a degree the same internal challenges are posed to all services as aspects of the targeting revolution are integrated into their systems of warfare.
"The mission of the United States Air Force is to deter and defeat threats to the United States of America through the control and exploitation of air, space, and cyberspace."

This is in part a throwback to the mission statement pre-2005, which emphasizes the three main domains in which the Air Force operates, and a broad notion of control and exploitation beyond simply flying, fighting, and winning. The mission also differs from the old mission statement in that ‘defend’ is replaced with ‘deter and defeat,’ based on the difference between deterrence and defense as well as the proactive role the Air Force often plays in combating threats through direct engagement – defeating a threat is distinct from “winning” in that it can be defined in terms of specific threats with measurable results, while winning remains a more ambiguous concept.

At the same time, the Air Force must refocus on what it means to be an airman and what the warrior ethos must look like from an airman’s perspective. The Air Force has fought accusations for much of its history that it is too technical, too corporate, and lacks the traditions of valor that tend to dominate the identity of other services. The evolution of the Air Force Mission and the Airman’s Creed were intended to refocus the Air Force on its war fighting mission as airmen increasingly found themselves involved in joint and tactical environments, but possibly at the expense of broader mission effectiveness. Airpower advocates from the beginning argued for an independent Air Force because it was something fundamentally different, that operating in the third dimension of air (and now in the added domains of space and

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165 Defense consisting of actions taken once an attack is underway or measures taken for protection in anticipation of an attack, while deterrence consists of threats of force designed to dissuade an adversary from attacking. The defense role is included within the definition of ‘defeat’ in this mission statement given the tools the Air Force would use to protect the United States from an active attack.
cyberspace) alters not just the way wars are fought, but the mindset of those fighting in those domains and the means to achieve victory.

As Meilinger noted of Douhet, he saw airmen as stoic professionals who went about their daily business in an unremarkable way, not the knights of a new era of war. Mitchell wrote at length about what he called ‘air-going people,’ dominated in his era by pilots, who once they gain control of the air are in a position to force an enemy to defend territory at the will of the attacker (Mitchell, 1925, pp. 7-10). This represents a fundamentally different view of war from that of the warrior ethos, as rather than elevating the honor of an adversary it sees them as a temporary impediment to the real mission. Warden and Deptula expanded on this by placing the emphasis on tactical actions to achieve strategic effects, a process that fuses intelligence and operations in a way that can achieve greater impacts with less combat risk. This sophisticated perspective of the battlespace understanding the adversary and exploiting systems defines war in air, space, and cyberspace, and must be the hallmark of the air warrior’s ethos.

**Summary**

Though possibly the most understudied\(^{166}\) part of the RPA innovation and the targeting revolution more broadly in the existing academic literature, the organizational challenges posed by the targeting revolution in many ways exceed those of technological and doctrinal development. Organizations are often a significant barrier to technological innovation as noted in Chapter 4, and both the U.S. Air Force and U.S. Navy have shown institutional resistance to adoption of RPAs, both overtly through procurement and statements of officials and

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\(^{166}\) There are many opinion pieces and casual references to these challenges by pundits and observers when commenting on the implications of RPAs, but little in the way of significant research in academia on this aspect of organizational change.
organizationally through the promotion and decoration processes. The post-911 emphasis on creating a “warrior ethos” largely synonymous with personal courage in battle is equally problematic as, in an era when the Air Force is increasingly positioned to fight the ‘far war,’ that system of warfare is marginalized by the culture of the institution.

The main innovations of the targeting revolution as employed by the United States have been in the form of expanding the operating environment through providing the capability to analyze the adversary and control operations from the continental United States, the process known as “reachback.” This in some cases reduces the forward presence which is subject to hostile fire, but requires significant technological and manpower infrastructure to lead to effective operations. This has the effect of shifting the traditional operations/support balance of military forces with the number of forces in battle declining and the support infrastructure dramatically rising, and it reshapes notions of what constitutes “combat forces.” The RPA operator can be flying a mission out of Nevada, while their maintainers are at forward bases in greater harm’s way. The communications and intelligence personnel work around the clock gathering and analyzing data and communications, in effect making the combat decisions for the operator. All of this represents a significant shift from how air combat performed even during Desert Storm.

These organizational shifts pose long-term organizational challenges to military services given the current criteria for promoting and recognizing service members, both of which are largely built on the industrial era of warfare. Within the Air Force, there exists today a glass ceiling for RPA pilots similar to what has existed in the past for space, intelligence, and other career fields. Such systems are a detriment to the assimilation of the specialty into the broader service, and could potentially lead to the U.S. falling behind other states in advancing RPA
technologies and doctrines. The promotion process is hampered in part by requirements for command, and in part by the recognition process for RPA operators.

Courage was likely heavily correlated to military performance under Biddle’s Modern System and before given the role of individuals on the battlefield under fire in determining the outcome of battle. As the battlefield has shifted to a networked approach, particularly in the air domain, courage is almost incidental to military success, with many almost being as symbolic of a breakdown in the system allowing soldiers to fall into a bad situation as much as their courage in saving individuals in the process. I believe a clear delineation between valor, achievement, and meritorious service awards at all levels of the pyramid of honor with clear criteria for each are part of the ultimate solution, but ultimately any major revisions must be done internally by the Department of Defense, as part of a broader conversation on what it means to be a military professional versus a warrior in today’s military system.
Chapter 5: Evaluating the RPA in Small Wars

Having evaluated the development of the targeting revolution and how the RPA fits in with the numerous innovations, this chapter evaluates the debates surrounding the effectiveness of the RPA in its potential uses. To evaluate the utility of the RPA, I look first at the cost argument, then the arguments for strategic effectiveness of the U.S. RPA program in the war on terror, and finally at arguments surrounding ‘blowback,’ or mass popular resentment of strikes, rendering them counterproductive. Overall, I find that RPAs are not significantly cheaper than manned aircraft to operate, and over time are likely to become more expensive given both the numbers to be procured and the more advanced missions for which future RPAs are likely to be used. In terms of military effectiveness, RPAs have characteristics which should make them less likely to result in civilian casualties than alternatives, but operational employment is a critical factor which appears to have varied over time. RPAs have been shown to be effective in ‘high value targeting’ with clear signs of tactical gains, but less clear has been the ability to exploit those gains for strategic success.\textsuperscript{167} RPAs do not appear to cause significantly more civilian casualties than strikes conducted by manned aircraft, and the argument that RPAs produce "blowback" is difficult to sustain on the evidence.

\textsuperscript{167} I make no distinction here between ‘counter-terror’ and ‘counter-insurgency’ as the quantitative methods employed to measure the success of strikes have focused almost exclusively on tactical success, for which there is little difference between the two. Strategic exploitation, which goes to information campaigns and follow-up missions, will vary significantly between ‘counter-terrorism’ and ‘counter-insurgency’ and are discussed qualitatively.
The Cost of RPAs

The successes of Predator in Yugoslavia and early Afghanistan campaigns renewed U.S. interest in RPAs, with numerous platforms springing up in the following years to cover an array of missions, from tactical (battlefield) ISR, to strategic ISR and expanded attack roles. Table 16 outlines several of the most prolific RPAs in the US inventory today, but this list is by no means exhaustive. Globally, most growth in RPAs has to date been with tactical RPAs, as these systems can be controlled by local commanders through line-of-sight communications, and their utility is directed primarily at support for forces in a traditional military operating environment. This requires little in the way of doctrinal revision, and while it adds a significant capability in terms of ISR collection and ability to engage in tactical strikes against fielded forces, the result is not revolutionary. Tactical RPAs fill a role similar to helicopters in most cases, with a tradeoff often made in higher cost in exchange for the lack of an onboard operator (Table 16 shows the example cost of the Fire Scout helicopter as just over $18 million for one system, an MH-6 Little Bird, by comparison, is estimated to cost just over $2 million (Kress, 2005)).
### Table 16: Examples of U.S. RPAs

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<tbody>
<tr>
<td>Role</td>
<td>Low-altitude tactical ISR</td>
<td>Tactical ISR and battle mgmt.</td>
<td>NRT high resolution ISR, Persistent maritime ISR</td>
<td>ISR, targeting, forward air control, laser des., weapons delivery, BDA</td>
<td>No longer in production</td>
<td>Tactical RPA for ISR, targeting acquisition, and attack</td>
<td>Flight Test Quick-response armed recon.</td>
</tr>
<tr>
<td>Cost</td>
<td>$34,000/ acft</td>
<td>$10.3M /acft</td>
<td>$46.4M - $80M /acft (multiple variants)</td>
<td>No longer in production</td>
<td>$4.33M/ acft</td>
<td>$11.38M/ acft</td>
<td>$35 mil/ acft</td>
</tr>
<tr>
<td>Max Alt.</td>
<td>500 ft</td>
<td>20,000 ft</td>
<td>65,000 ft</td>
<td>25,000 ft</td>
<td>29,000 ft</td>
<td>50,000 ft</td>
<td>Flight Test Quick-response armed recon.</td>
</tr>
<tr>
<td>Max Endurance</td>
<td>90 min</td>
<td>8 hrs</td>
<td>36 hrs (24 on station)</td>
<td>40 hrs</td>
<td>25 hrs</td>
<td>27 hrs</td>
<td>Flight Test Quick-response armed recon.</td>
</tr>
<tr>
<td>Max Speed</td>
<td>44 KTAS</td>
<td>110 KTAS</td>
<td>340 KTAS</td>
<td>120 KTAS</td>
<td>167 KTAS</td>
<td>240 KTAS</td>
<td>Flight Test Quick-response armed recon.</td>
</tr>
<tr>
<td>Range (ISR)</td>
<td>7.5 mi</td>
<td>127 mi</td>
<td>&gt;10,000 mi</td>
<td>2 Hellfire missiles</td>
<td>1075 lbs 4 Hellfire missiles</td>
<td>3,750 lbs 14 Hellfire or 4 Hellfire &amp; 2x GBU-12 or 2 JDAMs</td>
<td>3,500 lbs internal payload Six external hardpoints</td>
</tr>
<tr>
<td>Payload (Attack)</td>
<td>High resolution, day/night camera and thermal imager</td>
<td>600 lbs EO/IR sensor and laser</td>
<td>HISAR sensor system, EO/IR Imagery, FMV</td>
<td>EO/IR video cameras, laser designators, may be equipped with Lynx Multi-mode Radar</td>
<td>EO/IR with laser designation, SAR, communications relay</td>
<td>EO/IR, Lynx Multimode Radar, multi-mode maritime surveillance radar, ESM</td>
<td>Multiple sensors, likely mirroring Predator B.</td>
</tr>
<tr>
<td>Collection Capabilities</td>
<td>High resolution, day/night camera and thermal imager</td>
<td>600 lbs EO/IR sensor and laser</td>
<td>HISAR sensor system, EO/IR Imagery, FMV</td>
<td>EO/IR video cameras, laser designators, may be equipped with Lynx Multi-mode Radar</td>
<td>EO/IR with laser designation, SAR, communications relay</td>
<td>EO/IR, Lynx Multimode Radar, multi-mode maritime surveillance radar, ESM</td>
<td>Multiple sensors, likely mirroring Predator B.</td>
</tr>
</tbody>
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168 Unless otherwise noted, information from US Air Force Raven Fact Sheet (Raven)
169 Unless otherwise noted, information from BGA Aeroweb (Oestergaard, MQ-8 Fire Scout, 2012)
170 Unless otherwise noted, information from BGA Aeroweb (Oestergaard, RQ-4 Global Hawk, 2012)
171 Unless otherwise noted, information from General Atomics Predator factsheet (Predator)
172 Unless otherwise noted, information from General Atomics Gray Eagle factsheet (Gray Eagle)
173 Unless otherwise noted, information from General Atomics Predator B factsheet (Predator B)
174 Unless otherwise noted, information from General Atomics Predator C factsheet (Predator C)
175 Information from BGA Aeroweb (Oestergaard, RQ-11 Raven, 2012)
176 Cost is for aircraft, estimate (Predator C At Sea, 2009).
Strategic RPAs require a significant investment in infrastructure and organizational change to enable effective operations. Calculating cost advantages of these RPAs versus fixed wing aircraft is often complicated by faulty comparisons as the Predator was built for a unique mission, not to replace a particular airframe. It is slow at 135 mph and carries no defenses, making it a target in most environments without air superiority. Despite these characteristics, it is often compared to the F-22. Michael Horowitz notes, when warning about the potential for diffusion, that “high-end estimates for the MQ-1 Predator drone place the production at about $6 million per plane (a system including four planes costs around $30 million), compared to over two hundred million dollars per F-22 (Horowitz M. C., 2011, p. 221).” P.W. Singer and Medea Benjamin make similar comparisons in their discussions of the disruptive nature of RPAs. The F-22, however, is a fifth generation fighter capable of supercruise with the most sophisticated air-to-air capabilities on earth, hardly a valid comparison to the Predator.

A better comparison would be against the proposed Textron AirLand, designed as a cheap air-to-ground alternative to advanced fighters using existing technologies. Though a formal cost estimate has not been released, it will be capable of flying similar missions to the Predator (although at higher speeds) with a desired cost of 1/10 the price of an F-16 per flight hour, or about $2,500 per hour (Lendon, 2013). This would place it as lower than the cost for the MQ-9 Reaper, which averages $3,253 per flight hour (Selected Acquisition Report: MQ-9

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177 Electro-optical/Infrared
178 Hughes Integrated Surveillance & Reconnaissance system; lower-cost derivative of Raytheon’s Advanced Synthetic Aperture Radar ASARS-2 package
179 Synthetic Aperture Radar
180 Electronic Support Measures
181 Reviewer Charles Westenhoff noted another possible equivalent manned aircraft might be the Vietnam-era O-2. It had about 5 hours of station time without auxiliary tanks and four weapons stations. Overall cost for the system would be under $500,000 with operating cost around $300/hour.
Reaper, 2011, p. 37). The per-hour number is also deceptive given the high number of hours flown per tail, which dilute the maintenance costs associated with the airframes. As one report on the issue from Time Magazine note, “If the calculation is for total maintenance costs over the course of a year for a Reaper unit, the relationship changes: at a per year cost of $5.1 million, per individual Reaper, and at $20.4 million per CAP, the Reaper shows itself to be well above the cost to maintain and operate over a year for an individual A-10C (at $5.5 million) or an F-16C (at $4.8 million). Annual operating unit cost for a Reaper unit is about four times the annual cost to operate an F-16 or an A-10 (Wheeler, 2012).”

It is for these reasons that when persistent coverage is not required, both the Army and the Air Force operate manned alternatives to Predator-variant ISR platforms, such as the MC-12. Directly compared the per-unit costs of the MC-12 and RQ-1 appear similar, with the MC-12 system costing $17 million (MC-12 Factsheet) for one aircraft and all support and sensor systems, and the MQ-1 system costing $20 million for four airframes and support infrastructure (MQ-1 Predator/MQ-9 ReaperFact Sheet). A direct comparison of these airframes is complicated by the mission set, with the RPAs designed for continuous operation over a given area and the MC-12 designed for specific short-duration mission requirements. In this light, Predator and Reaper look cheap because they are the only aircraft currently designed to perform their particular mission sets, because the long-term nature of the mission is one that is unique to RPAs. RAND noted a similar finding when analyzing the potential for RPAs in logistics missions, noting conditions under which RPAs would be more or less favorable for missions based on cost considerations among a number of other factors, as shown in Figure 19.
The Global Hawk versus U-2 comparison provides another alternative to the MQ-1 versus F-22 comparison that is often used, given that the Global Hawk was designed as a replacement for the U-2. Having first flown on February 28, 1998 and becoming operational in 2000, Northrop Grumman’s variants of the RQ-4 have to date flown over 100,000 hours, with the Air Force Global Hawk variant flying over 88% of those hours (Hoarn, 2013). In discussions with operators of the RQ-4 from the 13th Reconnaissance Squadron at Beale AFB, CA, I generally heard the RQ-4 likened to a satellite capable of remaining over the same portion of the earth for an extended period of time. Thus, it provides capabilities between that of a satellite and a U-2, which can provide similar products but is limited in time on station. A comparison of these capabilities, compared also to other notable RPA platforms, is shown in Figure 20.

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182 Chart derived from RAND Report *Unmanned Aircraft Systems for Logistics Applications* (Peters et al, 2011, xv), modified to replace references to UAS as RPAs for consistency.
183 Geosynchronous orbit satellites have this capability but only in locations near the equator and orbit at over 22,000 miles, creating extreme challenges for sensors.
Outfitted with a Hughes Integrated Surveillance & Reconnaissance Sensor System (HISAR), the Global Hawk trades a slightly inferior sensor for extended persistent coverage and the lack of an on-board operator. This was part of a cost-savings effort to make RQ-4 more competitive with U-2, which resulted in a significantly reduced payload (3,000 lbs vs 5,000 lbs) and the reduction of other features such as a de-icing system. The RQ-4 is also considered inferior to U-2 by analysts due to its lack of defensive mechanisms, its lower speed, and its reliance on data link connectivity to sustain missions, all of which hinder its performance in theaters such as the Pacific where weather is a significant challenge and where collection targets are better defended (Thompson, 2014). Thus, based on requirements, outward appearances, and attempts to make RQ-4 a U-2 a replacement for U-2, the RQ-4 is in many ways an ideal candidate for a cost comparison to show the relative tradeoffs between manned and unmanned variants based on operations and procurement. However, direct comparison remains difficult as many of the official numbers surrounding U-2 are classified. Indirectly, we have numerous statements and official documents on procurement and debate over cancelling RQ-4 variants which suggest the cost savings are minimal at best for at least some variants.

In 2012 the Air Force cancelled the Block 30 RQ-4\(^\text{184}\) citing higher than anticipated costs and failure to meet operational expectations. “Although cost was a key element in the cancellation decision, the RQ-4 had also not performed to expectations. Initially, the Global Hawk was seen as a viable replacement for the long-lived U-2 manned jet. Anticipated cost savings hoped to be realized in fielding the RQ-4 as a replacement for the U-2 never materialized (Dudley, 2012).” The Block 30 had only reached operational status the preceding August, and

\(^{184}\)“Block 20 aircraft are equipped with an enhanced imagery intelligence payload, block 30 aircraft have both imagery and signals intelligence payloads, and block 40 aircraft have an advanced radar surveillance capability (Defense Acquisitions: Assessment of Select Weapons Programs, 2013, p. 190).”
saw action over Libya shortly thereafter. Despite this, Congress mandated the Air Force continue to fly Block 30 through 2014, with the Air Force investing more in the newer Block 40 variant for future orders. Despite the cost overruns of the Block 30 relative to expectations, the Department of Defense expressed optimism that lessons were learned that would enable lower costs of Block 40 sufficient, with the increased collection capabilities of the airframe, to make it a viable alternative to U-2 once on-line (Defense Budget Priorities and Choices, 2012, p. 11). Indeed, by September of 2013, the U.S. Defense Department reported that program changes had reduced the operating costs of Global Hawk by 50% between 2010 and 2013 (Shalal-Esa, 2013).

**Figure 20: Comparison of Global Hawk Flight Characteristics**

Table 17 shows the relative cost comparisons of the RQ-4 Global Hawk to the manned U-2, while Figure 21 provides a side-by-side comparison of the Global Hawk with the U-2 and

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185 Derived from slide provided by 13th Reconnaissance Squadron in unclassified mission briefing (Bellissimo, 2010)
the Boeing 737 passenger aircraft. Given new operating procedures the costs of operating the RQ-4 have been lowered significantly, the hourly cost of operating the airframe remains just over half of the cost of the manned U-2, which also has the benefit of higher airspeeds to reach potential targets and a superior sensor. Thus, the main tradeoff for the Global Hawk is quality of product (minor, but conceivably critical in some environments) and speed (420 mph vs 350 mph) for persistent coverage (36 hrs versus 8-12 hours).

Table 17: U-2/RQ-4 Cost Comparison

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<thead>
<tr>
<th></th>
<th>Procurement Cost</th>
<th>Flight-Hour Cost</th>
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<tbody>
<tr>
<td><strong>U-2</strong></td>
<td>Classified/no longer in production</td>
<td>$31,000&lt;sup&gt;186&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Global Hawk (2010)</strong></td>
<td>$46.4-80 million</td>
<td>$40,600&lt;sup&gt;187&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Global Hawk (2013)</strong></td>
<td>$46.4-80 million</td>
<td>$18,900</td>
</tr>
</tbody>
</table>

Figure 21: Size comparison of RQ-4 Global Hawk with U-2 and Boeing 737

<sup>186</sup> Information from DailyTech report (Hatamoto, 2011).
<sup>187</sup> See Shalal-Esa (2013) for Global Hawk flight-hour costs.
The key takeaway is that similar capabilities require similar airframes in terms of size and cost once the capability desired exceeds the size of a pilot on-board. The human pilot and the life support mechanisms associated with the cockpit matter when the sensor payload suite is small as is the case for tactical RPAs with simple electro-optical cameras and line-of-sight links to controllers, but is relatively insignificant for strategic collectors of multiple intelligence sources. A remotely-piloted U-2 will look and cost something very similar to a manned U-2, just as a remotely piloted F-22, something akin to the X-45/47 UCAV, will cost similar to and be approximately the same size as a manned F-22. These examples show there are tradeoffs between airframes for similar missions, furthering the conclusion that RPAs and manned airframes should be complementary airframes for different mission sets, remotely piloted when duration is the critical factor, manned in most other cases.

The RQ-4 Global Hawk also demonstrates the complexity of the larger strategic RPAs compared to smaller, tactical RPAs which have more widely proliferated. Strategic assets like Global Hawk and Predator/Reaper rely on satellite infrastructure for long-range missions, the types of missions that provide Predator and Reaper with a relatively unique capability. Figure 22 illustrates the global communications infrastructure required to operate the Global Hawk; a similar system exists to support Predator and Reaper as was discussed in Chapter 4. With tactical RPAs, the platform has utility as a stand-alone. With strategic RPAs, the platform is of limited benefit without the network.
The prospect of RPAs as a cheap alternative to modern air forces is a common refrain of those concerned with the rapid proliferation of RPAs as previously noted, but a head-to-head evaluation of tactical RPAs to similar tactical aircraft, as well as the strategic RQ-4 versus the U-2, shows that in many cases these cost savings are minor to nonexistent, with RPA technology in many cases being more expensive. Additional insights may be gained from examining the record of accidents involving RPAs in comparison to other airframes.

Figure 23 shows the number of U.S. Air Force Class-A Mishaps\textsuperscript{188} involving fixed-wing aircraft from 2001 through 2012. As the number of operational Predators and Reapers rise and as the ops tempo also increases from 2006 through 2012, there is a clear correlation with a higher number of Class A mishaps, with RPAs, and predominantly MQ-1 Predators, accounting for

\textsuperscript{188} Signifying total loss of the airframe, a fatality, or over $1 million in damages
approximately half of all Air Force Class A mishaps in recent years. At the same time, the reported mishaps for other airframes, notably close air support assets like the F-16 and the F-15E, saw their numbers of mishaps decline as MQ-1 mishaps rose. This could indicate that as the MQ-1/MQ-9 is increasingly taking on roles previously conducted by manned airframes, the types of airframes involved is simply changing as well.

**Figure 23: USAF Class-A Mishaps, 2001-2012**

![Figure 23: USAF Class-A Mishaps, 2001-2012](image)

Figure 24 addresses this issue by comparing airframe mishap rates based on the cumulative hours flown by the airframe. Predator, in this comparison, is for the most part on target with the F-16 in mishaps, while Global Hawk appears to be on roughly the same trend as U-2. The sharp increase in RPA flight hours, thus, may account for the appearance of a higher mishap rate relative to other aircraft. As with budgeting, however, higher hours per sortie may mask the issue as fewer mishaps tend to occur in sustained flight compared to takeoff and

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landing. A comparison of airframe mishaps per sortie may thus be a better comparison but such data is currently unavailable. Smaller RPAs, such as the Pioneer and Shadow, fare significantly worse. The issue could also be reflective of commanders willing to take greater risks with RPAs than with manned aircraft, which would be a function of the employment of the technology rather than the technology itself. Peter Singer, in public interviews, has noted receiving briefings where he was told that RPAs were intentionally left over a target area despite being low on fuel because the target was deemed to be that valuable, a risk that would likely not be taken with a manned asset (Subbaraman, Drones crash (a lot) but the military's safety lessons may help civilians, 2013). If this is the case, the added safety to aircrew from RPAs is coming with a tradeoff of higher costs for procurement and sustainment.190

Figure 24: Class A or B Mishaps per 100,000 hours comparison191

190 Charles Westenhoff noted in my conversations with him that this is a limitation on the U.S. that won't be a limitation on many other states. African states and Middle Eastern states such as Iraq are using cheap manned platforms to fill similar ISR requirements at lower costs than RPAs such as Predator. Even relatively advanced RPA states such as Israel have relied on similar cheap manned platforms for a number of missions.  
Many tactical RPAs have no manned alternative for direct comparison, which clouds the issue of costs but again highlights the complementary roles of RPAs versus manned aircraft. As with Predator, many small RPAs exist because they fill a mission that is not feasible with manned alternatives as the aircraft is too small, and in many cases would be unacceptable as the aircraft would be too vulnerable vice the potential gains for the mission. Such RPAs, while carrying a low per-unit cost, must be procured in higher numbers both to be employed on a scale to be effective and to replace those that are destroyed as they are operating in dangerous environments. Figure 25 illustrates this issue showing the requirements for types of RPAs procured by the U.S., with tactical RPAs purchased in significantly higher numbers.

**Figure 25: US RPA Procurement**

![Graph showing RPA inventory and goal for different models](image)

Pioneer, Shadow, and Hunter, as tactical RPAs, are likely to be both exposed to more hazards that could impair performance due to low flight and might see their ops tempo extended due to needs of mission commanders. Also, due to their smaller airframes, they are more vulnerable to wind, rain, and other weather conditions that limit flight capabilities and could lead to mishaps in the air, a factor that will remain an obstacle as designers pursue smaller RPAs for
tactical missions. The 2005 UAV Roadmap noted that, as of that report, 58% of ground aborts for Hunter were weather-related (Unmanned Aircraft Systems Roadmap 2005–2030, 2005, p. H4). As the Roadmap notes, for those seeking to acquire RPAs who see a potential low initial cost as grounds for such an investment, a higher mishap rate and associated maintenance is likely to erase any potential gains from the lower initial investment.

The cost of the airframe also must be understood in terms of the requirements necessary to allow for its operation. Advanced RPAs such as Predator and Reaper are equipped with all-weather sensor capabilities, but the airframes themselves and their data links are subject to a number of limitations based on weather conditions. Tirpak noted that the U.S. Air Force has never claimed that the Predator or Reaper can fly either in bad weather or contested airspace, two principal obstacles that the service was working to overcome at the time with the next generation MQ-X (possibly with the unmanned variant of the long-range bomber) (Tirpak, The RPA Boom, 2010). A report from the Project on Government oversight in 2002 noted the shortcomings of the Predator in weather, noting that it had a max crosswind for takeoff and landing of 17 knots (compared to 25 for an F-16\(^\text{192}\)) nor in any adverse weather to include any visible moisture such as rain, snow, ice, frost or fog (Fighting with Failures Series: Case Studies of How the Pentagon Buys Weapons - Predator UnManned Aerial Vehicle, 2002). The report further notes that in Bosnia operations from 1996-1997, nearly half of planned Predator sorties were cancelled due to weather.

The challenges posed by weather to RPAs can be illustrated by a series of accidents resulting in loss of airframe. A prominent example came on June 5, 2011, when an MQ-1 Predator operating from Jalalabad lost its satellite uplink in deteriorating weather conditions

\(^{192}\text{F-16 crosswind component chart, available online through Combatsimchecklist.net}\)
while supporting ground operations in Afghanistan. Accident evaluators determined a lightning strike caused the loss of connectivity and the loss of aircraft. This by itself is not particularly shocking, as all aircraft are potentially vulnerable to such weather conditions, but it becomes more problematic given the volume of similar accidents that have been observed involving the MQ-1 and MQ-9. Unacknowledged or not discussed in the report is whether impaired situational awareness or lack of risk of a risk-aware on-board operator caused the Air Force to take additional risks that a manned aircraft would not take. Were this the case, the reduced situational awareness of operators working from a remote digital consul would be a limiting factor on the effectiveness of RPAs vice an operator with full analog, sensory awareness.

Beyond weather and airspace concerns, effective range is a key limitation to many RPAs. In many cases, geography is destiny in warfare, and RPAs are not immune to the challenges of global reach posed to other airframes. While the Global Hawk is capable of long-range operations, the effective use of RPAs in most combat environments requires operations from airfields in proximity to the area of operations to maximize the advantage of persistence. The Air Force lists the range of the MQ-9 Reaper as 1,000 nautical miles and the Predator as 675 nautical miles. This range limitation has necessitated an expansive network of forward bases to enable global strike operations. RPA critic Nick Turse listed in 2011 as many as 60 bases worldwide to support U.S. operations, from Afghanistan and Nevada to the Seychelles and other islands in the Indian Ocean (Turse, Tomgram: Nick Turse, Mapping America's Shadowy Drone Wars, 2011). Sustainment for such operations is thus not merely a function of the platform, but the international cooperation and investment that may be necessary to secure such basing rights.

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194 From the relevant Air Force fact sheets.
A naval alternative launched from a carrier may provide a future alternative to this basing challenge, but this would likely come at a significantly higher cost.\textsuperscript{195}

Another limitation with the widespread use of tactical RPAs is the prospect of either information overload or tunnel vision based on overreliance on a sensor that, by itself, only has a narrow view of the operational environment. Effectively using systems requires multiple intelligence sources working together to cue a sensor to its target. In close battle, these sensors can be directed based on ground forces to key positions on the battlefield that troops and commanders identify, but without outside sensors or other forms of cueing, attempting to conduct broad surveillance with such a platform would be searching for a needle in a haystack. If a commander attempted to field a fleet of such sensors without the strategic network to aid in processing and analyzing the data, the commander would quickly be overwhelmed without guidance on what constitutes the critical information for which he/she should be looking. This capability, when used effectively, could be decisive in swaying a battle. But increased intelligence of a battlefield is not a virtue by itself, and the quest for further intelligence and waiting until a clearer picture of the battle emerges can also be a handicap that leads to decision paralysis.

Overall, the RPA as it exists today has a number of hidden costs which make a simple comparison of an RPA airframe to a manned airframe generally faulty. Many concerns about the proliferation of RPAs stem from a blending of concerns of the costs of low-end tactical or private commercial RPAs to the capabilities of advanced strategic RPAs. These comparisons overlook the costs of networking, basing, sensors, and precision munitions that make the latter expensive and the reliability, vulnerability, range, payload and capabilities limitations that make the former cheap. Combine that with weather obstacles, accident history, and the propensity for overuse by

\textsuperscript{195} See O’Hanlon’s comparisons of the cost of land-based aircraft to carrier aviation in \textit{The Science of War}.\textsuperscript{195}
operators that has been seen historically and the per-unit costs of RPAs rise rapidly. Of the potential virtues of RPAs for military purposes, low cost is not among the highest virtues.

**The Military Effectiveness of RPAs**

The preceding chapters outlined a probable strategic process, rooted in airpower doctrine, which frames the use of RPAs in U.S. operations worldwide. Although it provides a logical rationale for the use of RPAs in the targeting process, it leaves open the question of the net effect of those operations. This is a subject of intense debate, as this section will detail. As most U.S. RPA operations are covert and largely not discussed by U.S. leadership, firm data to analyze strikes for cause-effect relationships in terms of insurgent activity levels is difficult to ascertain, leaving a variety of independent groups to gather and evaluate data independently. This has led to many contradictory reports on the net effectiveness of RPA operations.

This section will briefly outline the major debates on RPA effectiveness and examine the issues facing independent analysts who are evaluating the RPA campaign. In evaluating the effectiveness of RPA operations, it is difficult at times to separate the debate on the military value of airstrikes with the legal debate on what constitutes a legitimate target based on the question of whether territories outside Afghanistan constitute war zones. Of more immediate concern is whether or not strikes result in the creation of more adversaries, and with it a greater strategic threat, than they destroy. This is the essence of the “blowback” argument, which holds that RPA strikes increase insurgent recruiting and undermine the legitimacy of the government or coalition.

The debate today is complicated by a lack of concrete data available. Data collection is impeded in active war zones by a variety of factors, to include the U.S. classifying its own data
on operations, to researchers being limited in their ability to collect data first-hand, and to active agendas on the part of all parties to conflicts which may skew what they tell researchers developing qualitative surveys. As a result, analysis is reliant on databases of attacks that are largely in dispute, and anecdotal information resulting from small-\textit{n} surveys. With this as a background, it is important to acknowledge what the key claims are on both sides, and what lessons can be drawn from the information available that can withstand scrutiny.

Throughout this chapter, I outline the underlying surveys and conclusions of a number of observers of the U.S. RPA program, from \textit{Living under Drones} to the New America Foundation. \textit{Living Under Drones}, a project of joint team form the New York University and Stanford Law Schools, is one of the most scathing critiques of the RPA program. Their work, along with the writings of Michael Boyle (a former counterterrorism advisor to President Barack Obama’s campaign team) frames the anti-RPA argument most succinctly, with Boyle also providing what I see as a fair overview of the pro-RPA arguments in his account. He identifies the primary argument in favor of RPAs as stemming from their effectiveness in the war on terror, which in turn can be broken into four sub-arguments (Boyle M. J., 2013, p. 4):

(1) RPAs are effective at killing terrorists with minimal civilian casualties

(2) RPAs have been successful at killing so-called ‘high value targets’ (HVTs)

(3) The use of RPAs puts such pressure on terrorist organizations that it degrades their organizational capacity and ability to strike.

(4) RPAs are less costly than alternative tactics, such as the deployment of ground troops

\footnotesize{These points are derived from statements ranging from Defense Secretary Leon Panetta, to former CIA Director Michael Hayden, to John Brennan.}
Using the 2010 failed Times Square bombing as evidence of blowback, Boyle argues that RPA attacks in Pakistan run counter to U.S. interests because the empirical evidence offered for their success is weak, because they undermine the stability and credibility of our allies, and because the U.S. example of RPAs has ushered in an era of proliferation that will be counter to U.S. long-term interests.

I evaluate these arguments for and against the U.S. RPA program in this section in four broad categories: the expansion of the U.S. conflict, the effectiveness of targeted killing, the risks of civilian casualties, and the risks of blowback. Overall, I find support for the argument that RPAs have been successful in engaging and killing key leaders of al Qa’eda and that the way the U.S conducts its operations without acknowledging them opens it up to heightened criticism and anger within populations. Arguments showing a significant ‘blowback’ effect where opponents become supporters of U.S. adversaries, however, tend to be overstated and with less empirical evidence than there is for success of the program. But, I argue that a revised program with more disclosure that could engage the al Qa’eda information campaign would reduce the risks of what blowback may be occurring. The issue of the precedent is left unanswered in this section, as it is more broadly addressed in the following chapters given the legal issues surrounding the precedents being set and the larger arguments over the real implications of diffusion and future use by other states.

Expanding the War - Alternatives to RPAs Considered

A key element to Boyle’s opposition to the RPA campaigns in the war on terror is the notion that the alternative to RPAs would be largely diplomatic, under the assumption that areas outside of Iraq and Afghanistan are outside of zones of active conflict. In contrast, I argue that
this is a flawed assumption and we must evaluate whether or not similar strikes would be undertaken outside were RPAs not available as an option. This must be examined as it points to the overall strategy pursued by the United States to deal with international terrorism, which in turn frames the debate for analyzing which tools are the most effective means of carrying out this strategy. While Boyle notes that the argument in favor of RPAs is often one of cost, which was discussed in the previous section, he argues this is largely a red herring as alternative military strategies would not be pursued. Rather than modeling special operations raids or strikes by manned platforms as counterfactuals to the RPA campaign, Boyle argues “[t]he US is not formally at war with any of these states and is not legally entitled to use ground forces or air strikes on their territory…The realistic alternatives to drones in these cases range from diplomatic pressure to capacity-building to even covert operations, all of which were employed to some benefit prior to the Obama administration’s escalation of drone strikes in 2009 (Boyle M. J., 2013, p. 13).” By reversing the argument and downplaying the importance of the counterfactual debate, it allows critics of the RPA program to point to the potential flaws in the program without analyzing alternatives in detail, assuming instead that the alternative would inherently be diplomatic. This is a problematic argument on multiple accounts.

Boyle argues that were RPAs not used the U.S. would not be extending the war to Pakistan under Obama’s watch because it would be “outside a theatre of active combat (Boyle M. J., 2013, p. 12).” Boyle subtly lays the ground work with his reminder in the introduction that when “President Obama came into office, he pledged to end the ‘war on terror (Boyle M. J., 2013, p. 2).’” While that is an accurate statement to a point, it omits the broader context of how then-Candidate Obama intended to do so. In August 2007, then-Senator Obama spoke forcefully about the need to strike at al Qa’eda targets in Pakistan, stating, “I understand that (Pakistan)
President Musharraf has his own challenges. But let me make this clear. There are terrorists holed up in those mountains who murdered 3,000 Americans. They are plotting to strike again. It was a terrible mistake to fail to act when we had a chance to take out an al-Qaida leadership meeting in 2005. If we have actionable intelligence about high-value terrorist targets and President Musharraf won't act, we will (Obama "suggested bombing Pakistan.", 2008).”

President Obama expanded on this point emphasizing he would end the war in Iraq in order to refocus on al Qa’eda in Afghanistan and Pakistan (Holland, 2007). This was not a passing sentiment either, as he reiterated in a key policy speech on ending the Iraq War in July 2008. “The greatest threat to that security lies in the tribal regions of Pakistan, where terrorists train and insurgents strike into Afghanistan. We cannot tolerate a terrorist sanctuary, and as President, I won’t. We need a stronger and sustained partnership between Afghanistan, Pakistan and NATO to secure the border, to take out terrorist camps, and to crack down on cross-border insurgents. We need more troops, more helicopters, more satellites, more Predator drones in the Afghan border region. And we must make it clear that if Pakistan cannot or will not act, we will take out high-level terrorist targets like bin Laden if we have them in our sights (Obama’s Remarks on Iraq and Afghanistan, 2008).” Once elected, Obama announced a new strategy for Afghanistan and Pakistan, declaring the issue of al Qa’eda to be a regional one that affects both countries, that the U.S. would seek to pursue and dismantle the organization where it existed, and that the U.S. would do what it could to work with partners in both Pakistan and Afghanistan to achieve that end (Lee J., 2009).

A final issue to examine is the contention that RPAs versus diplomatic and covert operations is an either/or proposition. In reality, all indications are that diplomatic and covert operations continue even as the RPA strikes have escalated. The Special Operations raid on
Osama bin Laden’s compound is the most visible example, but there have also been reports of U.S. Special Forces in Pakistan training Pakistani forces (Griffin, Herridge, & Turner, 2011) and other cross-border activity. One report from late 2010 suggested that just as RPA strikes in Pakistan were peaking, U.S. officials were seeking to increase Special Operations raids into Pakistan. Administration officials had been reluctant prior to this point to authorize an increase “because of fears of provoking a backlash (Mazetti & Filkins, U.S. Military Seeks to Expand Raids in Pakistan, 2010).” The New America Foundation notes that missiles and other aircraft have been used in targeted strikes in Yemen, while AC-130 gunships and other manned airframes have been used in Somalia. Further, as Boyle notes, diplomatic and covert operations were already underway to an extent when Obama came into office. Clearly, however, President Obama felt that the operations underway at the time he came into office were insufficient and in need of a significant policy shift. Simply doubling down on the existing policy could never be considered the counterfactual in this situation.

From the onset, it was clear President Obama intended to expand military operations to more aggressively target al Qa’eda and allied organizations in Pakistan, with the goal of degrading the strategic threat of al Qa’eda through attacking its key leadership. While the specific legal issues surrounding the President’s authority to extend combat operations to new theaters and the issues of defining combat and non-combat employments of RPAs remains and will be discussed in greater detail in Chapter 9, it is difficult to argue that President Obama did not fully intend to expand operations against al Qa’eda with or without the RPA. The critical questions became the extent and the best tool for the mission, both in terms of achieving the desired tactical objectives and reducing collateral damage.
Targeted Killing

As described in the preceding chapters, the primary utility of strategic RPAs in conflict is their ability to engage in precision strikes against human targets, which is most likely to be effective against leadership targets in small wars such as counterinsurgency and counterterrorism. \(^{197}\) To evaluate their effectiveness is thus twofold, evaluating the utility of strategic targeting itself and evaluating the ability of RPAs to engage in this type of targeting versus alternatives.

The phrase “targeted killings” is a relative new phrase in the lexicon of conflict. A United Nations report on the topic determined it was first used by Israel in 2000 to justify strikes in the occupied Palestinian territories, and has since been used by Russia to justify strikes on Chechen leaders (2002), Sri Lankan against LTTE operatives from 2003-2008, and the United States as part of the war on terrorism (Alston, 2010, p. 4). Although the term itself is new, the concept is not and has taken on a number of forms both within and outside armed conflict for decades, with the most famous incident possibly being Operation Wrath of God, the Israeli operation which followed the Munich Olympics attack of 1972 \(^{198}\) or the Phoenix Program during the Vietnam War. The use of targeted killings is complicated on legal grounds based on interpretation of what is properly classified as armed conflict and what is classified under international human rights law, which is discussed in greater detail in the next section. For purposes of this section dealing with strategic effectiveness as part of a broader war on terrorism,

\(^{197}\) Various aspects of current U.S. campaigns are interchangeably labeled “counterterrorism” or “counterinsurgency.” Although there are significant doctrinal differences between the terms both in modeling the adversary and understanding the tactics necessary to defeat them, Kilcullen in The Accidental Guerilla makes the argument that, on whole, the U.S. campaign against al Qaeda represents a global counterinsurgency. For the purpose of this document in describing the overall conflict and various adversaries of the U.S., the term counterinsurgency is often used as it is sufficient for the purpose of analysis, while individual strikes on insurgent targets are better classified as counterterrorism per doctrinal definition.

\(^{198}\) Israel itself has never admitted responsibility for the series of killings that followed the attack, but paid compensation to one victim who was in fact a mistaken identity (Abrahamson, 2002).
I include the assumption, made by U.S. policymakers, that the areas of operations discussed constitute conflict zones and thus the laws of armed conflict standards apply, but as I shall discuss the arguments over legality undercut the effectiveness of the program and so clarifying the legal support for the program is ultimately vital.

Within the context of an armed conflict and specifically personality strikes, the definition of a target killing provided by Gary Solis is used for this discussion. Solis defined target killing as those strikes on individuals which meet five criteria: 1. There must be an armed conflict, either international or non-international in character. 2. The victim must be specifically targeted. 3. They must be “beyond a reasonable possibility of arrest.” 4. The killing must be authorized by a senior military commander or the head of government. 5. The target must be either a combatant or someone directly participating in the hostilities.

Daniel Klaidman noted that President Obama’s embrace of targeted killings appeared as one of the central paradoxes of his administration. “By his third year in office, Obama had approved the killings of twice as many suspected terrorists as had ever been imprisoned in Guantanamo Bay (Klaidman, 2012, pp. 117-118).” In principal, this was not a surprise as Obama had embraced the policy position of ‘taking the fight to the enemy’ in the 2008 Presidential campaign, speaking on multiple occasions about the need to attack al Qa’eda leadership in Pakistan when the Pakistanis were unable or unwilling to act. The scale, however, has raised potentially the most questions with respect to the effectiveness of the operations.

Looking at operations in Pakistan, Patrick B. Johnston and Anoop Sarbahi released a paper in February 2012 based on an analysis of open-source reporting from 2004-2010. Their research identifies a negative correlation between violence and the frequency of RPA attacks during the period, suggesting that although violence remains elevated, targeted strikes may be
contributing to the reduction of violence in the area. Using a simple correlation between incidents of drone strikes followed by a panel data analysis with fixed effects and first differenced regression for administrative regions within the FATA, Johnston and Sarbahi demonstrate that, when controlling for local effects, RPA strikes are associated with declines in militant attacks, fatalities inflicted in militant attacks, improvised explosive device attacks, and suicide attacks (Johnston & Sarbahi, 2012).

Although the effects they find are real and significant, Johnston and Sarbahi note that their method of analysis looks solely at tactical, rather than strategic, impacts and that the effects observed were modest in scope. Klaidman largely agreed, noting “[t]here was little doubt that the program was effective as a tactic; drone strikes routinely killed high-value targets on the CIA’s hit parade…the scores of lower- and midlevel militants that were being eliminated devastated al Qa’eda’s morale and seriously diminished its ability to train and plan operations….less clear was the strategic value of the program (Klaidman, 2012, p. 118).”

Anecdotally, Pir Zubair Shah illustrates the potential strategic effectiveness of RPA strikes in Pakistan largely consistent with Johnston and Sarbahi’s analysis. While he notes the conflicted views toward the strikes in Pakistan (both within the government and in the population of the FATA), his interviews with Taliban and other insurgent operatives show the net effect on the organizations. RPAs can be heard from the ground (they are called *bbungana*, or “the one that produces a bee-like sound”), and their flights push Taliban commanders off the grid, as use of electronics or being seen outdoors might make them targets, leading one commander to nap during odd hours, and for fighters to not even sit together to speak in some cases (Shah, 2012). As the prospect of RPA strikes has become accepted as part of the war by insurgents, the mere
threat of force undercuts organization and communication, potentially yielding strategic battlespace impacts.

Documents recovered from the bin Laden raid in 2012 further suggest this strategy was effective in disrupting al Qa’eda in Waziristan, with Osama bin Laden himself citing the threat to al Qa’eda leadership as cause for them either to maintain a low profile to evade detection or to leave the area altogether, and to never meet in visible locations. Bin Laden voiced such concerns in a letter dated 21 October 2010. “Regarding the brothers in Wasiristan [sp] in general, whoever can keep a low profile and take the necessary precautions, should stay in the area and those who cannot do so, their first option is to go to Nuristan in Kunar, Gazni or Zabil. I am leaning toward getting most of the brothers out of the area. We could leave the cars because they are targeting cars now, but if we leave them, they will start focusing on houses and that would increase casualties among women and children. It is possible that they have photographed targeted homes. The brothers who can keep a low profile and take the necessary precautions should stay, but move to new houses on a cloudy day. A warning to the brothers: they should not meet on the road and move in their cars because many of them got targeted while they were meeting on the road. They also should not enter the market in their cars….Note: tell the brothers that the ban is not only to those who come by car. The amir should not meet anyone except the two carriers. The Americans have great accumulative experience in photography of the area due to the fact that they have been doing it in the area for so many years. They can distinguish between houses frequented by men at a higher rate than usual. Also, the visiting person might be tracked without him knowing. This applies to locals too (bin Laden, Letter to Atiyya, SOCOM-2012-0000015, 2010).”
At the same time, it is difficult to credit the RPA campaign with being the key factor in turning the tide of the campaign in Yemen. Yemen may prove a weak precedent due to its own internal weaknesses and overreach which Osama bin Laden himself foresaw. Writing in May 2010, bin Laden expressed reservations about al Qaeda operatives holding territory in Yemen, believing they lacked the administrative and financial resources to control territory. Attempts to exercise control without providing for basic services would discredit the organization, and draw increased opposition from both the Yemeni government and the United States, which in turn would bring about its downfall (bin Laden, Letter to Atiyya, SOCOM-2012-0000019, 2010).

That said, the RPA could magnify the challenges for the al Qaeda’s organization in Yemen by placing local leadership under increased pressure to act against the direction of the al Qaeda leadership in Pakistan and by forcing the replacement of leaders closely tied to the broader al Qaeda network with other, more tactically skilled leaders. This observation relates directly to the issue of leadership replacement, noted by Cronin. The common argument is that target killing is short term as leaders are replaceable and in general are replaced. This claim is in a sense true as another person is generally available to fill the leadership role, but is problematic due to issues over their effectiveness in managing an organization, their strategic versus tactical skills, and when combined with the ‘scatter effect’ noted by virtually all observers that targeted killing leads to diffused networks and reduced hierarchy. These effects combine in many cases to reduce their ability to carry out operations that meet the strategic objectives of the organization at large; an outcome airpower advocates of strategic bombing from Mitchell to Warden to Deptula have long cited as the theory behind leadership and infrastructure strikes.

The scatter effect as it relates to terrorism is closely related to the insights of terrorist organizations as studied by Jacob Shapiro. Shapiro notes that terrorist organizations, to be

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199 This allegation has been repeated by Cronin, Boyle, and other RPA critics.
effective, must calibrate and control the level of violence as violence must be significant enough to be effective, but that mis-targeting or overuse of violence can become counterproductive. To be successful, large terrorist organizations must build bureaucratic networks to control the strategy of the organization while operatives can be empowered to carry out operations (Shapiro, 2013, pp. 3-5). In the case of the al Qa’eda organization, as with most organizations which employ violence (to include conventional militaries), this occurs at multiple levels: al Qa’eda central must control the strategic vision of the worldwide organization and direct/restrain regional affiliates, the regional affiliates must execute strategy within their allotted territories and direct/restrain local cells which carry out strikes. The greater challenge for terrorist organizations not faced by traditional military forces is that the means of control must be kept covert as their disclosure could compromise the entire organization (what Shapiro refers to as the “Terrorist’s Dilemma”). Viewed through this model, breaking the hierarchy of control empowers local affiliates and actors potentially at the expense of the strategic aims of the larger organization as violence can increase to unacceptable levels to sustain the organization.

Yemen provides an example of this lack of strategic focus. In 2010, Osama bin Laden warned against escalation of activities in Yemen, showing bin Laden’s vision of Yemen’s role to the organization. “Yemen represents a focal point in terms of supplies, as a reserve force for the Mujahidin, and it has become a proven fact in military science that in a war between two sides, neither side should commit all its forces to the fight; rather, it is important for a force to remain as a fork with several prongs in reserve (bin Laden, Letter to Atiyya, SOCOM-2012-0000019, 2010).” This message is in line with al Qa’eda’s long-standing strategy of defeating the “far enemy” (the United States and Western globalization more broadly) as being more important than defeating the “near enemy” (local dictators who rule in what Islamists see as an un-Islamic
fashion even while calling themselves Muslims). To fight such a war, some areas, even though they may be potentially strong Islamic states, may be the wrong battlefield in the short term. By breaking al Qa’eda’s central leadership and diffusing fighters, this provides tactical knowledge to make splinter groups more tactically proficient in the short-term, but also has the effect of forcing them to act independently generally fighting the “near enemy,” as is increasingly the case in Yemen, Syria, and elsewhere in the Arab world. This makes them a very dangerous adversary tactically in a number of these locations, but diminishes the strategic threat to the United States.

Leadership replacement also has costs in terms of the knowledge and skills of individual commanders, some of which are learned over time, and some being traits of charismatic leadership. Bin Laden wrote “It is important to have the leadership in a faraway location to gain expertise in all areas. When this experienced leadership dies, this would lead to the rise of lower leaders who are not as experienced as the former leaders and this would lead to the repeat of mistakes. Remind your deputies that all communication with others should be done through letters (bin Laden, Letter to Atiyya, SOCOM-2012-0000015, 2010).” This speaks to bin Laden’s recognizing the learning curve for new leaders and the potential for disruption within the organization as new leaders emerge. Further, the replacement of leaders can lead to institutional upheaval owing to divided loyalties and the potential for organizational changes that come with a significant leadership change. The loss of bin Laden in 2012 led to a leadership transition within al Qa’eda to Ayman al-Zawahiri, whose ability to make the transition some analysts questioned at the time due to divided loyalties.

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200 See The Far Enemy: Why Jihad Went Global for one authoritative summary of this strategy and its history (Gerges, 2005).
If this model is correct, then almost paradoxically the signs that are noted today as representing the failings of the RPA program might actually be the initial signs of strategic success. Increases in high levels of violence in the Horn of Africa, Yemen, and Syria among other locations might be a symptom less of a resurgent al Qa’eda than of one lacking strategic control, placing all reserves in the field. In Yemen, al Qa’eda has apologized for a recent attack on a hospital, which resulted in 52 being killed (al-Sayagh, 2013). In Syria, there have been leadership clashes between al-Qa’eda affiliates Jabhat an-Nuṣrah and the Islamic State of Iraq and the Levant, with al Zawahiri trying but failing to merge the organizations into a single entity (Al-Nusra Commits to al-Qaida, Deny Iraq Branch 'Merger', 2013), and with the Islamic State refusing Zawahiri’s call for disbanding its branch in Syria (Iraqi al-Qaeda chief rejects Zawahiri orders, 2013). In January of 2014, Zawahiri practically pleaded with his subordinates in Syria to get over their infighting and set up a “just Muslim government (Smith A., 2014).” These signs, combined within increased aggression of local affiliates in other areas such as al Shabbab’s mall attack in Kenya suggest an organization increasingly led at the lower levels and losing strategic vision.

**Civilian Casualties**

One of the most significant and controversial points of discussion of RPAs is the number of civilian casualties that RPAs produce, which in turn influences incidence of ‘blowback.’ Advocates of RPAs, and the targeting revolution more generally, often cited the reduced levels of civilian casualties from precision weapons of war as a benefit, with then-Counterterrorism advisor (now CIA Director) John Brennan saying of RPAs in early 2012 "It's this surgical

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201 Also referred to at times as The Islamic State of Iraq and Syria, or ISIS.
precision—the ability, with laser-like focus, to eliminate the cancerous tumor called an al Qaeda terrorist while limiting damage to the tissue around it—that makes this counterterrorism tool so essential (Serwer, 2012).” Limiting civilian casualties in a combat zone is vital, both for legal purposes within the laws of war and just war criteria as well as limiting the potential for blowback should it turn the local population against military activities.

Aerial bombardment has from its inception been a controversial military tactic decried as being immoral and thus vulnerable to blowback, regardless of a manned platform or an RPA. The Hague Convention in 1907 sought to significantly curtail the use of coercive bombing by prohibiting the “attack or bombardment, by whatever means, of towns, villages, dwellings, or buildings which are undefended (The Hague Convention, 1907).” Germany, in their declaration of war on France in 1914, claimed the action was justified in part by falsely claiming that France had bombed Nuremberg (Boyne W. J., 2005). In purely technical terms, the collateral damage caused by RPAs should be lower than for piloted aircraft, as the level of oversight due to reachback, the increased time on station, and the high-resolution imagery and advanced sensors for ground targeting they possess enable RPAs to monitor a potential target area with greater situational awareness than a manned platform with limited station time and fewer ground sensors (Lewis & Holewinski, 2013, p. 60). Returning to the earlier mentioned four factors that impact the accuracy of strikes, RPAs lower the time between decision and strike to near zero, and smaller warheads limit the blast radius of the munition to focus the strike on the intended target. This significantly reduces two of the causes of error to near zero, leaving mechanical error and intelligence analysis as the two remaining factors that would lead to civilian casualties, which would also be common with other strike options.202

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202 The problem of intelligence analysis distinguishing true civilians from true militants and leaders will remain a challenge and a source of error regardless of the technology employed, and even with near perfect information
In practice, other issues complicate the situation. The timing of the increase in RPA and air operations generally in 2010, coinciding with a rapidly expanding RPA fleet and demands to support an increase of ground force operations may have led to a temporary spike in RPA collateral damage. Perceptions that RPAs are cheaper to operate both in economic and human terms may lead to their increased use, which may increase civilian casualties in absolute terms if not in terms of rate. For operators, the recognition that RPAs might be technically more precise in terms of their ability to strike a designated target might cause the system to become sloppy in terms of the human analytical element. The pressure to increase operations and strike numbers might thus lead to a higher error rate for the intelligence analysis surrounding RPAs than would be the case for manned aircraft if the emphasis is the number of strikes and leaders measure success by ‘body count.’

To evaluate RPA performance in actual combat, we have several data points from the war in Afghanistan to compare the performance of RPAs and traditional fighter bombers. As Boyle noted, “If it is true that drones kill fewer Afghan civilians than NATO air strikes, it would be hard to argue that air strikes should be employed in preference to drones in active theatres of war, although hard questions would remain about the procedures and standards for selecting targets for those strikes (Boyle M. J., 2013, p. 13).” Thus, as a first step in evaluating the utility of RPAs in limiting civilian casualties, we can examine the record in Afghanistan compared to other airstrikes as well as alternative courses of action, to include covert strikes (which Boyle seems to imply would be acceptable as the alternative to RPAs).

Larry Lewis, a research scientist at the Center for Naval Analysis, and co-author Sarah Holewinski recently conducted a classified study of this very issue, determining in their study after a strike demonstrating the status of specific individuals is complicated as shown by divergent reporting of individual strikes.
that RPAs were significantly more likely to result in civilian casualties than manned aircraft. Holewinski, in an interview with The Guardian, stated they attributed this higher casualty rate to lower training for RPA pilots in avoiding civilian casualties. "These findings show us that it's not about the technology, it's about how the technology is used. Drones aren't magically better at avoiding civilians than fighter jets. When pilots flying jets were given clear directives and training on civilian protection, they were able to lower civilian casualty rates (Ackerman, US drone strikes more deadly to Afghan civilians than manned aircraft – adviser, 2013)."203 Without access to the underlying data for the study, it is difficult to accurately evaluate the claims of the causal mechanism for the results. Given the oversight of RPA operations from interviews I have conducted, to include the participation of legal advisers in a reachback capacity, this conclusion appears flawed. There is no indication that RPA pilots receive less training on avoiding civilian casualties than their counterparts, and there is additional oversight to RPA missions in the feedback loop. This discrepancy could, however, reflect changes in RPA oversight since the period studied, which was limited to peak operations from mid-2010 to mid-2011.

If this is the case and if the causal mechanism identified was correct and fixed by the new RPA training program, more recent numbers would show little difference between RPA and manned aircraft. Alternate explanations not discussed given the classified nature of the underlying report could include differences in the types of missions flown by RPAs and manned aircraft. A breakdown of civilian casualties controlling for mission type, or acknowledgment that such a control was implemented in the study, would provide stronger results in testing their hypothesis.

203 See also their summary of their classified report, published in PRISM online (Lewis & Holewinski, 2013, pp. 57-67).
The timeframe was also a period where there were a total of under 300 civilian casualties for all aircraft types and at a time where RPAs accounted for approximately 5% of the air campaign,\(^{204}\) indicating that for their publicly released assessment to be correct, RPAs would have been responsible for approximately 100 civilian casualties (a 30% rate) and manned aircraft would be responsible for 200 civilian casualties (a 3.9% casualty rate). These small numbers, given the timeframe, further lead to issues of significance given a single airstrike, in Nangahar province in August of 2010, was responsible for as many as 30 civilian casualties (NATO Expresses Regrets Over Afghan Civilian Deaths In Military Operation, 2010). Were an RPA responsible for this strike (unclassified data does not allow for a judgment), that strike alone would radically alter the overall numbers.

These questions aside, the underlying survey demonstrates that both manned and remotely piloted aircraft incur a risk of civilian casualties, and for one reason or another there was a higher casualty rate for RPAs, though the degree may not be as significant given the numbers. Due to the timeframe, the previously mentioned expansion of the RPA career field post-2009, and the dramatic increase in reliance on airpower during the timeframe evaluated, there may be cause to support the underlying conclusion, but that conclusion may no longer be applicable, relying on evaluation of newer data. Although data on civilian casualties in Afghanistan is limited, it is not entirely absent. UNAMA produces an annual report on protection of civilians in armed conflict for Afghanistan, which serves as a valuable starting point for assessing the various sources of civilian casualties from coalition military operations (UNAMA, 2013). Figure 26 and Figure 27 show the data on civilian casualties in Afghanistan.

\(^{204}\) Data extrapolated from Spencer Ackerman’s reporting on slides released by ISAF covering the air war in Afghanistan (Ackerman, 2012 Was the Year of the Drone in Afghanistan, 2012).
resulting from Coalition operations, showing airstrikes (all forms) as responsible for 35% of civilian casualties, and 126 fatalities in 2012.

**Figure 26: Afghanistan Airstrike Civilian Casualties**

![Airstrike Casualty Chart]

**Figure 27: Source of Afghan Civilian Casualties**

![Source of Casualty Chart]

These charts combined show that airstrikes represent the largest single share of sources of civilian casualties, but are well below a majority. During 2012 through the month of November, RPAs were responsible for 447/3886 air strikes, or 12.1% of all strikes (Ross, 2013). This can be directly compared to the UNAMA reports of RPA strikes, shown here in Table 18. This table shows a similar ratio of fatalities and casualties for RPA strikes as for airstrikes overall, suggesting a similar incidence of civilian casualties from strikes in Afghanistan regardless of the platform. But given the small-n involved and the difficulty attributing all strike sources, the data
is ultimately inconclusive. Further, as UNAMA only lists those strikes it assesses as being the result of RPAs, there is potential for a significant margin of error where a single additional RPA strike would lead to a much higher casualty rate for RPAs than for all aircraft, as the referenced classified report suggests is occurring.

Results from Afghanistan seem to show that RPA strikes are roughly comparable to other air strikes or at least technically should be with proper training and oversight. It is also difficult to show based on the Afghanistan data whether or not air strikes result in a higher casualty rate for civilians than other types of engagements without knowing the total number of engagements that caused those casualties. Anecdotally, we can see signs that ground engagements readily result in the same kinds of civilian casualties as air engagements, to the point where special operations raids and other forms of ground operations have met with periodic calls for suspensions after significant incidents in much the same way as air strikes have periodically been suspended.

### Table 18: Civilian Casualties from Afghanistan RPA strikes versus all airstrikes

<table>
<thead>
<tr>
<th></th>
<th>All Afghanistan Airstrikes 2012</th>
<th>Afghanistan confirmed RPA strikes (UNAMA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strikes</strong></td>
<td>4082</td>
<td>494</td>
</tr>
<tr>
<td><strong>Civilian fatalities</strong></td>
<td>126</td>
<td>16(^{205})</td>
</tr>
<tr>
<td><strong>Civilian casualties</strong></td>
<td>204</td>
<td>19</td>
</tr>
<tr>
<td><strong>Fatalities/mission</strong></td>
<td>.0308</td>
<td>.0323</td>
</tr>
<tr>
<td><strong>Casualties/mission</strong></td>
<td>.0499</td>
<td>.0385</td>
</tr>
</tbody>
</table>

The Afghanistan numbers are further complicated in separating “air strike” fatalities from ground fighting in many cases. In one example, in April of 2013 following the killing of a

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\(^{205}\) UNAMA acknowledges that this number could be higher as it is sometimes difficult to determine the source of all strikes.
civilian advisor in Kunar province, NATO ground forces called in an airstrike to target a Taliban position. This attack resulted in the deaths of 11 civilians to include a woman and two young children (Sarwary, 2012). Another prominent example using ground forces alone came in the raid on a wedding in Gardez, Afghanistan in February 2010. In what Jeremy Scahill describes based on his sources as a U.S. Special Forces raid “in response to an inaccurate or falsified tip-off (Scahill, 2013, p. 338),” seven civilians were killed including two pregnant women. Ground forces in proximity or not, munitions dropped from aircraft or fired by ground, the risk of civilian casualties remain. Neither air nor ground elements have complete information on any situation but the assumption is that the ground force, being closer and having been at the scene longer, has better understanding of the situation. This also points to the RPA’s attribute of endurance and long on-station time as being key to reducing these kinds of errors.

The Bureau for Investigative Journalism (BIJ) provides data for strike operations in Pakistan, Yemen, and Somalia, but within their Yemen numbers they provide some additional details not available in other regions: number of operations and casualties from “other covert operations.” This data is somewhat skewed by a single incident in 2009, where a cruise missile strike killed up to 58 civilians. But, even that single incident is instructive about the risk of civilian casualties without RPAs. Cruise missiles were a common weapon for use in counter-terror operations in the 1990s, particularly in the failed 1998 strikes aimed at al Qa’eda targets in Afghanistan and the Sudan, to include Osama bin Laden. Other examples of high casualty strikes from other than RPAs include attacks that witnesses suspect were made by the Yemeni Air Force, or in one case the Saudi Air Force. Table 19 covers the data as reported by the BIJ as of 17 June 2013.
Table 19: BIJ Reports on Civilian Casualties in Yemen

<table>
<thead>
<tr>
<th></th>
<th>Confirmed RPA</th>
<th>Possible RPA</th>
<th>Other Covert Ops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Strikes</td>
<td>46-56</td>
<td>80-99</td>
<td>12 to 76</td>
</tr>
<tr>
<td>Confirmed Killed</td>
<td>240-349</td>
<td>284-454</td>
<td>148-366</td>
</tr>
<tr>
<td>Civilians Killed</td>
<td>14-49</td>
<td>25-50</td>
<td>60-87</td>
</tr>
<tr>
<td>% Killed = Civilian</td>
<td>5.8%-14.4%</td>
<td>8.80%-11.0%</td>
<td>23.7%-40.5%</td>
</tr>
<tr>
<td>Avg Civilians killed/Msn</td>
<td>.304 to .875</td>
<td>.312 to .505</td>
<td>1.14 to 5.0</td>
</tr>
</tbody>
</table>

Taken together, as with most analysis of RPAs the quantitative data is ultimately ambiguous. The sample sizes are small, likely incomplete, and small changes in the data evaluated can radically alter the conclusions. In this case, a single high-casualty missile strike skews the “other covert operations” column to a level nearly a factor of ten higher than the RPA strikes, a phenomenon possibly similar to what was observed in the Lewis and Holewinski report. The technology of RPAs appears to enable accuracy at least equal to, if not greater than, piloted aircraft in Afghanistan dependent on the rules of engagement and the training/oversight applied, but without greater visibility of those oversight procedures it is difficult to make a definitive statement on whether or not sufficient oversight has been implemented.

**Blowback**

As discussed in the previous section, evaluating the overall effectiveness of the RPA campaign is difficult, owing to the secrecy surrounding the program, the difficulty in collecting accurate data on those killed by RPA strikes, and isolating the impact of strategic air campaigns on tactical changes in the operating environment. Johnston and Sarbahi provide probably the
best evidence that gains are real but may in fact be short lived, which the reporting of Peter
Bergen and others anecdotally supports. Numerous authors, however, have challenged these
gains as being insignificant when contrasted with the blowback resulting from such strikes.
These arguments are rooted most concretely in anecdotal accounts of specific attacks attributed
to RPA strikes, inference of recent recruiting gains by al Qa’eda in some areas resulting from
media and propaganda coverage of RPA strikes, and theoretical long-term growth of al Qa’eda
threats resulting from lingering anger over the strikes.

Traditional counterinsurgency models see the risk of blowback as the major danger of an
enemy-centric campaign, with Kilcullen noting that counterinsurgents who adopt an enemy-
centric approach “risk chasing their tails and so exhausting themselves, while doing enormous
damage to the noncombat civilian population, alienating the people and thus further
strengthening their support for the insurgency (Kilcullen, Counterinsurgency, 2010, p. 9).” This
concern has driven the U.S. toward population-centric counterinsurgency in Iraq in 2007, and
later in Afghanistan. Reaching a definitive answer on the implications of blowback from the
RPA campaign is difficult given the covert nature of the campaigns. The New America
Foundation and a joint effort by the Stanford and New York University (NYU) law schools have
extensively examined the issue and reached opposing conclusions as they pertain to Pakistan,
while Gregory Johnson and Christopher Swift represent the leading voices on opposing sides of
the debate in Yemen.

Living under Drones is among the most referenced critiques of U.S. RPAs. Based on 130
interviews and reviews of extensive documentation, the Stanford/NYU team reached the
conclusion that strikes were counterproductive, stating that the evidence of their effectiveness
was ‘ambiguous at best’ and cite a New York Times report that “drones have replaced
Guantanamo as the recruiting tool of choice for militants and a Pew study showing 74% of Pakistanis now view the U.S. as an enemy (Stanford Law School International Human Rights and Conflict Resolution Clinic; NYU School of Law Global Justice Clinic, 2012, p. vii). Though the study’s recommendations are sweeping, critics have already noted the flaws in the survey’s methodology.\textsuperscript{206}

With respect to Yemen, Gregory Johnson represents one of the top U.S. authorities on al Qa’eda in Yemen, and has emerged as a key critic of U.S. operations with respect to their potential for blowback. In The Last Refuge: Yemen, al-Qaeda, and America’s War in Arabia, Johnson contends that RPA activity is at least in part responsible for the growth of al Qa’eda in the Arabian Peninsula (AQAP), from 200-300 members in 2009 to over 1,000 today (Gregory Johnsen on Yemen, the U.S., and Drones, 2012). Despite this critique, Johnson does not advocate the total abandonment of targeted strikes, instead favoring restrictions of ‘signature strikes,’ greater limitations on high value strikes, and increased HUMINT collection on the ground. This, he says, would enable greater room for tribal leaders and clerics to take over the fight against al Qa’eda, building the legitimacy which ultimately will be needed to defeat the organization.

In contrast with Johnson, Christopher Swift sees the connection between U.S. strike activities and the increase in AQAP’s strength as weak. Per his interviews in rural areas of Yemen, Salafi clerics see the problem as an issue of development, with one noting “Some districts are so poor that joining al Qaeda represents the best of several bad options (Swift, 2012).” Some interviews point to Yemeni objections to RPAs not resulting from sympathy for

\textsuperscript{206}Joshua Foust, writing in the Atlantic, provides a thorough detailing of the potential sources of bias in the account noting the small sample size of the survey, the reliance on Pakistani media sources, the fact that the interviewees were initially referred by an advocacy group which lacked neutrality on the issue, and that most interviews were conducted outside the Federally Administered Tribal Areas (FATA), largely in urban areas (Foust, 2012).
AQAP or a result of civilian casualties, but a loss of national pride with the knowledge that another country is responsible for the security of Yemen.\textsuperscript{207} “Were these Yemeni drones,” one Yemeni Socialist Party member noted, “there would be no issue at all (Ibid.).” Swift’s research suffers from some of the same problems as the Stanford/NYU study, owing to its small sample size and possible questions surrounding the selection of those interviewees, but they do add to the problems surrounding discussion of the blowback debate by demonstrating the other motivations for disapproval of strikes that may materialize as evidence against their use on some surveys, which in fact might not be adding to the underlying conditions of insurgency as is the common interpretation. These findings parallel another survey looking back at the FATA in Pakistan where, despite the author’s frequent criticism of RPA strikes, the underlying data suggests that the population views a number of factors as of more significant concern to the population, notably decline in law and order, presence of foreigners, and “Talibanization” as the biggest problem in the FATA, with just 2.8% of respondents citing “drone attack” as the biggest problem (Shinwari, 2012, p. 59).

Peter Bergen and Jennifer Rowland, writing based on research conducted by the New America Foundation, provide some of the most complete analysis of the situation in Pakistan and Yemen,\textsuperscript{208} and their conclusions reflect the overall ambiguity in the debate. Unlike the Stanford/NYU study, Bergen and Rowland’s conclusions are that strikes are getting more precise, that collateral damage is declining, and that they have “undoubtedly hindered some of the Taliban’s operations, killing hundreds of their low-level fighters and a number of their top commanders (Bergen & Rowland, CIA Drone Strikes and the Taliban, 2012, pp. 232-235).” The New America Foundation’s database relies on at least two credible media sources for data points

\textsuperscript{207} This is a common objection to foreign interventions and is likely a major factor in other states as well.

\textsuperscript{208} To include the charts that appeared in previous sections on RPA utilization.
on strikes, with those having less than four total sources marked with an asterisk. As villagers in the region generally refer to outsiders as “foreigners,” those reports counting foreigners among the dead are generally tracked as ‘militants’ (The New America Foundation).

As complicated as the debate is over blowback at the macro-level using survey data for regions, the debate is equally complicated at the local level when contrasting anecdotes of ‘proof of blowback’ are evaluated qualitatively. The first attack characterized as blowback resulting from RPA strikes was the Khost bombing of December 2009. Hudson et al emphasize the role of RPAs in provoking the attack, noting the release of a video post-event where the attacker stated "[t]his attack will be the first of revenge operations against the Americans and their drone teams outside the Pakistani borders (Hudson, Owens, & Flannes)." As a result, they classify this as a “purposeful retaliation,” the first of two types of blowback they identify.  

While the compound was likely attacked due to its role in killing senior Taliban-linked operatives, classifying such a strike as “blowback” to RPAs is problematic. It appears revenge for the death of a key leader is the primary motivation, rather than the means used to attack, with the reference to drone attacks in the video clarifying target selection. Further, the attacker was not radicalized by the RPA attacks, as family members noted he was a changed man following his detention by Jordanian officials in 2009 due to his writings on Jihadist websites, and criticized Jordan as an enemy of his equal with the United States. In the same video he cited the killing of Mehsud as the cause of the attack (Farrell, 2010). The fact that active members of the organization were used in a suicide bomb attack against a military target believed to be affiliated with the strikes, rather than recruiting outside individuals to launch random revenge attacks, 

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209 The second being those recruited as a result of attacks.
210 In this case operatives affiliated with the Haqqani Network, a key Taliban ally who maintain an Islamist Nationalist philosophy within Afghanistan. They specialize in highly advanced IEDs and pioneered suicide attacks in Afghanistan (Mapping Militant Organizations - Haqqani Network, 2012).
suggests more that the organizations saw these attacks as effective and needed to find a way to stop them militarily. Rather than proof of ‘blowback,’ direct retaliation attacks such as the Khost attack can just as easily be seen as indications of successful strategy demanding a military response.

The second strike cited as immediate blowback is the Times Square attempted bombing of 2010. This is the attack that Michael Boyle uses to frame his argument over the ineffectiveness of RPA strikes. “While his comments were reported in the American press, the Obama administration never acknowledged that it was revulsion over drone strikes—which Shahzad was rumoured to have seen at first hand when training with militant groups in Pakistan—that prompted his attack (Boyle M. J., 2013, p. 1).” As with the Khost bombing, this attack was made in retribution for the attack that killed Beitullah Mehsud, as stated in a video made by the bomber in advance of the attack. Unlike the direct attack in Khost province, the choice of tactics in this case suggests that the RPAs may have played a role in the attack planning, as they appeared to justify ‘indiscriminate attacks on civilians.’ But is this the true justification for the attacks, or is it an attempt at rationalization of the attacks to further propaganda? In other words, did the RPA strikes truly prompt the attempted attack, or was it used to attempt to justify an attack that probably would have been carried out regardless? This is where the debate becomes a challenge.
Al Qa’eda made multiple attempts to target the United States prior to the 9/11 attacks, and since those attacks there has been a near steady stream of attacks and thwarted attacks. Lists attempted attacks and plots within the United States since September 11, 2001, and background and motivations for these attacks are listed in Appendix 3. A regular pattern emerges of all citing the suffering of Muslims at the hands of U.S. foreign policy, and all add the additional piece of what is generally the most recent policy objection. Immediately post-9/11 is most generic, followed by the suffering of people in Iraq, followed by Guantanamo and other U.S. prisons, followed by RPA strikes. Importantly, there are no true spikes in activity around any particular issue as would be expected if true blowback were taking place. Instead, we see a relatively steady stream of attempted attacks, two per year on average when plots set up by U.S.

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211 Data for chart derived from *Terrorism since 9/11: The American Cases* (Mueller J., 2013). Categories are modified from original source to highlight the change in incidents of plots post-2009 largely due to increased government operations that initiate plots, which may indicate that the plots were the product of government operations and would not have occurred independently. Category 1 plots consist of those that were created or heavily facilitated by government entities, Category 2 cases are any cases which in the view of authorities might rise to the level of a threat to the US, Category 3 cases are those that were disrupted regardless of stage, and Category 4 cases are those which had reached the stage of committing, or trying to commit, a terrorist act against the US. See Appendix 2 for overview of cases.
government informants are excluded, aimed at mass civilian casualties. 2009 is one anomaly with six attacks taking place, but this follows two years of lower activity, suggesting a random anomaly or possibly one related to significant events in the 2008-09 timeframe such as the financial crisis or the presidential election. Regardless, this largely predates the U.S. RPA campaigns, which have seen the greatest activity post-2009 and were only at their infancy when the spike in suicide bombings occurred. In this light RPAs do not appear to be leading to blowback in the form of increased attacks, but may play into al Qa’eda propaganda by appearing to validate their attacks.

A common strain in the blowback literature is increased recruiting resulting from strikes. This recruiting argument stems from the counterinsurgency literature that notes that you cannot kill your way out of an insurgency, attempting to defeat an insurgency by force alone will lead to the creation of more fighters, growing the insurgency. Audrey Kurth Cronin, writing in *Foreign Affairs*, provides one example of this argument, noting that while in the short term the campaigns do appear to be successful in killing key leaders of al Qa’eda and related organizations while reducing near term operational capacity, the underlying resentment they are creating will likely make them a net negative in the long term.²¹²

Hudson, Owens, and Flannes likewise introduce their counter to RPA effectiveness based on recruitment and resentment. “Between 2004 and 2009, our research and databases compiled by others document a dramatic spike in deaths by suicide bombings in Afghanistan and Pakistan. While it is impossible to prove direct causality from data analysis alone, it is probable that drone

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²¹² “Targeted killings have not thwarted the group’s (al Qa’eda’s) ability to replace dead leaders with new ones. Nor have they undermined its propaganda efforts or recruitment...it has been significantly enhanced by them. As Sahab (The Clouds), the propaganda branch of al Qaeda, has been able to attract recruits and resources by broadcasting footage of drone strikes, portraying them as indiscriminate violence against Muslims. Al Qaeda uses the strikes that result in civilian deaths, and even those that don’t, to frame Americans as immoral bullies who care less about ordinary people than al Qaeda does (Cronin, 2013).”
strikes provide motivation for retaliation, and that there is a substantive relationship between the increasing number of drone strikes and the increasing number of retaliation attacks (Hudson, Owens, & Flannes, p. 4).” This correlation is based on databases compiled by RAND and by the University of Chicago’s Project on Security and Terrorism. As presented, it sounds plausible that a correlation may exist that could be a basis to support their thesis, but in examining the data underlying the claim, the data appears to support the opposite conclusion as there is a negative correlation between RPA strikes and suicide attacks in Afghanistan. Figure 29 compares the Global Terrorism Database’s results for suicide bombings in both Afghanistan and Pakistan and to New America Foundation’s database on RPA strikes in Pakistan. Suicide attacks in Afghanistan peak in 2007 before beginning a decline, which coincides with the rise in RPA strikes in Pakistan that peak in 2010. As RPA strikes declined in 2011, suicide attacks began to rise again. This correlation does not show a causal link between RPAs and the reduction in suicide attacks, and indeed the rise in 2011 may be at least in part a reaction to the RPA strikes which peaked the year prior. However, for RPA strikes to be causing the increase in suicide bombings prior to 2010 as stated by the source article, a positive correlation at minimum should have been observed. Meanwhile, the level of attacks has not skyrocketed, but merely returned to approximately their 2007 pre-RPA campaign levels.

213 The Project on Security and Terrorism only includes one month’s data for 2011 so 2011 is excluded. The comparison to the other database is shown to note similar trends even as absolute numbers may differ.
The incidents of suicide attacks, if directly related to RPAs, may in fact be due to an immediate ‘vengeance’ response rather than blowback, which is a different phenomenon with different implications. A 2011 report by David A. Jaeger and Zahra Siddique (Jaeger & Siddique, 2011) was one of the earliest to examine the results of the RPA campaign based on data from the early years of the campaign in Pakistan. While their results found little to no tactical impact of the strikes (unlike later surveys by Johnston and Sarbahi which may show improvement in targeting over time), they did find a significant negative correlation in attacks more than a week after the strike, indicating a deterrent effect to future activities resulting from the presence of RPAs. From an effect-based standpoint, and along the lines of my earlier critiques of analysis of the effectiveness of bombing campaigns in general, the deterrent effect achieves the strategic aims of the program as much as the potential for decapitation.

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214 Suicide attack data derived from the Chicago Project on Security and Terrorism (Chicago Project on Security and Terrorism Database, 2011), RPA strike data derived from the New America Foundation database (The New America Foundation).
A closer examination of the Pakistan strikes and their targets also points to a problem in the anti-RPA argument regarding the creation of new enemies as a result of RPA strikes. “Far from concentrating exclusively on Al-Qaeda, the US has begun to use drone strikes against Pakistan’s enemies, including the TTP, the Mullah Nazir group, the Haqqani network and other smaller Islamist groups. The result is that the US has weakened its principal enemy, Al-Qaeda, but only at the cost of earning a new set of enemies, some of whom may find a way to strike back (Boyle M. J., 2013).” Listed conspicuously among those groups is the Haqqani Network, an organization who has long been seen as the leading organization responsible for suicide bombings in Afghanistan.\(^{215}\) The Project on Security and Terrorism does not differentiate the Haqqani Network from the Taliban at large (who comprise the overwhelming majority at 350 total suicide attacks over the listed timeframe), and given the Haqqani Network’s history and the number of specific incidents tied to the Haqqani Network it is clear for most observers that the network was a key enemy within Afghanistan well before the RPA strikes. Indeed, Jalludin Haqqani has been a member of the Taliban Quetta Shura since 2003, and his influence has been critical to Taliban control of the pivotal Paktia region of Afghanistan (Dressler, 2010, p. 20). The listing of the Mullah Nazir Group as a distinct enemy from al Qaeda is also odd, as he was a long-time Taliban leader who proclaimed himself to be a member of al Qa’eda and stated that the Taliban and al Qa’eda are one and the same (Riggio, 2011).

The Pakistani case of ‘blowback’ is further complicated by the multiple levels of violence occurring within Pakistan and division over blame of responsibility. In addition to the RPA campaign, Pakistan’s Federally Administered Tribal Areas (FATA) has long been an area where some of Pakistan’s most hardened militants have found sanctuary (Fair, 2013, p. 18). In

\(^{215}\) Siraj Haqqani imported the tactic in the 2003-2004 timeframe after observing its success in Iraq. The Haqqani network is more likely to work with factions outside of Afghanistan and is more likely to recruit foreign fighters to engage in attacks (Dressler, 2010)
connection with campaigns in Afghanistan and elsewhere, the area is home to active fighting with both Afghan and Pakistani Taliban and the government of Pakistan, as well as numerous longstanding tribal disputes. In Understanding FATA, opposition to U.S. military operations in the FATA was measured at 85.3% of the population strongly opposed to a U.S. presence, but this compared to 79.5% opposing Arab and al Qa’eda fighters, 74% opposing Afghan Taliban fighters, and 72% strongly opposing Pakistani Taliban fighters (Shinwari, 2012, p. 87). When asked if RPA strikes were justified, strong majorities in both 2010 and 2011 of residents in the FATA said they were never justified (58.8% in 2010 and 62% in 2011), but 72% also think foreign fighters/jihadis should be asked to leave when discovered (Shinwari, 2012, p. 100). RPAs are certainly hated by the local population who want them to stop, but the question of whether they are causing ‘blowback’ in the traditional sense – driving the population toward the Taliban – is far more complicated.

**Figure 30: FATA - RPA Strikes vs. Blame for Suicide Bombings in Pakistan**
Figure 30 shows a correlation between the rise in RPA strikes in 2010 followed by an increase in people in the FATA blaming the U.S./Western influence for suicide bombings in Pakistan, but as with the actual number of suicide attacks in Afghanistan and Pakistan in Figure 29 this correlation is complicated by the fact that the numbers have largely returned to their pre-RPA campaign levels, rather than a significant spike. Future trends supported by qualitative evidence supporting that the RPAs specifically, rather than other issues in U.S.-Pakistani relations at the time, were driving this change and seeing the trend continue in the upward direction would be necessary to see this as evidence of blowback. In reading through the remainder of the document for qualitative evidence, it is appropriate to compare the number of RPA strikes with a year-by-year comparison of the results of Understanding FATA’s survey on what people within the FATA saw as the biggest problem on a year-by-year basis, as Figure 31 does (Shinwari, 2012, p. 59). While most individuals saw issues like crime and unemployment as the biggest issues, this figure shows that people were generally more likely to list either the Taliban or some variation on ‘foreign fighters’ or ‘bomb explosions’ as the biggest problem in the FATA.216

The two charts to an extent appear contradictory, and point to the more nuanced problem that exists within small wars. Multiple parties are involved, parties received differing share of blame for conduct that has negative impacts on the population such as collateral damage, but the overall impact is not necessarily a zero-sum game. Luke Condra and Jacob Shapiro looked at the issue of blame for such incidents in Iraq from 2004-2007, and found the Coalition was more likely to be punished by the population than insurgents were for indiscriminate violence (Condra 216 The change in terminology here complicates the issue as ‘foreign fighters’ may refer to either U.S. or Taliban activities. In most references to the conflict in Afghanistan or Pakistan, a ‘foreign fighter’ usually references a ground combatant from outside of the area and thus normally an Arab or Pakistani within Afghanistan or an Arab within Pakistan, but this is unclear in this instance.
Applying that logic to RPA campaigns, it is logical that the populations would disproportionately blame the U.S. for the conduct of strikes and the resulting collateral damage, though this does not necessarily imply that they would take up arms to fight alongside the Taliban.

**Figure 31: RPA Strikes vs. 'FATA's Biggest Problem'**

In Yemen, attribution of blowback to RPAs is complicated by alternative explanations for the growth of al Qa’eda in the Arabian Peninsula during the 2007-2011 timeframe. Accounts of the size and strength of AQAP vary, but generally place the strength of the group as rising from around 300 in early 2009 to 700 in mid-2012, or as high as 1,000 per Gregory Johnsen’s account (Kelley, 2012). RPA critics point to a correlation in these rising numbers with the increase in RPA strikes. In this case, unlike the aforementioned suicide bombing case, the positive correlation is present. This simple correlation, however, omits a number of alternative explanations for the rise in AQAP’s membership over the same timeframe, and provides little
supportive data beyond anecdotes to demonstrate that the increase in RPA strikes drove the increase in AQAP membership. The drawdown of U.S. military operations in Iraq, al Qa’eda’s strategic planning, the global financial crisis, the Arab Spring, and the resulting change in the Yemeni government all coincided with rising al Qa’eda recruitment numbers, which actually appear to have preceded the U.S. RPA campaign. The U.S. RPA campaign hit its peak in Yemen in 2012 with 46 RPA strikes and nine additional air strikes per New America Foundation’s numbers, yet the statistic that AQAP’s strength has risen from about 300 to nearly 1,000 has been readily repeated by critics of U.S. intervention since 2010 with little evidence to show a dramatic rise in AQAP’s strength in that time period.

Islamist militancy in Yemen long predates the formation of al Qa’eda in the Arabian Peninsula in 2009, most notably the 2000 attack on the USS Cole. During the Iraq war, Yemenis constituted a major share of foreign fighters in the conflict, with combined numbers from Iraq and Afghanistan showing that Yemen produced the third highest number of foreign fighters per capita, behind only Libya and Saudi Arabia (Watts, 2008). As the United States drew down forces in Iraq during the 2008-2009 timeframe, violence began to increase in Yemen as fighters from Iraq returned home. At the same time, Saudi Arabia was executing a significant crackdown on al Qa’eda within their territory, virtually eliminating the terrorist threat within its boundaries during that same timeframe.  

In one interview in August of 2013, Gregory Johnsen cited a State Department report stating “And yet what we have seen over the past three-and-a-half years is that AQAP has gone from a group of about 200 to 300 people on Christmas Day 2009 to, according to the U.S. State Department, more than a few thousand people today (Warner & Johnsen, 2013).” However, State Department reports from that time still listed as the most current as of this date states “Although it is difficult to assess the number of AQAP’s members, the group is estimated to have close to one thousand members (Country Reports on Terrorism 2012, 2013).” Saudi Arabia’s crackdown has been criticized for extending well beyond al Qa’eda to all political dissent within the Kingdom (Mizner, 2013), but those efforts have largely seen the elimination of al Qa’eda threats from domestic sources, with Yemen being the primary base for attacks against Saudi Arabia (Butt, 2012).
Yemeni fighters travel back and forth, said Nabil al-Sofee, a former spokesman for a Yemeni Islamist political party’ in 2008 (Knickmeyer, 2008).

The return of fighters to Yemen as well as additional al Qa’eda operatives pushed out of Saudi Arabia coincided with an increase in political instability in Yemen, which peaked in February 2012 with the removal of President Ali Abdullah Saleh. The political crisis cannot be separated from a simultaneous economic crisis, wherein many Yemenis faced water, electric, and food shortages over much of the period. Inflation rose by conservative estimates of between 20% and 30%, GDP contracted by 7.8% in 2011 as oil output declined to 180,000 barrels/day, vice 250,000 before the crisis (Thiel, p. 45). All of these factors combined to form a perfect storm of grievances that al Qa’eda in the Arabian Peninsula was positioned to exploit, as they have in Syria, Libya, Egypt, and elsewhere in the region, with RPA strikes emerging late in al Qa’eda’s growth as a factor that might affect recruiting.

Looking at data on both terrorist attacks and RPA strikes by month in Yemen, a strong case can be made for RPAs in reaction to terrorist activity, rather than the other way around. The largest spikes in RPA activity occurred following an increase in terrorist attacks in March of 2012, resulting in reduced but elevated levels of violence throughout 2012. Although a simple year-by-year analysis of Yemen would show a coincidental rise in both terrorist attacks and RPA strikes, the monthly data shown in Figure 32 shows a reverse correlation, if any, for 2012. However, the data is once more insufficient to make a definitive conclusion, as the March 2012 spike may have been the result of a long-term plan to build on resentment from the 2010 strikes, which resulted in far greater proportions of civilian casualties relative to the strikes from 2011 forward. To draw such a correlation, however, would require a significant amount of qualitative research from within the AQAP organization in addition to the work done by Johnson and others.
with tribal leaders in Yemen, which likely will come from the future exploitation of documents which will be unavailable for the near future.

**Figure 32: Yemeni Terrorist Attacks vs. RPA Strikes**

Despite the recruiting gains of al Qa’eda in the Arabian Peninsula from 2009-2012, the combination of RPA strikes, increasing effectiveness of the Yemeni government and military responses, and coordination between those elements have led to a sharp decline in al Qa’eda in the Arabian Peninsula’s territorial foothold in 2013. If blowback has led to recruiting gains, mistrust and dysfunction have largely negated their ability to capitalize as Shapiro’s work would predict. Peter Bergen cited an interview with one tribal leader close to al Qa’eda, who told him of "a feeling that the Americans have infiltrated its ranks, especially with the killing of several of its leaders (Bergen & Rowland, Al Qaeda in Yemen: On the ropes, 2013)." Bergen cites the killing of 30 key leaders, and states that since its high mark in 2012, al Qa’eda in the Arabian Peninsula has lost virtually all of their gains of the previous year, both in terms of territory held and manpower. He notes “AQAP could regenerate, particularly if Yemen sees more upheaval, but for now, the group is on the run from the Yemeni army and U.S. drone strikes, fearful of
spies in its midst, is unable to launch large-scale attacks, and boasts a dwindling cadre of leaders. AQAP, in short, is struggling to survive (Bergen & Rowland, Al Qaeda in Yemen: On the ropes, 2013).” RPAs alone cannot be credited with turning the tide against al Qaeda in Yemen, just as they cannot be dismissed as one possible factor in the growth of AQAP. But, at this point, the prospect of blowback undermining gains appears to be remote, and will likely decrease as their use is likely to decline in the region.219

A final issue with discussing RPAs and the prospect of blowback is the prospect of propaganda and varying agendas of eyewitnesses in reporting RPAs. One recent account illustrates the issue as Afghan villagers were put forward by the Afghan government to talk about the horrors and civilian casualties of a recent airstrike in their village. Per this account, these villagers witnessed a number of civilian casualties in their village resulting from an airstrike the week of the 20th of January 2014. During press interviews, one reporter showed the villagers pictures provided by the Afghan government of the casualties resulting from the strike which the witnesses corroborated with names and biographical summaries of the individuals pictured. This was moving and convincing, until it was pointed out that the very same photographs had been widely circulated following an airstrike in 2009, and hundreds of miles away from the site of the recent attack (Rosenberg M., 2014). In this particular anecdote, the villagers had incentive to portray the U.S. as the aggressor and knowingly misrepresent the photographic evidence, and there are myriad potential reasons from domestic tribal politics, to seeking financial damages, to a bargain struck with the Karzai regime to add leverage in ongoing negotiations of the status of forces and aid post-2014 withdrawal of combat forces.

219 There were 54 strikes in 2012, and as of 6 August 2013 there have been 17 in 2013, to include an increase in attacks from 30 July to 6 August coincidental with the increased threat warning in the region (The New America Foundation).
It is too early to attribute a motivation in this particular case, but so long as most airstrike operations remain covert and absent clear evidence of a mischaracterization of the evidence (either by photography as in this case or clear disagreement between eyewitnesses), the U.S. refusal to acknowledge and discuss the RPA program in other fields leads to the U.S. abandoning the debate and yielding the debate to other actors with outside interest, and allowing the perceptions formed by that debate, rather than hard evidence from actual results, to frame the second and third order effects from RPA strikes. This will remain a problem because, despite the evidence that suggests a net positive military result from RPA strikes, the lack of formal justification for specific strikes opens the door to the accusation that the real target is not the leadership of a particular adversary, but states or societies at large. It is not enough for the RPA to enable military forces to separate leadership from civilian targets, those civilians must be reassured that neither they nor their society are the target, otherwise the operation risks the same ill effects of coercive bombing. Clarifying the legal status and openly discussing the RPA program thus becomes essential to improving the military utility of RPA strikes.

**Law and Targeted Killing**

Among the biggest obstacles to the success of RPA operations in current military campaigns is the ambiguity surrounding the legal status of targeted leadership killing against non-state actors, which drives the potential for international blowback from RPA operations. To opponents, this type of warfare appears more like extra-judicial killing outside the parameters of a traditional war zone. Much of the talk of future RPA wars surround the need for new international treaties and agreements on their use and limitations, but this often focuses too much on the RPA platform rather than the real issues of modern warfare. How do you define the limits
of conflict zones when a nation state opposes a non-state actor? Is it a war, or is it a law enforcement action, and thus what law should apply? As with other questions, the RPA is the tool for implementation, but has become a distraction as a focal point of potential discussion. The RPA does have some specific traits that will require either changes to controls of RPAs or modifications of existing treaties, such as requirements for communication and traffic deconfliction in international airspace, but the areas that draw the most intense debate would still be contested without the RPA innovation, as targeted killing strategies extend beyond just RPAs.

The legal status of RPAs in war is vital not just because of the near term potential for abuse, but because many of the challenges to RPAs are caused by their secrecy. In non-international conflicts, the RPA overcomes the internal targeting challenge of identifying key individuals and striking with precision in a time and manner of the operator’s choice. However, this only represents half of the challenge as without formal acknowledgment of the strike and justification for the targeting, any strike could easily be portrayed by adversaries as a strike against civilians. This has been done with the blowback debate and why so much discussion from critics focuses on collateral damage. The popular perception of the character of the strike is as important in this respect as the actual character of the strike. If the population perceives the strike as coercive bombing aimed at destroying society rather than tailored strikes against a particular group, this could in turn have the same impact as the least efficient use of airpower, coercive bombing campaigns. Figure 33 uses the typology of the targeting revolution to demonstrate the challenge posed by the counterinsurgency literature of distinguishing combatants, non-combatants, and leadership in such campaigns. The technology of the RPA may enable the strike by clarifying the status of potential targets for attackers, but the regular
release of information under a solid legal framework must justify the strike to maximize its effectiveness.

**Figure 33: Targeting Challenge in Small Wars**

The U.S. war on terrorism is often referred to by proponents as a “Just War” because it was launched in response to an attack and because of an emphasis in desire (intention, with some clear failures over time) to adhere to *Jus in Bello* criteria, but self-defense is but one of the *Jus ad Bellum* criteria, while the others are often neglected in pursuit of political and military expediency. This likely comes at the expense of efficiency, and harms the prospect for eventual success. As Philip Alston concluded in his summary of targeted killing operations, lack of acknowledgement and accountability results in “the steady undermining of the international rule of law, and the setting of legal precedents which will inevitably come back to haunt the United States before long when invoked by other states with highly problematic agendas (Alston, The
CIA and Targeted Killings Beyond Borders, 2011, p. 446).” Building a strong justification in international law is thus vital to maximizing the efficiency of RPA strikes in small wars.

**Jus ad Bellum and Non-International Conflict**

Much of the RPA debate focuses on the underlying argument of whether RPA strikes constitute a legitimate act of war or whether they constitute state-sanctioned murder. Medea Benjamin (2013), Nick Turse and Tom Englehardt (2012) fall into the latter category, with near constant references in their works to strikes as ‘assassinations’ and ‘murder by remote control.’ Kenneth Anderson, in contrast, takes the former position readily defining strikes in the context of a U.S. war, while arguing that their capabilities make them both ethical and effective. This fundamental divide is mirrored internationally, with officials in the U.S. maintaining that this is a war, while allies abroad characterize anti-terrorism as largely a law enforcement issue.\(^{220}\)

Defining whether these strikes are acts of war is central to the debate, and must be examined first to develop a legal framework for the employment of RPAs. The real challenge is that the effect of the targeting revolution is to return some types of warfare to a highly-specialized endeavor with the goal of capturing or killing key individuals, much as it was before the Infantry Revolution. This is nearly impossible to justify within a system of international law devised for

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\(^{220}\) President Bush first used the phrase ‘War on Terrorism’ in unscripted remarks on 16 September 2001 and more prominently on 20 September 2001, declaring “(o)ur ‘war on terror’ begins with al-Qaeda, but it does not end there. It will not end until every terrorist group of global reach has been found, stopped and defeated (Bush, 2001).” This was the rationale maintained throughout the Bush presidency, reinforced by the 9/11 Commission Report, which stated “Calling this struggle a war accurately describes the use of American and allied armed forces to find and destroy terrorist groups and their allies in the field, notably Afghanistan. The language of war also evokes the mobilization for a national effort (The 9/11 Commission Report, 2003, p. 363). President Obama offered similar justification in calling to define and scope the character of the war at his speech to the National Defense University (Obama, 2013). In contrast, the Christian Science Monitor noted in 2004, “After decades of battling terrorism on their own soil, Europeans continue to believe that the best counterterrorism work is done through police intelligence and cooperation. And they believe that characterizing the fight as a ‘war’ only antagonizes the populations that have produced terrorist groups and makes it harder to address the root causes of terrorism (LaFranchi, 2004).”
nation states within the framework of war post-Infantry Revolution. Rethinking the law, rather than the tools, is essential.

The *Jus ad Bellum* criteria have been codified in international law to define and limit wars between nation-states, but applying this state-based derivation of Just War criteria to non-international conflicts serves to confuse, rather than clarify, the issues that the law seeks to address. International norms, and eventually international law, must be shaped to address the realities of non-international conflict. Defining and clarifying that line of war is the essential first step to understanding the laws of employment of RPAs on either side of that line. Non-International conflict, though not completely new, has taken on an increased role in U.S. policy since the end of the Cold War, with the war on terrorism representing now the longest war in U.S. history fought under ambiguous legal status both domestically and internationally. The legal framework for that war has been justified against a backdrop of domestic and international law built around applying just war principles to conflicts between nation states. While most legal scholarship focus on the application of existing law to the RPA, I return to the underlying principles of *Jus ad Bellum*, just cause for war, to outline a path for new legal frameworks for defining and scoping non-international conflict.

François Bugnion, writing in the *Yearbook of International Humanitarian Law*, noted that the framework for international law has incorporated *Jus in Bello* criteria for the conduct of war within non-state conflicts through both treaties and customary international law, while there is room to doubt similar accommodations have been made for *Jus ad Bellum* criteria.\(^{221}\)

\(^{221}\) Bugnion notes that the incorporation of *Jus in Bello* to non-international conflicts to include civil wars and rebellions is itself a relatively recent phenomenon with states historically rigorously adhering to Just War traditions in international conflicts while ignoring them in domestic conflicts. The law, for much of the past few centuries, was a contractual agreement between parties – states – and not applicable to non-contracting parties. The norm of recognizing rebellion as belligerency subject to *Jus in Bello* is first seen in the American Revolution, and again in 1847 during the Swiss Civil Conflict and in the 1860s with the U.S. Civil War, but fell into disuse in the early 20\(^{th}\)
U.N. Charter is ambiguous with respect to the issue of Civil War, recognizing both the rights of peoples for self-determination as well as the rights of states to suppress internal rebellion to include resulting to the use of armed force. “There is therefore a set of norms regulating the recourse to armed force in non-international armed conflicts, although those rules are still rudimentary and state practice is not always consistent (Bugnion, 2003, pp. 168-170).” This lack of consistency in applying the rules of *Jus ad Bellum* defines the differing opinions of RPA observers as to whether their use constitutes acts of war or not.

*Jus ad Bellum* represents a set of principles designed to limit the horrors of war by providing justification for military action, defining the scope of conflict, and ideally laying the groundwork for re-establishing peace at the end of hostilities. These criteria have been refined over the years through both philosophy and codification in international law, today being described generally as: having just cause, being a last resort, being declared by a proper authority, possessing right intention, having a reasonable chance of success, and the end being proportional to the means used (Moseley A.). Historically, in wars between states, a ‘declaration of war’ satisfied the requirements of *Jus ad Bellum* by stating the causes of war, declared by proper authority within the state as defined by domestic law. The Hague Convention of 1907 formalized the requirement of issuing a ‘declaration of war’ prior to initiating hostilities between states and notifying neutral states of the existence of a state of war (Convention Relative to the Opening of Hostilities). However, the ratification of the U.N. Charter and the decline in interstate conflicts post-World War II have led a number of analysts to

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Century with the Spanish and Russian conflicts. It isn’t until adoption of Article 3 of the Geneva Conventions of 1949 that *Jus in Bello* is formally established as applying in civil conflict.  

222 Often the monarch historically, but often today residing with the parliament or legislature in democratic states. Article 1 of the U.S. Constitution places this power solely in the hands of Congress. Domestic law is critical to defining proper authority as it is inherently linked to sovereignty. “War was an attribute of sovereignty and was lawful when waged on the orders of the ruler, who was the sole judge of the reasons which prompted him to take up arms (Bugnion, 2003, p. 172).”
conclude, given the common understanding of declarations of war as a matter of inter-state conflicts, that declarations of war as commonly understood may be obsolete.\textsuperscript{223}

The model of state responsibility has in part framed the war on terrorism, particularly President Bush’s statement of 20 September 2001. “We will starve terrorists of funding, turn them one against another, drive them from place to place, until there is no refuge or no rest. And we will pursue nations that provide aid or safe haven to terrorism. Every nation, in every region, now has a decision to make. Either you are with us, or you are with the terrorists (Bush, 2001).” The challenge has come with states that are either ambiguous in their position, unwilling to publicly support the tools of counterterrorism used by the U.S., or fearful of a domestic backlash for choosing sides in which the U.S. sees a need to intervene.\textsuperscript{224}

The challenge for the United States in establishing norms for the use of force against non-state actors within such states compliant with traditional understanding of \textit{Jus ad Bellum} is twofold: establishing in domestic law/constitutional structure a clear framework for identifying a proper authority for declaring a state of conflict, and identifying a means of using such a declaration to scope the conflict to comply with the principles of having a reasonable chance of success and the end being proportional to the means used.\textsuperscript{225} To date, the authority has largely

\textsuperscript{223} A report prepared for the Parliament of the United Kingdom stated “The United Kingdom has made no declaration of war since that against Siam (modern Thailand) in 1942, and it is unlikely that there will ever be another. Developments in international law since 1945, notably the United Nations (UN) Charter, including its prohibition on the threat or use of force in international relations, may well have made the declaration of war redundant as a formal international legal instrument (unlawful recourse to force does not sit happily with an idea of legal equality). The courts have recently decided that, as a matter of our constitutional law, the United Kingdom is not at war with Iraq because there has not been a declaration of war. In this report, when we use the word “war”, we use it in the popular sense, conscious of its limitations as a definition suitable to our purposes in the modern world (Waging War: Parliament's Roles and Responsibilities, 2006).”

\textsuperscript{224} Pakistan is the most cited example of this dilemma, and Yemen is to a lesser extent as the Presidents of Yemen have supported U.S. operations openly while they have been strongly rebuked both by Parliament and by cabinet ministers.

\textsuperscript{225} The authors of the National War Powers Commission noted the war powers of the United States have suffered from two centuries of confusion (National War Powers Commission Report, 2008, p. 11), owing to the division of powers between a Congress empowered to “declare war, grant declare War, grant Letters of Marque and Reprisal,
been extra-constitutional, with Congress authorizing the President to use force against the organizations that attacked the U.S. on September 11th, 2001 and their allies, but deferring on specifically defining who those organizations are and any geographic boundaries for the conflict. This creates a situation where domestic law in the United States regards the President’s use of force to be lawful, but which fails to satisfy the broader questions about whether that use of force constitutes a war due to obfuscation over the issue of proper authority and clarity over the causes and parameters for that use of force.  

Unlike these previous AUMFs, the U.S. involvement in the war on terror has not always involve U.S. forces intervening in what is commonly recognized as an active war zone, nor is it confined to a conflict within a single sovereign entity. The Barbary Wars were cases where war was declared on the United States, an example of what Professor Saikrishna Prakash categorizes under the pragmatic theory of war: the declaration of war by another state alleviates the need of the second state to declare war in response as a state of war already exists (Prakash, 2007). In

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226 The use of an Authorization for the Use of Military Force (AUMF) is not new, and has been used by the U.S. government to engage in combat actions more often than formal Declarations of War. The first combat actions involving U.S. forces, the Quasi-War with France from 1798-1800 and the First Barbary War of 1802, were fought under authorization from Congress for the President to use the U.S. Navy in a defensive role against aggressive states (See “the Quasi War Cases” for further information on the 1798-1800 Congressional actions (Sidak, 2005)). The U.S. Congress has issued similar authorizations in the Second Barbary War, the Veracruz occupation, the Russian Civil War, Vietnam, and the Gulf War of 1991 among others. Congress has further funded actions, but not explicitly authorized the use of force, in the Korea War, the Bosnia War, and the Libyan intervention Operation Odyssey Dawn.

227 Prakash himself disagrees with this view arguing that a ‘categorical theory’ of war is what the Constitution intended, expanding a declaration of war also to Congress’s ability to authorizing wars after another state had declared war on the U.S. This perspective can be critiqued by the notes from the Constitutional Convention cited by Alstyne (Alstyne, 1972, pp. 6-7), where the original text granting Congress the power to ‘wage war’ was struck in favor of ‘declare war,’ “leaving it to the executive to repel sudden attacks.” This, combined with the history of
the case of Korea and elsewhere, an international entity recognized a conflict zone and a requirement for forces to re-establish peace under existing treaties. In the more complicated cases of Vietnam, Bosnia, and Libya, the actions were clearly tied to intervention in a recognized sub-national conflict with specific legislation authorizing intervention and international pressure to confine the conflict within specific states. International norms provided a means of generally recognizing civil war based on the levels of violence, and thus these uses of force represented intervention in active wars under a pragmatic theory of war.

Rather than a single conflict based on one legal theory, the war on terror is justified based on a hodgepodge of justifications, with each bent to the unique circumstances of the specific campaign. It is primarily justified domestically by a single authorization as a war without boundaries against a transnational entity, but is often rationalized as a series of interventions within specific nation states. The example from the previous section of President Bush’s state sovereignty and responsibility argument represents one example of this approach. The latter justification has the strongest legal tradition, but generally when it is sanctioned either by the state through a request for forces, or when the intervention is explicitly emphasized by the entity with the war-declaring powers. The former represents a new idea for fighting trans-national wars with no concrete precedent in international norms or domestic law. The war on terrorism is often talked about as an non-international conflict rhetorically, but is for legal purposes a series

Congressional authorizations for force, reinforces a normative compromise position. Prakash sees the history of response declarations of war (as was the case in World War II) as evidence that the pragmatic theory is flawed, but more likely is a recognition that the legal status is ambiguous and so in a number of cases the response declarations of war served to remove any debate between the legal schools of thought and to reinforce national unity, rather than to satisfy an actual legal requirement. I would argue instead Congress’s war powers require their consent to continue to make war after a reasonable period to legislate such action, and to declare war absent an existing state of war.
of non-international armed conflicts. Absent open permission for intervention in a civil war/rebellion, intervention within a sovereign state without formal notification and justification for intervention thus appear to violate the *Jus ad Bellum* criteria.

Parsing the constitutional war powers to establish a domestic legal justification for employing force in many ways undercuts the latter in the name of satisfying the former. The declaration of war, for traditional interstate conflicts, was a means to satisfying the ends of *Jus ad Bellum*. The practice of issuing AUMFs merely satisfies the question of the President’s ability to make war, rather than defining the causes, scope, and implicitly means of achieving a peaceful conclusion. To reconcile the problems posed by the AUMF and the need to satisfy *Jus ad Bellum* criteria, Congress could modify the AUMF to specifically empower the President to in effect declare war against non-state actors (interpreting the Article 1 powers to pertain to interstate conflicts). In doing so, Congress could explicitly require formal declarations and notification of organizations which the president finds to meet the criteria as authorized in the AUMF, areas the U.S. assesses as operating areas for that organization for the purposes of the AUMF, as well as to justify the cause for that organization’s inclusion. This would allow for a scenario where, politically, the war could be described in terms of a single conflict against a global entity and planned by U.S. forces in such a manner, but for the purposes of law could be evaluated as a series of campaigns each confined to a specific geographic area within an existing state.

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228 This is the view adopted by the U.S. Supreme Court in *Hamden v. Rumsfeld* (*Hamdan v. Rumsfeld*, 2006), and my review of the literature of the laws of war since that time refers to the laws governing the war on terror shows this as the primary legal model.

229 This would represent a significant shift in war powers for the specific character of non-international conflict to the presidency and only when specifically designated as Congress’s agent by statute, but in doing so the Congress could conceivably maintain several checks on the President’s authority within the legislation itself. One mechanism could be a variation on a legislative veto. Legislative vetoes have been enacted as part of various statutes over the years, from the single-house legislative veto over immigrant deportations to overturning federal regulations through a Joint Resolution. The single House veto was declared unconstitutional in 1983 because
One area where outside parties tend to agree, regardless of their evaluation of the effectiveness of RPA strikes, is that the lack of disclosure of U.S. targeting strategies is probably the most problematic part of the program. For supporters, lack of disclosure prevents the U.S. from exploiting strike operations through information campaigns, aid for victims of collateral damage, and countering the narrative of RPAs put forward by their detractors. To critics, non-disclosure Joshua Foust concurs with the NYU/Stanford study Living Under Drones on this point in his critique, stating “the authors are absolutely right -- more transparency about targeting and effects would help everyone understand the consequences of drone strikes in Pakistan (Foust, 2012). The Obama Administration itself seems to agree in principle to the need for greater transparency, increasingly speaking about legal justification and the possible deliberate leaking of discussion over development of a “Drone Rulebook.” The main problem appears to be both internal debate over the exact framework for the rulebook itself, and the degree of transparency. Clarifying the law defining the conflict and legitimizing action domestically is a critical first step to establishing laws and norms internationally, which in turn is necessary to fully exploiting the potential gains of the RPA innovation in small wars by minimizing the risks of blowback.

Declarations of War, Disclosure, and the Targeted Killing Debate

As noted in Boyle’s critique of RPA operations, the lack of a declaration of war has led to a number of problems in assessing the RPA campaign, not the least of which stems from a failure to appreciate the purpose and scope of a declaration of war and how it differs from an authority to wage war. Boyle argued that because a state of war does not exist between the U.S. and states

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neither house of Congress could “act alone and outside of its prescribed bicameral legislative role” outside of purposes explicitly mentioned in the Constitution (INS v. Chadha, 1983). The power to overturn regulations through Joint Resolutions remains, but is of debatable utility as a Joint Resolution requires the signature of the President or sufficient votes in both Houses to override a veto.
such as Pakistan or Yemen, conducting operations in those territories cannot be considered legitimate wartime operations. This is problematic as the U.S. grievance is not with those states, but with non-state entities operating within their territories. A traditional declaration of war is therefore not applicable, but the alternative normative standards for conducting military operations in the territory of another country also don’t necessarily apply, especially without disclosure or open discussion of the operations.

The absence of a declaration of war against a state does not preclude the use of armed forces in that state. The first RPA strike in Pakistan killed Nek Muhammad in June of 2004, a tribal leader and fierce opponent of the Mubarak regime who Pakistan had unsuccessfully sought to kill on earlier missions. Per reporting by the New York Times’ Mark Mazetti, The U.S. was granted authorization to conduct missions over Pakistan in exchange for the removal of Nek Muhammad, so long as they never publicly claimed credit for the mission (Mazetti, A Secret Deal on Drones, Sealed in Blood, 2013).

This account provided details to an earlier article by the Washington Post’s David Ignatius, also alleging a secret agreement for RPA strikes (Ignatius, 2008). The International Crisis Group largely concurred, stating “Ample evidence exists of tacit Pakistani consent and active cooperation with the drone program, contradicting the official posture that it violates the country’s sovereignty. This includes acknowledgements by former President Pervez Musharraf in April 2013 and by then-Prime Minister Yousuf Raza Gilani in 2008 and 2010 (Drones: Myths And Reality In Pakistan, 2013).” In Yemen, the situation is different as President Abdu Rabbu Mansour Hadi has openly praised RPA operations, stating the U.S. “helped with their drones because the Yemeni Air Force cannot carry out missions at night…The electronic brain’s precision is unmatched by the human brain (Shane S., 2012).”
If we are to assume that Ignatius and Mazetti’s account\textsuperscript{230} and the assessment of the International Crisis Group of an agreement between Pakistan and the United States is correct and that at one point there was a secret arrangement allowing for RPA operations in the Federally Administered Tribal Areas (FATA), it might be challenging to square a FID mission with operations that have occurred in recent years. Since 2010, an increasing number of Pakistani officials have spoken out against RPA strikes, most notably with newly-elected Prime Minister Nawaz Sharif calling for an end to the strikes. Beyond these calls, however, the reaction of the Pakistani government has been characterized as "borders on the schizophrenic" by the International Crisis Group (Drones: Myths And Reality In Pakistan, 2013). But, even if Pakistan had fully rescinded authorization to allow for these strikes, there would remain serious questions to the argument that the U.S. was not authorized to conduct such strikes.

While Boyle and other critics site this as an absolute from a perspective of sovereignty, this is in fact a highly ambiguous area of international law. UNSC Resolution 1373 places an affirmative requirement on states to “deny safe haven to those who finance, plan, support, or commit terrorist acts.” Further, Lionel Beehner noted in the Yale Journal of International Relations, “Sovereignty, after all, confers rights as well as responsibilities (Beehner, 2011).” Beehan further notes that strikes in the Fata directly related to groups fighting an active war in Afghanistan of which the U.S. is a player can be justified as an act of pursuit. Under this theory of sovereignty, actions aimed at terrorists operating in the FATA would be legal under international law and justified, though problematic due to lack of acceptance of responsibility for the strike invoking justification.

Philip Alston, writing in the Harvard National Security Journal, concurs noting that “A targeted killing conducted by one state in the territory of a second does not violate the latter’s

\textsuperscript{230} An account also backed by Scahill and Klaidman, among others.
sovereignty if either (a) the second state consents, or (b) the first, targeting, state has a right under international law to use force in self-defense under Article 51 of the UN Charter, because (i) the second state is responsible for an armed attack against the first state, or (ii) the second state is unwilling or unable to stop armed attacks against the first state launched from its territory (Alston, The CIA and Targeted Killings Beyond Borders, 2011).” The true problem for U.S. policy is not the lack of a declaration of war against the states in which the U.S. is conducting operations, but the lack of formally justifying the strikes and providing notice that this represents an ongoing campaign justified under Just War criteria. We do not know openly if there is consent for operations, nor do we know under which justification the U.S. is launching specific strikes.

The lack of formal justification has the potential to set a bad precedent for international norms moving forward if the U.S. does not move swiftly to rectify the ambiguity of the legal status of non-international conflicts. Continuing on the current path threatens to undermine the traditions of Just War as it applies to non-international conflicts, expand covert operations by other powers to potentially destabilize regimes, and undercut the post-World War II norms on conflict and self-determination. Using Just war criteria, rather than manipulating existing international law derived from Just War criteria, the U.S. can begin the process of establishing new norms for behavior for non-international conflict, with clear standards for targeting inside designated theaters governed by International Humanitarian Law, and outside those theaters governed by International Human Rights Law.
**RPAs in Designated Theaters of War**

Once a mechanism is established for delineating what constitutes a war zone under *Jus ad Bellum* criteria, RPA activities within that area can be evaluated under the second set of Just War principles, *Jus in Bello*, codified primarily under International Humanitarian Law. Broadly speaking, this criteria can be broken into two broad criteria, that of proportionality and military necessity. Similar criteria define the use of force in International Human Rights Law, which would govern RPAs outside of theaters of military operations, but the standards of proportionality and necessity would be significantly higher and result from a deliberative legal process with the burden of proof shifting much more to those executing the strikes.

The Manual on the Law of Non-International Armed Conflict, which defines International Human Rights Law for conditions best approximating that envisioned by this section, limits targeting to “fighters or military objectives (Schmitt, Garraway, & Dinstein, 2006, p. 18).” This is derived from a series of international treaties and customary international law which codifies the principal of discrimination. For the purposes of human targeting away from an active battlefield, distinguishing ‘fighters,’ ‘military objectives,’ and ‘civilians’ (who are explicitly prohibited from targeting that entails ‘violence’) is essential for establishing parameters. The best guidance provided in the Manual is that a fighter is one who takes a direct/active part in hostilities, as illustrated by “a sufficient causal relationship between the active participation and its immediate consequences (Schmitt, Garraway, & Dinstein, 2006, p. 4).” This definition would include those in the leadership chain and who are active in the organization, but excludes those who ‘support the war effort (Ibid),’ which in the COIN literature discussed in Chapter 4 would include sympathizer networks, passive supporters, and other elements of the general population.
The challenge for human targeting via RPAs, as with any other platform or against any other military target, is identification, justification, and assessment of proportionality. As discussed in Chapter 4, rigorous bureaucratic methodologies are in place to minimize collateral damage not just to comply with the letter of the law, but to comply also with the doctrines of COIN in the name of a variation of ‘first do no harm’ strategically. Civilians have been killed, but it is difficult to say that the RPA has been less discriminate than other platforms given both the quantitative and qualitative cases available. International Humanitarian Law does not prohibit these civilian losses tragic though they may be, they simply must be done within the context of a defined armed conflict and provided the criteria of discrimination and proportionality are properly applied to legitimize the action and allow for open discussion.\footnote{The existence of the principle of proportion actually makes civilian casualties acceptable, provided the process to ensure it is necessary for military ends.}

Of these two criteria, proportionality has been the more relevant issue when factoring in the risk of collateral damage given the lack of precision guidance and the history of coercive bombing in World War II and other wars. With precision guidance and a move to human targeting, discrimination is the more delicate subject. Discrimination is relevant both in identifying a target list – how far up and down the leadership change and what specific functional areas in the leadership (recruitment, financing, propaganda, etc.) are acceptable for targeting – and for identification of the individual for kinetic engagement.\footnote{As previously noted, 70\% of casualties from collateral damage in the war on terror has resulted from misidentification.} In clearly differentiating warzones from non-warzones, the potential for a broader interpretation of a kill list would exist within a designated theater of war, while outside the theater of war it would be strictly limited.
Inside a designated warzone, fighters, planners, and other elements of a terrorist organization who, in a conventional force, would be uniformed personnel performing duties directly supporting operations would be lawful to target, in much the same way an individual in those circumstances could be targeted by a soldier with a bullet. Discrimination is the challenge, which is met in part by a rigorous process of analysis as previously discussed but can be supplemented by oversight mechanisms and increased disclosure and discussion of operations post-strike to ensure that the criteria of discrimination is met and that those targeted are targeted in good faith based on clear perception that they are fighters.

**RPAs Outside Designated Theaters of War**

Outside of a designated theater of war, International Human Rights Law would dominate targeting decisions. While International Humanitarian Law permits target killing so long as the individual targeted is in direct participation in hostilities, it is deemed a military necessity, and steps are made to ensure the principles of distinction and proportionality are followed, International Human Rights Law follows what is more often referred to as a ‘law enforcement’ model. This makes a state killing legal only if it is required to protect life and there is no other means of eliminating the threat such as capture or incapacitation (Alston, The CIA and Targeted Killings Beyond Borders, 2011, pp. 301-304). This poses an obligation on the state to minimize the use of force, rather than allowing for expedient lethal action.

This would not absolutely prohibit the use of lethal force, even by RPAs, but it would set a much higher threshold for its employment to demonstrate both that a higher standard of ‘imminence’ of threat (greater than simply being a member of an opposing force which generally

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233 This can be a deceptive analogy as it is binding on all who act on behalf of the state, not just designated law enforcement officers.
satisfies the imminence requirement in combat) exists and that no other viable means of capture exists. To satisfy these requirements, a more rigorously vetted ‘kill list,’ focused solely on the top al Qa’eda figures who are in a position to launch and have threatened to launch attacks against the U.S. based on their orders, could meet this standard of imminence. This list could be made public and therefore open to scrutiny, but in a manner that does not disclose where the U.S. believes they are operating and the means used to identify and track the individuals. A U.S. citizen, such as Awlaki, would be able to challenge their status through legal channels and could potentially seek an injunction barring the use of lethal force in what would ostensibly be a law enforcement scenario, but should a court not concur with the underlying suspicions of the government and capture deemed infeasible, lethal targeting would be an option should a good faith of imminent threat exist.

The greater challenge is the decision to use a standoff weapon such as an RPA versus a ground operation such as the raid that captured Osama bin Laden. Geography, timeliness of intelligence, and lack of time to plan and execute such a raid (all of which would put a capture force at significantly higher risk to the point of disproportionality in the other direction) may be used to justify the lethal option over the capture option as capture would be unfeasible, but that decision will vary greatly on a case-by-case basis. This reflects the calculus of the Obama White House in the decision Saleh Ali Saleh Nabhan in Somalia in 2009 (Klaidman, 2012, pp. 122-127).234

Were Pakistan and the FATA omitted from a list of active theaters of war, limited intervention within Pakistan as well as other states bordering recognized warzones could theoretically be justified on the grounds of ‘hot pursuit.’ Turkish government officials have used

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234 At the same time, Nibhan would likely not have risen to the level of imminence were Somalia deemed to be outside a war theater.
this as justification for cross border raids into Iraq in pursuit of Kurdish rebels, and the U.S. was briefly lobbied to use this justification to launch raids into Syria during the Iraq war in pursuit of insurgents (Beehner, Can States Invoke ‘Hot Pursuit’ to Hunt Rebels?, 2007). However, this interpretation of ‘hot pursuit’ is countered as a flawed reading of a precedent from laws of the seas, which allows pursuits into international waters following the violation of sovereign territory.

This issue points to the remaining gray area of international law - reconciling the right of self-defense with the rights of sovereignty in cases where a government lacks ‘effective control’ of an entity within its borders. Beehner noted that prior to the 9/11 attacks the International Court of Justice found that Nicaragua was not responsible for funneling arms to El Salvador-based guerrillas in the 1980s based on this principle, while the precedent of the overthrow of the Taliban suggests sovereignty must mean responsibility (Beehner, Can Nations “Pursue” Non-State Actors across Borders?, 2011, p. 112). The FATA appear almost designed to illustrate this dilemma, with Christine Fair noting the ‘second class citizenship’ status of those living within the FATA. “Pakistan’s constitution does not apply to FATA. Instead, FATA is governed by a colonial governance instrument called the Frontier Crimes Regulation, or FCR. As a consequence, foreign journalists are prohibited from travelling to FATA without the approval of the ministry of interior and/or an escort from the military and intelligence services. Even ordinary Pakistanis cannot legally visit the area unless they themselves have family ties there…These restrictions serve the Pakistani state’s interests because it has long used FATA to host a dizzying array of Islamist militant groups operating in Afghanistan, India, and even Pakistan itself. Some of Pakistan’s most hardened Islamist militants as a consequence have found sanctuary in FATA (Fair, 2013, p. 18).” Those in the FATA are accountable to a
"political agent" who acts on behalf of the government and whose decisions are binding. Pakistan’s high Court have on several occasions overturned laws governing the FATA as violations of both Pakistan’s Constitution and International law, but to no avail as no government has enforced such rulings.

Fair also points out that the U.S. appears to accept the status quo and the gray area under international law as it serves both the interests of Pakistan and the U.S. The U.S. aids Pakistan in targeting anti-Pakistani terrorists relying on Title 50 authority, Pakistan’s services are able to attack terrorist infrastructure to decrease effectiveness, Pakistanis raise objections and gain support from civilians in government who have no constitutional power to intervene on actions in the FATA, and thus operations continue. This has worked in the sense that operations have been allowed to proceed and as the previous chapter has shown to some measurable effectiveness, but the precedent may end up being against long-term U.S. interests. Clarifying the responsibilities of sovereignty, the bounds of a doctrine of ‘hot pursuit,’ and the requirements of declaration and notification are vital to limiting the potential indefinite expansions of such operations in the future and enforcing the importance of International Human Rights Law.

Summary

The RPA as employed by the U.S. has proven to be a costly innovation despite the belief of many outside observers that it provides a cheap alternative to manned flight. Tactical RPAs are relatively cheap in comparison to larger and more capable manned platforms, but must be procured in higher numbers and must be subject to greater risk of loss and damage in order to be an effective tool of armed forces, overshadowing the low per-unit cost. When the average

235 The U.S. Code which establishes the framework for covert operations.
person hears about ‘drones,’ they often think not of these types of RPAs, but of advanced RPAs like Predator and Reaper, which are expensive relative to manned alternatives both per-unit and as complete systems.

The U.S. has invested in this technology not as much because of its cost, but because of its perceived military utility in counterterrorism and counterinsurgency campaigns. Analyzing the effectiveness of RPA attacks and contrasting it with the negative potential for blowback is complicated by the low number of RPA strikes that actually occur, the secrecy surrounding the operational planning for those strikes and their intent, and conflicting data on the results of those strikes. Judging based on output in terms of the effectiveness of terrorist and insurgent organizations relative to RPA strikes, the literature overall suggests at minimum a short-term tactical advantage to RPA strikes in degrading organizational effectiveness and potentially deterring activity. This in turn has potentially destroyed the central leadership and strategic potential of al Qa’eda, while increasing the tactical expertise of localized insurgent and terrorist groups.

The long-term ramifications are less clear. The evidence of civilian-based blowback to airstrikes leading to a recruiting boom for al Qa’eda is largely theoretical and anecdotal with little empirical evidence to support a significant movement of local populations toward al Qa’eda based on airstrikes. Further, what blowback has been seen may be the result not of the RPA campaigns themselves, but the one-sided information operations campaign surrounding the use of RPAs as the U.S. has largely abdicated the information battlespace in the name of keeping the program covert. Al Qa’eda’s central leadership and planning appears to have been disrupted by strikes and is disrupting the strategic goals of the organization by empowering local affiliates. However, a single terrorist or insurgent organization succeeding and gaining a foothold in a state
such as Yemen or Syria could reinvigorate the broader international organization if the leadership is able to coalesce around a unified leader and refocus on the traditional al Qa’eda mission. These, however, are problems beyond the role of the RPA and for which the RPA was not intended as the total solution.

Critical to working through the problem of blowback and its negative impacts on the utility of the RPA and leadership targeting is developing a stronger legal framework for non-international conflicts. The great challenge with the RPA legal debate today is whether operations outside of theaters such as Afghanistan constitute wartime actions or law enforcement actions, and thus whether International Humanitarian Law or International Human Rights law applies. To date the U.S. appears to have settled on an internal framework whereby International Humanitarian Law applies, but has limited discussion of the issue so as not to potentially jeopardize operations. In the process, it risks undercutting the potential successes of those operations due to the potential fallout of allowing adversaries to define what is being attacked and why. Settling the legal debate may limit some operations in the short-term, but will likely make them more effective in the long-term.
Chapter 6: Diffusion of RPAs

As the U.S. has increasingly relied on RPAs in the war on terrorism from Afghanistan to campaigns in Pakistan and Yemen, one of the more significant debates surrounding RPAs has been their proliferation and the potential precedent set by U.S. operations. A recurrent theme for many critics has been, given the U.S. use of RPAs to violate the sovereignty of other countries, what happens when other countries like China start using RPAs to violate U.S. sovereignty.\(^{236}\) Simon Jenkins’s aforementioned quote comparing the proliferation of RPAs to the proliferation of nuclear weapons represents this argument taken to its most extreme.

The doomsday scenarios surrounding the prospect of RPA discussions come in part from the conflation of all RPAs into a single category, leading to an almost mythical ‘super RPA’ combining the most favorable characteristics of all classes of RPAs – cheap, significant ISR collection and sharing capabilities, significant armament of precision weapons, etc., without regard for the tradeoffs involved in different types of RPAs.\(^{237}\) I have previously demonstrated variation in RPAs based on classification, divided between tactical and strategic RPAs based on their connectivity to their operator, which differentiates those that are part of global networks that incorporate the targeting revolution and those that are more simple locally controlled line-of-sight RPAs. This section will in turn look at the realistic prospects of RPA diffusion and applications of RPAs based on those classes by applying Adoption-Capacity Theory to the case of RPAs.

\(^{236}\) One extreme example is Hug Gusterson, writing in the *Bulletin of the atomic Scientists*, comparing RPA proliferation to nuclear weapons and seeing a future when RPAs are regularly launched by terrorists within the U.S. at various pieces of infrastructure, leading to a near police-state crackdown (Gusterson, 2013)

\(^{237}\) Gusterson notably makes this mistake constantly referencing the ‘relatively cheap’ costs of RPAs, which is an illusion as previously shown (Gusterson, 2013).
Adoption-Capacity Theory projects the rate of diffusion of a military innovation by evaluating its costs to implement versus its organizational capacity to adopt the change. Costs to implement are a factor of the dual-use civilian-military applications of the innovation, and the per-unit cost of the asset. Organizational capacity, meanwhile, is a function of the organization’s age, willingness to experiment, and critical task focus. Unlike Horowitz, however, who models innovations as single innovations falling into one type on his 2x2 matrix, I model the same underlying platform innovation as producing multiple innovations with differing rates of diffusion as each innovation is used differently. In Horowitz’s case study, for instance, he models all flat top carriers as attempts at implementing the aircraft carrier innovation, whereas I argue that the amphibious ship represents a fundamentally different innovation with greater potential for diffusion, much as the tactical RPA versus the strategic RPA.\textsuperscript{238}

While Horowitz’s model purports to predict state-level choices regarding adoption, I find his model limiting in this regard as it looks as innovations in terms of direct military challenges, rather than the broader applications of a new technology to support their strategy.\textsuperscript{239} I thus look to an additional model to project the causes states choose to adopt advance technologies. Looking to the nuclear literature as an area where significant literature exists on the choice of whether and why to adapt a new innovation, I model the choice to adopt RPAs based on the reasoning set forth in Scott Sagan’s “Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb.” Under Sagan’s models for nuclear adoption, states can be motivated by security, domestic politics, or international prestige to develop a weapons system, the third

\textsuperscript{238} The fact that the U.S. has adopted both types of vessels, a critical detail omitted from Horowitz’s case study, demonstrates this point.

\textsuperscript{239} Horowitz’s model doesn’t inherently exclude other methods of state choices for diffusion as his discussion of ‘strategic choice’ is broad and generalized, but as his book seems to be most focused on the system-level effects this issue is underexplored. Applying other theories of state-level choices here is a means to expand on Horowitz’s model to better define state strategic choices.
option being largely omitted from Horowitz’s model. After examining the applications of applying Sagan’s reasons for state-level adoption to Horowitz’s model for the rate and costs of diffusion, I briefly examine the historical precedents for the diffusion of innovations through a re-examination of the cases of aircraft carriers and cruise missiles.

Although Horowitz viewed the potential dangers of proliferation of RPAs as they could significantly change the way nations utilize air power (p. 221), I instead argue that while proliferation of RPAs is likely to be significant, their overall impact on the balance of airpower is likely to be limited. This is because most RPAs will be limited to battlefield operations in intelligence gathering roles and equally accessible to both sides of the conflict, limiting their strategic effectiveness. Few states will adopt RPAs capable of strikes far removed from the traditional battlefield as they are expensive, require extensive support infrastructure, and uniquely suited to a mission set for which most states do not possess a requirement. As the RPA represents a variety of classes of aircraft, the RPA would not be limited to a single square on Horowitz’s matrix, nor would I argue should several of the innovations he modeled in testing his theory. Tactical RPAs are small, relatively cheap, low-organizational capacity requirements, and have the potential for a number of significant non-military applications. For all these reasons, tactical RPAs would be classified in the Low-Low square of Horowitz’s model, indicating rapid diffusion. Strategic RPAs, due to their cost, reliance on new organizational systems for reachback analysis and support, high costs due to vital infrastructure and complementary innovations such as satellites and precision munitions, and the lower likelihood of non-military applications for such systems would place them in the High-High category, indicating slow diffusion throughout the system. Rather than thinking of all as a single RPA innovation, their
implications are better understood as remotely piloted strategic bombers versus remotely piloted helicopters.

Some states will have the economic capacity but lack the organizational flexibility or global network capability to incorporate the full strategic RPA, and they will be likely to adopt RPA platforms as prestige weapons but to limited operational use beyond line-of-sight. Other states that possess the organizational capacity but lack the economic means will likely ally closely with first movers to gain access to the airframes in combined operations. In addition, countries can develop RPAs which have the appearance and payload of strategic RPAs, but due to a number of technological and organizational barriers they are unable to achieve the same capabilities. The strategic requirements and organizational capacity of states will dictate which types of RPAs they will pursue, while the rate of diffusion can be predicted by applying Horowitz’s Adoption-Capacity Theory.

Because of the civilian applications for tactical RPAs, from local law enforcement, property security, aerial photography, etc., and the relatively low financial costs per unit, the tactical RPA has a low financial intensity. Smaller battlefield RPAs equipped with limited sensors such as full-motion video and basic offensive weapons are easy to operate by individuals and small units, and thus require low amounts of training or modifications of existing organizations, they represent a moderate increase in existing scout capabilities.

**Adoption-Capacity Theory**

In his 2010 work, *The Diffusion of Military Power*, Michael Horowitz put forth a cohesive theory of the diffusion of innovations based on existing theirs which modeled aspects of diffusion. As Horowitz noted, most of the existing literature looked at the question of what made
countries interested in responding to innovations, while his main interest was determining what made innovations spread generally and how that spread influenced the international security environment (Horowitz M. C., 2011, p. 21). Evaluating the financial intensity as well as the organizational capital required for adopting an innovation, Horowitz posits that his theory provides both the system-level distribution of responses as well as the way the individual actor makes decisions (Ibid., 30).

When presented with a new innovation, states have a variety of responses, both internally and externally, to the innovation. Externally, they can attempt to balance with a second-mover adoption against the first mover, they can bandwagon with the first mover, or they can become neutral if they foresee the inability to adapt to the innovation making their foreign policy goals impossible to achieve. Internally, they can attempt to adopt the innovation themselves, and/or they can attempt to counter the innovation. Figure 34, adopted from Horowitz (p. 27) but modified to simplify the decisions for allying with a first- or second-mover, illustrates this range of options for state reactions to a major military innovation.

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240 Many innovations will require both, as the acquisition by State A of a new weapons system such as a missile is not sufficiently countered by State B adopting the same system. This defensive capability gap created by the new offensive system can restart the innovation process for a new major military innovation.
Once the state attempts to adopt the innovation, an analysis of the state’s financial and organizational capacity to adopt defines the extent to which the state will adopt the innovation. This provides system-level predictions of the rate of infusion based on the requirements of states to adopt the innovation, and provides basic insights into state-level decisions whether or not to adopt innovations based on the capabilities and requirements of the state. The strategic choice models employed by Horowitz are limited however and tend to focus on offensive or defensive weapons which would pose a challenge to the balance of power in the event of direct confrontation, rather than broader and more abstract means of extending global influence, as applies in many ways to the RPA innovation. As a result, I focus here primarily on the system-level predictions made by Horowitz and the implications of that model, while examining models for state adoption separately.

Financial intensity is defined as “the particular resource mobilization requirements involved in attempting to adopt a major military innovation (Horowitz M. C., 2011, p. 31).” This looks at the cost per unit of the innovation and the cost and character of the underlying
technologies necessary to adopt the innovation. If the technology has military-only applications, the costs if implementing the innovation for the state are likely to be higher than a technology which has significant civilian applications, which will cause non-government sectors to absorb many of the costs of the innovation as they adopt it for their own purposes and as the demand for the technology rises. This impact of the military/civilian basis of the technology and the per-unit cost considerations of an innovation is shown in Table 20.\textsuperscript{241} Per Horowitz’s model, the higher the financial intensity required implementing an innovation, the slower it will spread. Left unaddressed by Horowitz is whether this measure of financial capacity represents the absolute cost of the innovation, or the cost relative to alternatives. In many cases it makes sense to speak of absolute costs, particularly with the high costs of innovations like atomic weapons and aircraft carriers. In the case of RPAs and other aircraft, however, an absolute metric is odd as aircraft are generally measured in terms of economic efficiency compared to alternative airframes for the same mission. As a result, rather than absolute costs, I specify a ‘high’ or ‘low’ requirement of financial intensity based on a relative comparison to other airframes vice the measure of absolute per-unit cost.

\textbf{Table 20: Financial Intensity Drivers}

\begin{center}
\begin{tabular}{|l|l|l|}
\hline
\textit{Underlying Basis of the technology} & \textit{Cost per unit} & \\
\hline
Civilian & Low financial intensity & Low financial intensity \\
\hline
Military & Medium financial intensity & High financial intensity \\
\hline
\end{tabular}
\end{center}

\textsuperscript{241} Derived from Horowitz, p. 33 (Horowitz M. C., 2011).
While financial capacity is relatively straightforward in defining and measuring, organizational capital is more ambiguous as it encompasses a number of traits of an organization that are impacted differently based on the character of the innovation. Jason Cummins, quoted in part within Horowitz as a useful definition, defines organizational capital as “an adjustment cost for IT investment, defined as the difference between the value of the installed IT and the uninstalled IT…. The reason that any given piece of tangible capital is more valuable at Dell than at Hewlett-Packard relates to Dell’s unique business model and routines, organizational capital that combines the usual factors of production in a special way. HP cannot simply replicate Dell’s tangible capital stock and become as profitable as Dell (Cummins, 2004).” As with previous discussion of the RMA literature, a focus on the technology is insufficient to determining its military value, and at minimum an examination of its organizational employment is required to determine its military value. This ambiguous definition, however, creates measurement problems, so Horowitz further defined organizational capital into three categories: critical task focus, experimentation, and organizational age.

Critical task focus evaluates how closely a firm ties its organizational identity to a particular means of achieving that mission. For military organizations, this means that the more specifically the organization defines its task, the harder it should be for the organization to innovate new solutions for achieving that goal. Horowitz uses the examples of the U.S. Marines versus the U.S. Army as examples of the variance of critical task focus, with the Marine Corps focus on a broader warrior ethos versus the Army’s historical focus on systems of conventional warfare demonstrating a broad versus a narrow critical task focus. The Marines, per Horowitz, should be more able to adopt new innovations, while the Army will be slower to adapt (p. 35-37).
Experimentation looks at institutional willingness to experiment, generally through investment in new technologies or in parts of the institution whose focus is the development of new technologies. The Marine Corps Warfighting Lab, the Air Force’s partnership with Lockheed’s “Skunk Works,” and DARPA all represent examples of institutional willingness to experiment. Organizational age, in contrast, factors in Olson’s observations that older organizations become more stagnant, making it more difficult for them to deal with transformational change (Ibid., p. 38).

Taken together, the factors of financial capacity and organizational capital required for a given innovation allows for a model of the rate of diffusion for an innovation across the system. Table 21 shows the predictions for the rate and extent of diffusion that Adoption Capacity Theory postulates based on the variables of financial intensity and organizational capacity. Innovations that are financially intensive and require a significant level of organizational capital will diffuse slowly and to a low extent, while those that do not require significant organizational capital nor are financially intensive will spread rapidly throughout the system and to a large number of state actors.

**Table 21: Adoption-Capacity System-Level Diffusion Predictions**

<table>
<thead>
<tr>
<th>Level of financial intensity required to implement major military innovation</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Rate/extent fast</td>
<td>Rate/extent medium</td>
</tr>
<tr>
<td>High</td>
<td>Rate/extent medium</td>
<td>Rate/extent slow</td>
</tr>
</tbody>
</table>

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242 Table originally appeared in *The Diffusion of Military Power* (Horowitz M. C., 2011, p. 40).
State-Level Drivers of Adoption

The two-by-two matrix provided by Horowitz’s theory presents a starting point for the analysis of state adoption, allowing for the evaluation of the necessary financial and organizational capital required to estimate which states will be in a range of potential adopters. I refer to this as the ‘supply side’ of the diffusion puzzle, looking at the costs associated with acquisition. But, once narrowed to this range, what drives some states to pursue adoption of the innovation on the demand-side? Horowitz posits this is a function of strategic choice, where a combination of geopolitics and domestic politics serve as limiting factors on the decision to pursue the innovation and instead pursue the alternative strategies identified in Figure 34 as the dominant strategies, and examples of the success or failure of the innovation (Horowitz M. C., 2011, pp. 40-42). This is the underdeveloped portion of Horowitz’s model from a theoretic standpoint, which forces him to rely on a variety of models to explain adoption in individual case studies. As a result, the strategic choice framework provides little insight to state-level predictions for the diffusion of RPAs.

One issue with the diffusion of RPAs is that the relative change in international power stemming from its adoption is more indirect than direct. The strategic attack RPA, being best used in low-intensity environments such as foreign intervention or what the military often refers to now as ‘Phase 4 operations’ for conventional wars, would pose a minor direct threat against another major power which Horowitz’s model would suggest would be the primary driver of similar adoption of the asset. Under Horowitz’s model, the risk of significant diffusion of such a platform should be low as most states would respond through offsetting, as their existing air

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243 In answering the critiques of Adoption Capacity Theory, Horowitz himself seems to grant this vulnerability as he states “adoption-capacity theory is not deterministic on the reasons why states might attempt to purchase specific technologies (Horowitz M. C., 2011, p. 58).”
defense networks should be sufficient, or only require moderate expansion, to ensure defense against the RPA. RPAs used for ISR collection, such as the Global Hawk, would require a similar counter-innovation to secure against a collection threat, but would not inherently require the development of a similar ISR collection platform; especially without forward basing mirroring U.S. global basing capabilities. Indeed, unless a state seeks to mirror the U.S. model for global power projection and intervention, there would appear to be few incentives to develop the RPA innovation as currently employed by the U.S. under Horowitz’s model. To understand diffusion, a broader understanding of the causes for adoption is required looking at the strategic decision making process that occurs within states in reaction to major innovations.

Looking at the question of nuclear proliferation, Scott Sagan identifies three reasons states adopt nuclear weapons. The first two closely parallel Horowitz’s ‘strategic choice’ model, with security threats and domestic interest groups being primary drivers in the decision to adopt a weapon or not. Security impacts a state’s decision to adopt based either on the need for defense against another nuclear state, or to give in the potential to coerce a non-nuclear state. Domestic politics plays a role too as industry might have financial incentive to press for a weapons program, bureaucracies such as a state’s nuclear energy department and/or military establishment may favor or oppose development, and political parties and interest groups will have a vested interest in the decision to proliferate as well. A third element, a normative model whereby nuclear weapons represent a particular status in the international community, also impacts the decision as weapons can be viewed as enhancing the status of a state in entering the ‘nuclear club’ or make the state be seen as a pariah for violating non-proliferation norms that have existed since the signing of the Non-Proliferation Treaty (Sagan, 1996). With respect to RPAs, all three of these potential influences on proliferation are at play as well, as the U.S.’s use
of RPAs in a variety of conflict has elevated the status of RPAs as a prestige weapons system, similar to aircraft carriers, nuclear weapons, or stealth aircraft given the parallels that discussion of RPA proliferation have with these weapons systems, notably the talk of a ‘drone arms race.’

As previously noted, Horowitz’s model doesn’t exclude discussion of these reasons states may pursue the adoption of a military innovation, and especially when evaluating the ‘norms’ aspect of causes for diffusion, Sagan’s model for proliferation can complement Horowitz’s model by helping to explain why states may choose to financially invest in a weapons system’s technology while failing to fully implement the innovation. If the state is driven by a normative desire to have the weapon for status purposes, its capacity for operational employment is less important as few besides those who follow the proliferation of such arms carefully will notice the difference. In the case of RPAs, this is most visible with the constant blurring of the costs and capabilities of strategic and tactical RPAs, resulting in RPAs being commonly seen as having the benefits of both systems without the limitations. States have an added incentive to acquire RPAs for the normative ability to say they have a similar capability to the U.S., but in many cases without the strategic need to develop the working operational capability.

In addition to this framework for what drives state choices, I further add that when faced with an expensive and complex system, Adoption Capacity Theory can provide insights into the state’s reaction to the adoption based on their ability to react. Assuming, based on the strategic calculus of the state that they see adoption of the innovation as being in their interest, the 2x2 matrix of Adoption Capacity Theory provides a framework for predicting the response strategy from the range available in Figure 34. If the state has both the financial and organizational capacity available to allocate towards pursuing the innovation, they will pursue the full innovation. If they lack both, they are more likely to pursue neutrality with respect to the
innovation, either simply because they lack the capacity to compete and do not wish to or because they may see the technology as threatening and seek to de-legitimize it as a viable weapon for diffusion. In the event the state has the financial capacity to develop the underlying technology but lacks the organizational capacity to achieve the full innovation, the state will pursue the technology as a baseline for prestige purposes, but will be unable for the immediate future to develop and implement the doctrines for effective employment under the existing model or they may find alternative uses for the technology. Finally, if a state has the organizational capacity to adopt the innovation but lacks the financial capacity required, it is more likely to seek alliances with adopting states in order to gain access to the technology while providing the manpower and geographic basing to operate the technology. This allows the potential adopter to free ride on the technology of the first mover to prove the need for the technology and ability to adapt in order to justify future budgets for acquisition of the technology. This is depicted in Table 22.

<table>
<thead>
<tr>
<th>Level of organizational capital available to implement major military innovation</th>
<th>Level of financial intensity available to implement major military innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low: State does not develop innovation</td>
</tr>
<tr>
<td></td>
<td>High: State develops technology for prestige purposes; may develop full innovation over longer timeframe</td>
</tr>
<tr>
<td>High</td>
<td>Low: State balances/bandwagons with adopting state; may acquire technology over time from adopting state</td>
</tr>
<tr>
<td></td>
<td>High: State pursues adoption of full innovation</td>
</tr>
</tbody>
</table>

To evaluate this proposition, I have re-examined Horowitz’s case study of the aircraft carrier innovation, with a particular eye to the means by which the carrier spread and the extent
to which states pursued the full innovation. As with RPAs, carriers can be further subdivided into classes that can be depicted in Horowitz’s 2x2 matrix for a financial and organizational cost assessment perspective, allowing potential adopters of the innovation a virtual menu from which to choose based on their internal requirements, capabilities of the different systems, and how the state can depict the adoption of the system. I then look at the case of cruise missiles, which like RPAs today were in the 1990s seen as being at the early stages of an impending destabilizing breakout of proliferation, which took longer to materialize than initially thought and once it did had a lesser impact on the system than projected as states migrated toward smaller, tactical systems and because states found ways to counter the innovation through mobility, camouflage, and concealment. These two cases combined with Horowitz’s broader research and resultant model for diffusion will allow for a starting point on understanding the proliferation of RPAs, which can be then projected looking at the innovative history and requirements of individual states who are potential adopters.

Case 1: Aircraft Carriers

Carrier warfare has been limited predominantly by three factors: cost, organizational requirements, and strategic requirements. The first two criteria are accurately predicted by Horowitz’s Adoption-Capacity Theory, which indicates the range of potential adopters of the carrier innovation was low. Within this sub-set of those who had both the economic and organizational potential to adopt the carrier, the state’s strategic choices dictated whether or not to invest in the carrier innovation, with to date only four states adopting the carrier innovation.

244 This count is generous as it considers both the United Kingdom and France to be adopters of the full carrier innovation, when both have adopted it to a significantly lesser extent than the U.S. and when both navies, as currently configured, lack the capabilities of the innovation today.
The adoption of the carrier by the United States was itself a slow process, as even though the British would first demonstrate an aircraft carrier during the First World War the U.S. decision to pursue the carrier innovation was slow, and not fully embraced as central to the future of naval power until as late as 1942. As John Campbell recounted, “the modern all-big-gun capital ship, unsurpassed in speed, fire-power, and endurance, was the ultimate weapon, according to Admiral William D. Leahy in 1941; he and his contemporaries had been trained to think in terms of the set piece gunnery battle between fleets (Campbell, 2009).” While Billy Mitchell advocated for an independent Air Force, the prospect of aircraft sinking ships and threatening the centrality of the battleship to naval warfare sent shockwaves through the Navy’s senior ranks, often leaving naval airpower visionaries like William Moffett and Forrest Sherman looked at with suspicion within the Naval hierarchy. As Campbell recounted, the sinking of the Ostfriesland in 1921 may have been seen as the end of an era by outside observers, the failures of some of Moffett’s early experiments in naval aviation were cited by naval leaders as proof that Mitchell’s concerns about the vulnerability of the U.S. to air attack was off-base and that control of the sea remained the central goal.

The U.S. embrace of the carrier innovation in World War II springs both from necessity given the destruction of the Pacific battleships at Pearl Harbor and the demonstration of its military necessity in the Pacific War, notably in the Battle of Midway where the opposing battle fleets did not physically see one another, except from the air. As Horowitz recounts of Admiral Chester Nimitz’s notes from the battle, “the priority of long-range air strikes against the Japanese carriers meant carriers had become a decisive element of naval battle and it was necessary to take America’s carriers, rather than its battleships, to Midway (Horowitz M. C., 2011, p. 69).” The experiences of 1942 would lead to the 1943 release of Pacific Fleet Tactical Orders and
Doctrine, commonly referenced as PAC 10. This publication marks in many ways the full adoption of the modern carrier innovation by the United States, as it established the basic framework for the four-carrier task forces that would form the primary mobile striking arm of the Pacific Fleet within the structure of a combined naval force, including battleships and carriers (Hone, 2013, pp. 63-64).

The British, meanwhile, failed to develop carrier warfare on a similar scale to the U.S. and Japan. Despite their early innovations in the early post-World War I years and their successful single carrier strike against the Italian port of Taranto in 1940, the British largely lacked a similar strategic impetus to develop carriers to meet the needs of World War II in Europe. The British decision to place all aviation under the control of the Royal Air Force led to a policy of ‘air substitution,’ where ground-based strategic bombers could in theory fulfill many of the missions previously performed by the army and navy, curtailing the budgets of those services. Experienced airmen shifted to the Royal Air Force, limiting the tacit knowledge available to the navy necessary for the development of both aircraft and optimizing carrier deck designs. Britain also did not face a major naval power in its home waters as Italy maintained a small fleet and Germany’s surface fleet was limited to several powerful battleships (Van Tol, 1997, pp. 83-84). Each of these factors contributed to a continued British emphasis on battleships over carriers, up to the recognition in 1945 that full adoption was necessary to conduct joint operations with the U.S. fleet in the Pacific.

In accordance with Horowitz’s theory, adoption of the aircraft carrier has been slow, with only at most four countries adopting the full carrier innovation.\textsuperscript{245} Table 23 reproduces Horowitz’s distribution of aircraft carriers, showing nine countries having adopted aircraft

\textsuperscript{245} The U.S. and Japan adopted the full innovation in World War II, France and Britain did so to varying extents shortly thereafter, but both have struggled to maintain a carrier force while Japan had their Navy destroyed after World War II.
carriers in some form, with only three having carriers capable of both launch and recovery of conventional fixed-wing aircraft, all others utilizing a modification of the carrier innovation, the assault carrier, as its representative of adopting some extent of the carrier innovation. As Horowitz states in his note on this table, this is a carrier design that emerged mainly in the 1960s with the development of the Harrier, and is used primarily for antisubmarine warfare or for assisting amphibious landing operations (Horowitz M. C., 2011, p. 80). The latter use for amphibious landing was also what one of the original missions of the U.S. carrier fleet prior to the adoption of the full innovation in 1943, as outlined by Admiral Earnest King in 1939’s “Operations with Carriers” (Hone, 2013, p. 57).

Table 23: Horowitz’s Distribution of Aircraft Carriers (Horowitz M. C., 2011, p. 80)

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Carriers</th>
<th>Air Wing Type</th>
<th>Propulsion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>1</td>
<td>Catapult/arrest landing</td>
<td>Conventional</td>
</tr>
<tr>
<td>France</td>
<td>1</td>
<td>Catapult/arrest landing</td>
<td>Nuclear</td>
</tr>
<tr>
<td>India</td>
<td>1</td>
<td>VSTOL</td>
<td>Conventional</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
<td>VSTOL</td>
<td>Conventional</td>
</tr>
<tr>
<td>Russia</td>
<td>1</td>
<td>VSTOL/arrest landing</td>
<td>Conventional</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>VSTOL</td>
<td>Conventional</td>
</tr>
<tr>
<td>Thailand</td>
<td>1</td>
<td>VSTOL</td>
<td>Conventional</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2</td>
<td>VSTOL</td>
<td>Conventional</td>
</tr>
<tr>
<td>United States</td>
<td>11</td>
<td>Catapult/arrest landing</td>
<td>Conventional/Nuclear</td>
</tr>
</tbody>
</table>

The doctrinal use of aircraft carriers pre-1943 being emulated by other ‘adopters’ of the carrier innovation is a first sign that something other than simply a scaled down adoption of the carrier innovation may be at work. Horowitz notes that World War II demonstrated that carrier innovation was important because sea control now relied on air control as well, but the purpose of VTOL carriers is not control of the air for the purpose of power projection from the sea, but
limited control of the air for support of forces on land. Further, the adoption of the full carrier innovation did not preclude those adopters from also pursuing their own assault carriers. Indeed, just as the U.S. dominates Horowitz’s table for aircraft carriers, the U.S. would similarly dominate a list of VSTOL carriers as well with its Wasp-Class and Tarawa Class amphibious assault ships. Although the distinction was largely limited to a note in Horowitz’s work, the assault carrier and the true carrier represent two different innovations with different military applications; they differ from one another not just in terms of size, but in terms of missions. True aircraft carriers are, in effect, mobile airbases capable of projecting power through control of the air and sea via an array of air assets, to include advanced fighter-bombers and airborne early warning systems. Assault carriers leverage smaller wings of helicopters and some vertical takeoff tactical aircraft (such as the Harrier) in support of amphibious landings and anti-submarine warfare. To the casual observer, both can be labeled aircraft carriers as they both have a flat surface and do carry aircraft, but their capabilities are distinct.

The United States was a first mover with the carrier innovation, but simultaneously was a first mover with the VSTOL innovation as well. The dawn of the carrier age in 1943 saw the U.S. carrier fleet divide into two classes, ‘escort carriers’ which supported the island-hopping campaigns in support of amphibious landings, and the ‘Fast Carrier Strike Group,’ which represents the precursor of the Carrier Battle Group. Smaller aircraft carriers were generally refitted as assault carriers, while larger carriers moved to the strike groups. Post World War II, the addition of the helicopter increased the abilities of the escort carrier as a ship for amphibious wars, with the British modifying their carriers to support such missions for the Suez Crisis of 1956, pioneering the ‘vertical deployment’ innovation for amphibious assault (Cooper T. , 2003). One of these ships that had been converted for this role, the HMS Ocean, had previously been
the first carrier to successfully land a jet fighter (R68 HMS Ocean). The U.S., similarly, would convert its Essex-class carriers Boxer, Princeton, and Valley Forge, as well as the Casablanca-Class Thetis Bay into helicopter air wing assault ships, which would see significant action in Vietnam along with the Iwo Jima-class which was launched in the early-1960s. Table 24 expands Horowitz's table to distinguish between these classes of carriers, and identifying which have fully adopted the carrier warfare innovation. This re-organization of Horowitz's table, combined with added data both which was omitted in the previous version and which is new since his publication, shows some interesting new correlations. World War II Japan, the U.S., Britain, and France are the only four states that adopted the full carrier innovation, with Britain and France developing it to a much lesser extent than the U.S. Four other states have developed true aircraft carriers, Brazil, Russia, India, and China. This pattern of diffusion suggests, rather than evaluating carriers from a supply-side single innovation, a demand-side perspective would see three separate innovations with three patterns of diffusion as shown in Table 25.
### Table 24: Current Distribution of True and Assault Aircraft Carriers

<table>
<thead>
<tr>
<th>Country</th>
<th>Carrier Warfare Innovation Adopters&lt;sup&gt;246&lt;/sup&gt;</th>
<th>CATOBAR/STOBAL Carriers&lt;sup&gt;247&lt;/sup&gt; (True Carriers)</th>
<th>STOVL/VTOL Carriers&lt;sup&gt;248&lt;/sup&gt; (Assault Carriers)</th>
<th>Propulsion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>N</td>
<td>0</td>
<td>2</td>
<td>Conv</td>
</tr>
<tr>
<td>Brazil</td>
<td>N</td>
<td>1</td>
<td>0</td>
<td>Conv</td>
</tr>
<tr>
<td>China</td>
<td>N</td>
<td>1</td>
<td>1</td>
<td>Conv</td>
</tr>
<tr>
<td>France</td>
<td>Y*</td>
<td>1</td>
<td>3</td>
<td>Nucl/Conv</td>
</tr>
<tr>
<td>India</td>
<td>N</td>
<td>3</td>
<td>1</td>
<td>Conv</td>
</tr>
<tr>
<td>Italy</td>
<td>N</td>
<td>0</td>
<td>5</td>
<td>Conv</td>
</tr>
<tr>
<td>Japan</td>
<td>Y*</td>
<td>0</td>
<td>5</td>
<td>Conv</td>
</tr>
<tr>
<td>Russia</td>
<td>N</td>
<td>1</td>
<td>1</td>
<td>Conv</td>
</tr>
<tr>
<td>South Korea</td>
<td>N</td>
<td>0</td>
<td>3</td>
<td>Conv</td>
</tr>
<tr>
<td>Spain</td>
<td>N</td>
<td>0</td>
<td>1</td>
<td>Conv</td>
</tr>
<tr>
<td>Thailand</td>
<td>N</td>
<td>0</td>
<td>1</td>
<td>Conv</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Y*</td>
<td>2</td>
<td>2</td>
<td>Conv</td>
</tr>
<tr>
<td>United States</td>
<td>Y</td>
<td>11</td>
<td>12</td>
<td>Nucl/Conv</td>
</tr>
<tr>
<td><strong>Total Ships</strong></td>
<td></td>
<td><strong>20</strong></td>
<td><strong>37</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total States</strong></td>
<td></td>
<td><strong>3</strong></td>
<td><strong>7</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

### Table 25: Variation in Capacity for Carriers

<table>
<thead>
<tr>
<th></th>
<th>Variation in Capacity</th>
<th>Required level of organizational capacity</th>
<th>Expected diffusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Warfare</td>
<td>High</td>
<td>High</td>
<td>Rate/extent low</td>
</tr>
<tr>
<td>Aircraft Carrier</td>
<td>High</td>
<td>Low</td>
<td>Rate</td>
</tr>
<tr>
<td>Amphibious Assault Carrier</td>
<td>Medium</td>
<td>Medium</td>
<td>Rate/extent moderate</td>
</tr>
</tbody>
</table>

<sup>246</sup> Those innovators marked with an asterisk have only sustained the innovation for specific periods of time and have not maintained a continuous capacity.

<sup>247</sup> CATOBAR (catapult-assisted takeoff but/barrier assisted landing), and STOBAR (short takeoff but/barrier assisted landing) vary based on the launch mechanism but allow for regular air operations with fixed wing aircraft.

<sup>248</sup> STOVL (short takeoff vertical landing) and VTOL (vertical takeoff and landing) carriers primarily operate rotary-wing aircraft in support of anti-submarine warfare or limited close air support for amphibious invasions.
It is unlikely that it is a coincidence that the four states that have aircraft carriers but not the full carrier innovation are four of the five states commonly referred to as the BRICS. More likely, the acquisition of aircraft carriers is a mark of national prestige to enhance the military status of these economic powers. India, Brazil, and China purchased their carriers from other states as a first step toward a future carrier capability, while Russia developed their carriers in the later years of the Soviet Union. India’s initial move toward aircraft carriers can be seen as militarily justified in the context of the India-Pakistan wars, as the Vikrant saw extensive service in those conflicts, but its role was primarily akin to an amphibious assault ship rather than a blue-water power projection platform. Modern upgrades have similarly been argued to be a result of China’s foray into aircraft carriers, but aside from purchase of the basic carrier platform little investment appears to have been made by India into developing a full strike group for blue-water operations. In all cases, prestige seems to be a significant motivator for carrier development beyond military necessity. With Brazil, this was most explicit with Brazilian President Fernando Enrique Cardoso, saying of the purchase “[a] country as ours, possessing of the extensive coast, with more than a thousand kilometers of coast, requires a compatible Naval Power with its stature in the international scene (São Paulo).”

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249 South Africa, the fifth state, has a minor navy on which it has placed little emphasis.
250 India purchased their first carrier from the United Kingdom in 1961 and their current flagship Viraat was purchased from the United Kingdom in 1987. Brazil purchased their carrier from France in 2000 while China purchased their carrier from Russia in 1998.
251 See The Guardian’s account of the most recent India purchase from Russia (Urquhart, 2013). As an aside, if China’s carrier is causing an arms race for carriers in the Indian Ocean, Russia is supplying both sides.
The Russia move toward aircraft carriers, similarly, appears closely tied to the need to appear to have a similar capability to the U.S. for purposes of power projection to third-world states during the Cold War. The Soviet Union largely rejected carriers as unnecessary, as their economy was less reliant on external trade via shipping lanes. One U.S. report of the era noted “Tactically, it is easier to disrupt communications than to protect them and the type of naval fleet necessary to conduct these divergent military roles will be different. Thus the U.S. Navy has emphasized the role of the aircraft carrier and capital vessels to protect them, while the Soviets have structured its strike force around submarines and small, maneuverable, tactical vessels (Senate Commerce Committee, 1976).” That same report viewed the future prospects of aircraft carriers as instruments of war as weak given their growing visibility to missiles, but saw a need for them for the U.S. and potentially for the Soviet Union as peacetime tools to display naval power to third parties, especially in the Indian Ocean for the Soviets. Horowitz notes Admiral
Sergei Gorshkov’s need for a balanced fleet, but more telling appears to be Gorshkov’s insistence that Lenin’s Principles of Military Science dictated that since the U.S. had carriers, the Soviet Union needed them as well (Ibid.). His public and private statements together suggest Gorshkov felt the carrier an unnecessary tool militarily for the Soviet Union, but one which needed to be better understood to counter and that could serve a great value in peacetime as a demonstration of Soviet power.

Case 2: Cruise Missiles

Prior to the debate over the spread of RPAs, a number of analysts saw the future danger of destabilizing proliferation in cruise missiles. Dennis Gormley (Gormley, Missile Contagion, 2008) and Seth Carus (Carus, 1992) both pointed to the characteristics of missiles which would make them desirable for most states, and the spread of technology in the 1990s that could make that spread a reality. Cruise missiles have existed in one form or another since the end of World War I, when the United States and several other nations planned for the use of unmanned aircraft filled with explosives that would be crashed into enemy positions, but the modern cruise missile and operational employment can be traced to World War II and the introduction of the German V-1 flying bomb. At various points in history, from World War II to the 1960s to the post-Gulf War period, cruise missiles appeared primed for breakout as a new wonder weapon that would be sought out by most advanced states, but in each case the weapons have largely failed to spread beyond one or two new adaptors, and to mixed results.

During World War II, the German Luftwaffe launched more than 10,000 of V-1 missiles toward targets in the United Kingdom. Guided by a preset compass capable of carrying its 1-ton payload to a maximum range of 160 miles, the earliest cruise missiles were a formidable weapon
until British defenses developed proximity fuse anti-aircraft countermeasures that ensured a 95% attrition rate (Huisken, 1981, p. 15). The slow speed and low altitude approach of the V-1 made the weapon easier to defend against than its successor, the V-2, setting the stage for early emphasis in the Cold War on ballistic missile development. Despite the post-war preference for ballistic missile development, both the United States and the Soviet Union pursued cruise missile programs beginning in the latter stages of World War II through the early Cold War period. The US JB-2 Loon, based largely on the design of the V-1, went into production prior to the end of the conflict, though none were used in that war (Huisken, 1981, p. 15). Interest in the cruise missile climbed steadily throughout the 1950s as the Air Force developed three strategic systems (the Snark, Navajo, and Hound Dog) while the Navy developed two (The Regulus I and II).

All cruise missile systems were initially envisioned as long range strategic systems, but all suffered from unforeseen problems in developing the requisite guidance systems and reliable engines. Early US missiles were guided by Inertial Navigation Systems (INS) and propelled by turbojet engines. However, long flight times resulted in unacceptable navigation errors for the missiles’ INS, rendering it inaccurate and precluding it from terrain-following flight paths that would allow it to evade air defenses. The cumulative result was a weapons system with virtually no military utility (Gormley, Missile Contagion, 2008, p. 49). While the development of strategic cruise missiles gave way to the ballistic missile force, the Air Force continued to develop tactical air launched cruise missiles (ALCMs) for employment complimenting fighter bombers in Europe. With a range of 1500-2200nm, the Mace and Matador systems were the longest range tactical nuclear delivery systems in the US inventory from the late 1950s through the early 1970s. These missiles employed a new guidance system, the ATRAN (Automatic Terrain Recognition and Navigation), which enabled them to penetrate air defenses at altitudes as
low as 500ft, with the commander of the first Mace squadron in Europe claiming they were capable of penetrating any known air defense (Huisken, 1981, p. 23).

Despite these advances, cruise missiles played a minor role in Air Force strategy for much of the Cold War. Little mention of these systems appears in military journals at the time, in assessments of military balance-of-power, or in terms of congressional interest (Huisken, 1981, pp. 23-24). The Navy, meanwhile, showed less interest in the prospects for cruise missiles in the early post-WWII period. While the Navy established programs immediately following the war, cruise missile development programs virtually ceased in 1958 with the cancellation of the Regulus II. The Cuban Missile Crisis of 1962 and the Egyptian sinking of an Israeli vessel with an SSN-2 Styx missile led to the November 1970 Defense Select Acquisition Review Council (DSARC) meeting that approved both air launched and Harpoon missile systems, and at the same time initiated development of ship defense systems (a process that would lead to the development of AEGIS, Vulcan-Phalanx, and other point-defense systems) and their first plan for an advanced cruise missile program (Huisken, 1981, pp. 29-31). Though this program would be cancelled after two years, it laid the foundation for the Strategic Cruise Missile program, which produced the Tomahawk cruise missile.

The Soviet Union, like the United States, began to develop cruise missiles in the closing years of World War II based largely on captured German designs from the V-1. However, the programs diverged both in designs and doctrinally by the mid 1950’s owing to the technical and doctrinal differences between US and Soviet strategies. While the United Stated developed a robust naval force based around aircraft carriers, the Soviet Union lacked a similar system. Advanced anti-ship cruise missiles came to be seen by the Soviet Navy as the best counter to the US surface fleet, many of which were built with tactical nuclear applications (Kopp, 2012).
AS-1 Kennel is the earliest example of an indigenous Soviet cruise missile. Modeled after the MiG-15 but as a remotely piloted anti-ship missile, the AS-1 received in-flight guidance from X-band radar aboard the Tu-4 (later Tu-16 Badger) aircraft that would launch them, with terminal guidance provided by a K-2 semi-active homing seeker mounted in the nose of the missile which relied on illumination from the X-band system (Kopp, 2012). This was paralleled in the navy by the SS-N-1, SS-N-3, and SS-N-2 Styx series of missiles.

In the 1960s, the Soviets introduced their first advanced long-range cruise missiles, notably the Kh-55/AS-15 Kent, the Kh-22/AS-4 Kitchen, and the Novator missile systems (such as the SS-N-27 Sizzler). The Kitchen was designed both as a nuclear standoff and an anti-shipping missile with both radar guidance and anti-radiation seekers. Capable of top speeds reported to exceed Mach 4.6 with a range of up to 300nm, the Kitchen was largely responsible for the US military’s development of AEGIS and other fleet defense systems. It remains the primary weapons system of the medium range Tu-22 Backfire bomber platform (Kopp, 2012).

Critical to the expanded interest in cruise missile programs in the United States in the 1970s was the development of other technologies that enabled the cruise missile to perform as earlier theorists had intended. New guidance systems such as terrain contour matching (TERCOM) and digital scene matching area correlation (DSMAC) improved the missiles’ ability to penetrate defense systems and improve terminal accuracy, while advancements in satellite imagery, precision mapping and targeting, and eventually the GPS would make precision targeting a reality.

When introduced in the early 1980s, the Tomahawk and Air Launched Cruise Missile relied on a pre-programmed fire-and-forget model which was capable of long-range strike but also manpower intensive. The Air Force’s introduction of the Conventional ALCM (CALCM)
in 1988 combined the ALCM platform with a network of satellite guidance through GPS which enabled the missiles to guide themselves to targets, dramatically decreasing the programming preparation and thus making the missiles functional for large-scale use in conventional war (Rip & Hasik, 2002, pp. x-xi). The first demonstration came in the Gulf War in 1991, where 282 sea-launched Tomahawk and 35 CLACMs were employed with what the Joint Chiefs of Staff boasted as an 85% success rate (Gormley, Missile Contagion, 2008, pp. 49-50).\textsuperscript{252}

As the US developed its strategic ALCM force in the 1970s, the Soviets countered with the Kh-55 program.\textsuperscript{253} The missile is in many ways similar to the US BGM-109, with a cylindrical frame, pop-out planar wings, ventricle turbofan (though this is mounted and deployed differently on the Kh-55 and the BGM-109), unfolding tail control surfaces, and with guidance provided by TERCOM-aided INS. The first systems came online in 1984, with the Tu-95MS capable of carrying up to 16 missiles with its internal rotary launcher and external pylons. With the 1987 modification of conformal fuselage fuel tanks, the Kh-55SM was capable of delivering a 200 kT warhead to a range of 1,620 nm.

Between the Gulf War and the Iraq War of 2003, the cruise missile had become the weapon of choice for the US military, finding periodic use in Iraq, NATO missions in the former Yugoslavia, and probably most controversially in attacks on assessed al Qa’eda-related facilities in Sudan and Afghanistan following the 1998 African embassy bombings. The lag time between intelligence gathering, targeting, and impact in the case of the Afghan attack demonstrated to military planners the need for first unarmed, and later armed, RPAs to enable precision targeting on an ad hoc basis (Gormley, Missile Contagion, 2008, p. 52). By the start of the Iraq War,\textsuperscript{252} Gormley notes this was overstated for the Tomahawk and a lower, but classified, success rate has been acknowledged. The Tomahawk systems employed TERCOM guidance, which likely limited their effectiveness over the desert environment, while the CALCMs were GPS-guided and had a higher success rate as a result.\textsuperscript{253} Kopp notes that some Russian sources claim this program had begun earlier, but was opposed by many in the Soviet hierarchy who were skeptical such a complex system was viable.
cruise missiles and RPAs would be regularly employed due to their precision strike, deep penetration with modifications to the cruise missile warheads, and relative safety of service members employing these systems.

The United States and Russia/the Soviet Union have historically led in the development and proliferation of cruise missiles, and in recent years China has also expanded programs. However, throughout their history various observers have predicted an impending breakout of cruise missile proliferation which would dramatically reshape the international system, with each case the predictions largely falling short of the reality. The Kh-22/AS-4 Kent, Kh-55/AS-15 Kitchen, the Tomahawk, and the AGM-109 represented the most advanced cruise missile systems on both sides of the iron curtain at the time of the fall of the Soviet Union, but were by no means the sole cruise missile programs. Nor were these countries alone in development and testing of cruise missiles. Great Britain, France, Israel, Italy, and numerous other countries developed tactical land attack and anti-ship cruise missiles from the mid-1970s onward. The Soviet Union’s collapse would lead to a period where no new advances were made on former-Soviet (Russian) systems, while the US military shifted most of their systems to a primarily conventional role. The re-emergence of Russia, the rise of China, the US’s prolific use of cruise missiles in the post-Cold War period, and the desire of other nations to build an Air Force “on the cheap” seeing the advantages gained by the United States would combine to lead many observers to project a new era of cruise missile development and proliferation in the 1990s and beyond.

Seth Carus identified the unique characteristics that would raise the appeal of cruise missiles in the 1990s. They are small enough to be launched from a small ship or a truck, they are capable of achieving high accuracy even at long range, they are capable of evading air
defenses designed to intercept primarily ballistic missiles, and they are highly maneuverable (further increasing their survivability) (Carus, 1992, p. 18). With globally available GPS guidance, a radar cross section of less than 0.1m$^2$ in many cases, and advanced air-breathing engines (removing the need to carry oxidizers) could enable a minor regime to launch chemical, biological, or even nuclear warheads deep into adversary territory that even upon detected would be difficult to defeat without advanced integrated air defense systems (IADS). Missile engine tests do not require large rockets with significant heat signatures that are detectable from space, and production can be masked by mixing production of cruise missile pieces within aircraft production lines.

Figure 36: Cruise Missile Proliferation$^{254}$

Despite Carus’s predictions, it wasn’t until about 2004 that cruise missile proliferation truly took off, and even then missile proliferation was largely limited to shorter-range land attack

$^{254}$ See Appendix 5 for data underlying this chart.
cruise missiles, systems with generally more tactical applications. Figure 36 illustrates the proliferation of cruise missiles by country, indicating their introduction with the German V-1 program, the period of U.S. programs from the early 1950s through the late 1960s, the re-emergence during the late Cold War, and increased proliferation following the Gulf War (seen from the 1992 through 1996 timeframe) and after the initiation of the War on Terrorism (seen around 2004). Gormley notes this is due in part to the increased use of weapons by the United States in seven different conflicts, but also cites the spread of specialized knowledge and advances in US missile defense technologies as critical to the timing. More importantly are the organizational and economic challenges to adopting the innovation, and the strategic requirements of states with respect to the capabilities of different classes of cruise missiles.

Adoption-capacity theory provides many insights into the limits of cruise missile proliferation. The financial capacity for cruise missiles are relatively high as there are few civilian applications for such a system, while the alternative long range technology, ballistic missiles, potentially has non-military roles in space applications. Ballistic missile technology is more generally cheaper owing to lesser requirements for guidance systems, leading to ballistic missiles as the preferred alternative and therefore more rapid to diffuse over the past half-century. Cruise missiles also come at higher organizational costs dependent on the mission. As previously discussed in Chapter 4 on the Precision Revolution, effectively leveraging precision is a function both of the capabilities of the weapons platform and the accuracy of the underlying intelligence. A precision system designed to attack strictly military targets with identifiers such as radar emissions is therefore more likely to diffuse rapidly that one guided by GPS and reliant on a significant investment in human capacity for intelligence collection and analysis, and which requires the integration of global strategic strike doctrine.
Table 26: Cruise Missiles

<table>
<thead>
<tr>
<th>Missile</th>
<th>Type</th>
<th>Range</th>
<th>Payload</th>
<th>Guidance</th>
<th>States Operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALP EG</td>
<td>ALCM</td>
<td>135-215 nm</td>
<td>880 lb warhead</td>
<td>Inertial GPS, TERCOM, Imaging IR</td>
<td>France, Greece, Italy, Saudi Arabia, UAE, UK</td>
</tr>
<tr>
<td>AGM-158 JASSM</td>
<td>ALCM</td>
<td>200-500 nm</td>
<td>1,000 lb warhead</td>
<td>Inertial GPS</td>
<td>US, Australia, Finland</td>
</tr>
<tr>
<td>Taurus KEPD 350</td>
<td>ALCM</td>
<td>270 nm</td>
<td>1,000 lb warhead</td>
<td>Inertial GPS, TERCOM, IBN</td>
<td>Germany, Spain, Sweden</td>
</tr>
<tr>
<td>Brahmos</td>
<td>ALCM or SLCM</td>
<td>162 nm (SSM)</td>
<td>661 lb (SSM)</td>
<td>Homing radar seeker</td>
<td>Russia, India</td>
</tr>
<tr>
<td></td>
<td></td>
<td>270 nm (ASM)</td>
<td>441 lb (ASM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HN-1/2/3 (C-602)</td>
<td>ALCM or SLCM</td>
<td>320-1620 nm</td>
<td>single warhead</td>
<td>Active radar homing, imaging IR</td>
<td>China</td>
</tr>
<tr>
<td>Kh-55 (AS-15)</td>
<td>ALCM</td>
<td>1350 nm</td>
<td>200-250 kT (nuclear)</td>
<td>Terrain mapping</td>
<td>Russia</td>
</tr>
<tr>
<td>Kh-101/102</td>
<td>ALCM</td>
<td>1,000-1600 nm</td>
<td>880 lbs</td>
<td>Imaging IR</td>
<td>Russia (devel)</td>
</tr>
<tr>
<td>AGM-86 ALCM</td>
<td>ALCM</td>
<td>1350 nm (nuclear)</td>
<td>200 kT (nuclear)</td>
<td>TERCOM (nuclear) Multi-channel GPS (conv)</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td>650 nm (conv)</td>
<td>2,000 lb (conv)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomahawk</td>
<td>SLCM</td>
<td>863 nm</td>
<td>1,000 lb warhead</td>
<td>GPS, INS, TERCOM, DSMAC</td>
<td>US, UK</td>
</tr>
</tbody>
</table>

Cruise missile proliferation has generally come as a result of first movers selling the technology to allies, with the U.S. AGM-158, the French/U.K SCALP, the German Taurus, and Russian SS-N-26 variants (notably the Indian Brahmos) being the most widely proliferated cruise missiles today. For strategic cruise missiles, the U.S. Tomahawk has been exported to the U.K. and along with the AGM-86 ALCM still represent the primary strategic cruise missiles for the West, with the Russian development of the Kh-101/102 and Chinese H-1/2/3 variants as the only competing strategic cruise missiles.
Table 26 depicts both the most commonly proliferated and the most well-known cruise missiles which provides some basic insights into the nature of cruise missile proliferation, with shorter range ALCMs commonly used as standoff weapons (used against fielded forces or for interdiction in tactical settings) being most commonly employed, while longer range strategic munitions are much more limited. Most other cruise missiles not displayed on this chart\textsuperscript{255} most closely mirror those toward the top of the chart in terms of capabilities, with radar homing the most common guidance system. This is also the most tactical system in nature as it requires the target be a radar-emitting system such as an anti-aircraft missile site.

**Table 27: Diffusion pattern of cruise missiles**

<table>
<thead>
<tr>
<th>Organizational capital to implement major military innovation</th>
<th>Financial intensity available to implement major military innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>- Ballistic missiles</td>
</tr>
<tr>
<td>High</td>
<td>- Limited acquisition of existing cruise missile systems</td>
</tr>
</tbody>
</table>

As with aircraft carriers, the wide range of mission sets and disparities in requirements for production and employment of cruise missiles leads me to the conclusion that cruise missiles should be broken into multiple classes of innovation, which vary the cost and organizational requirements for adoption. Cruise missiles generally fall into two categories: air launched cruise missiles (ALCMs) and surface or ship launched cruise missiles (SLCMs). These can be further subdivided into strategic and tactical categories, which many analysts subdivide based on nuclear

\textsuperscript{255} Comprehensive list in Appendix 5.
or conventional missions, or by mission. With adoption-capacity theory as my primary lens of analysis, I let the financial intensity and organizational capacity requirements drive the categorization based on my previous observations of the relative merits and missions of cruise missiles. The results are shown in Table 27, where strategic precision missiles are likely to spread slowly as they are high-financial-intensity, high-organizational-capacity weapons systems. Standoff cruise missiles like the JASSM and radar-homing cruise missiles are likely to spread faster owing to their lower organizational requirements, while ballistic missiles, as observed historically, diffuse the fastest and to virtually all states as they are relatively cheap compared to cruise missiles and organizationally function similar to very long-range artillery, requiring fewer organizational adaptations. Some countries that have the organizational capacity but lack the financial intensity will be likely to seek alliances with states that have developed cruise missiles so as to enable them to offset the development costs and procure a limited number of munitions commensurate with their strategic requirements.

From this spectrum of potential systems and associated costs, individual states have a range of tools available to meet their strategic needs given the resources they are willing to commit. While few states will be capable of acquiring long range precision cruise missiles given the financial and organizational costs, fewer still will seek to purchase the weapons lacking a concrete strategic need for the capability. Some may still choose to invest in the weapons system for prestige purposes as was the case with aircraft carriers, but few will actually need to operate such a precision system at an extended range. As an example, Russia and China may want such a weapon to mirror U.S. capabilities, but given that most military threats those countries face are closer to their own borders than the threats faced by the U.S., there is little strategic need to

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256 The Air Force ISR Agency is one such example, noting “Unlike ballistic missiles, cruise missiles are usually categorized by intended mission and launch mode (instead of maximum range) (National Air and Space Intelligence Center, 2013).”
invest as much organizational capital in truly developing such a system of employment. Such states are more likely to develop standoff cruise missiles for precision targeting of closer-range threats, while relying on ballistic missiles for deterrence against the prospect of more distant potential threats like the U.S.

**Predicting the Diffusion of RPAs**

Thus, while largely agreeing with the overall conclusions of Horowitz’s theory in terms of systematic lessons of diffusion, I re-examine individual innovations from a state-level strategic perspective, seeing the carrier innovation in this case as resulting in several distinctive innovations. As three distinct innovations, each with a different strategic purpose, the carrier’s diffusion and its implications for international security can be understood in a larger context than the basic system-level lessons of adoption-capacity theory. A similar pattern of dividing RPAs by class and strategic purpose will allow for better predictions of patterns of diffusion of RPAs.

The focus on cheap RPAs and the idea that they can function autonomously with little human intervention has likely fed the impression among many observers, including Horowitz, that they will diffuse rapidly throughout the international system and thus have a greater short-term impact. However, as I have previously shown, categorizing all RPAs as being one type of innovation is flawed, as RPAs represent at minimum two different types of innovations, tactical and strategic RPAs. Given the high costs both per unit and per system of strategic RPAs, the significant organizational requirements to implement their use from the adoption of reachback capacity and the doctrines of strategic air warfare, the strategic RPA falls into the High/High category, indicating rate/extent of the diffusion will be slow. Tactical RPAs, on the other hand,
will remain in the Low/Low category, and diffuse rapidly but with less of an impact on the system.

Table 28: Predicted Rate of Diffusion of Tactical and Strategic RPAs

<table>
<thead>
<tr>
<th>Financial intensity available to implement major military innovation</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational capital to implement major military innovation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Rate/extent fast</td>
<td>Rate/extent medium</td>
</tr>
<tr>
<td></td>
<td>Tactical RPAs</td>
<td>Prestige or Proliferation</td>
</tr>
<tr>
<td></td>
<td>Dual Civ/Mil applications</td>
<td>Large tactical RPAs mimicking strategic RPAs in appearance, limited capabilities</td>
</tr>
<tr>
<td>High</td>
<td>Rate/extent medium</td>
<td>Rate/extent slow</td>
</tr>
<tr>
<td></td>
<td>Adopt RPA innovations in partnership with other states</td>
<td>Strategic RPAs/UCAVs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Precision munitions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Global ISR assets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Future air-to-air capable RPAs</td>
</tr>
</tbody>
</table>

One area of distinction between RPAs and both aircraft carriers and cruise missiles is the wider gap in relative costs, both financially and organizationally, in implementing the varied innovations. As detailed in previous chapters, the costs for tactical RPAs are low per unit, require little in the way of existing infrastructure, and have a multitude of potential uses outside of the military domain. Strategic RPAs are expensive, require significant infrastructure investment, and are at this point limited in their applications to military uses. The cost gap for aircraft carriers vs. amphibious assault carriers and for strategic versus stand-off cruise missiles
will be lower both in financial and organizational terms, which suggests a greater gap in diffusion of tactical vs strategic RPAs than existed for those innovations.

Figure 37 shows the diffusion of RPAs to date, largely confirming this hypothesis as nearly 80 countries have adopted, either militarily or in domestic law enforcement, some form of tactical RPA. Strategic RPAs, meanwhile, have solely been adopted as a stand-alone capability by the U.S. and U.K., and have only been adopted to a limited capacity in partnership by allied nations such as France, Japan, Canada, and the Netherlands.

**Figure 37: The Diffusion of RPAs**

Outside of those who have either adopted strategic RPAs or are adopting them in partnership, several other states are heavily invested in future RPA capabilities both as proliferators and for their own purposes. China is currently developing a wide array of RPA platforms, many of which appear closely modeled on U.S. RPA programs. Kimberly Hsu, a policy analyst at the US-China Economic and Security Review Commission, noted tactical UAV
systems constitute about 93 percent of Chinese UAV projects (Hsu, 2013, p. 14). Of their strategic RPAs, many bear a close resemblance to U.S. counterparts, with a Chengdu Aircraft Industry Group salesperson acknowledging the similarities of the Chinese Pterodactyl-1 RPA and the U.S. RQ-9 Reaper, noting the major advantage of the Pterodactyl-1 was cost savings on the export market (Hsu, 2013, pp. 9-10).

China’s interest in the RPA market appears twofold, first is for the prestige of matching the US capability combined with the financial gains from entering the export market, and second for the strategic requirements of Chinese defense in the maritime environment. To date, the RPA export market has been dominated by the U.S. and Israel, with Predator, Reaper, Global Hawk and Hermes variants being the most widely proliferated strategic platforms. When proliferated, however, these RPAs function more like large tactical RPAs limited by line-of-sight control and therefore requiring lower costs to operate. The Hermes 450 is the best example of such a system, with a flight profile similar to the Predator and capable of long-endurance missions of up to 20 hours, but limited in range. For Israeli operations as well as those of most states whose primary concerns are with neighboring states, this is sufficient for most of their ISR and limited strike needs. For this reason, Hermes has been sold to Turkey, the U.K., Azerbaijan, Georgia, and even the U.S. where they were used briefly by the border patrol (Unmanned aerial vehicles support border security, 2004) among other states. Thus, an airframe similar in appearance to Reaper but with only line-of-sight controls would be an ideal platform for proliferation to markets of interest to China such as Asia, Africa, and the Middle East.

Strategically, China’s greatest need for RPAs is less likely to be for strategic attack (as the U.S. has employed them to date), but in maritime environments for observation of disputed territories as well as potentially integrated into targeting systems as part of an anti-access
strategy. China’s RPA program received headlines in February of 2013 when China’s news media announced it had considered, but ultimately rejected, a plan to use an RPA to strike a wanted drug kingpin who had killed 13 Chinese sailors and was operating in Myanmar (Perlez, 2013). China’s interest in similar interventions against non-state actors appears limited for the foreseeable future, however, as disputes with neighbors over territory such as the Senkaku Islands and islands in the South China Sea. In these disputes, strategic airframes such as the U.S.’s naval Global Hawk variant would appear to be of greater need for China.

The U.S. broad area maritime surveillance system for Global Hawk, designated the MQ-4C Triton, is a project in development that will provide persistent maritime surveillance to supplement operations of manned airframes such as the P-3 Orion and P-8 Poseidon. This system will be designed specifically for finding and identifying ships in the ocean and reporting combat information to operational and tactical users such as a Carrier Strike Group (Naval Air Systems Command). A similar system, operated by the Chinese, could be used to maintain persistent coverage over disputed territories in an effort either simply to ensure a response by competitors or worse to try to assert that airspace control conveys territorial sovereignty, which would be a novel concept. Worse, as shall be explored in the next chapter, such a system could be integrated with anti-ship missiles such as the DF-21D providing precision targeting data.

The overall implications for diffusion suggest significantly different tracks for the proliferation of strategic versus tactical RPAs. Proliferation of strategic RPAs is tied to the use and proliferation of global navigation and communications system, which for the foreseeable future should be a significant barrier to their widespread use. At present, only the U.S. (GPS), European Union (Galileo), Russia (GLONASS), and China (Bentou) operate such systems, with only the U.S. GPS system at this time being fully operational. Either the ownership of such a
system or the reliable support of the entity operating the system would be necessary for the operation of strategic RPAs.

Tactical RPAs, however, are both likely to spread rapidly and to see the greatest variations in terms of their uses. Though not revolutionary in their implications for warfare, they do have the potential to significantly alter tactics and the management of operations. The potential increase in ISR collection available to tactical commanders is a two-edged sword, as while commanders may have the capability to collect more information on their battlespace and the capabilities of their adversary, they will need to manage and effectively utilize the increased data available to prevent it from overwhelming their decision process. Further, increased reliance on such tactical methods of collection will provide adversaries opportunities to manipulate collection in keeping with the lessons of the Modern System, potentially making them a hardship if not effectively managed. Tactical RPAs may be able to provide fire support similar to a mini-Combat Aviation Brigade on call at the tactical level, but this too is not likely to be an unlimited resource. In these missions and in re-supply/communications, tactical RPAs have the potential to supplement existing systems to decrease some aspects of the friction of war, but neither the fog nor friction of war will ultimately be overcome by a purely technological solution.

Summary

RPAs, like numerous other technological innovations before them, have been subject to a great deal of scrutiny over their implications for diffusion and the prospect of a new ‘arms race’ similar to that of nuclear weapons in the Cold War. Adoption-Capacity Theory, as adapted in this chapter, suggests that the question of diffusion of RPAs will not be as simple as that. RPAs
will rapidly spread to most of the world owing to their low per-unit cost, true, but this is limited in application to tactical RPAs which are unlikely to be revolutionary in terms of their battlefield impact. Strategic RPAs, with higher per-unit costs, organizational barriers to doctrine and integration, and extensive support infrastructure, will spread very slowly with few states adopting. Between those extremes, larger RPA platforms which have the appearance of strategic RPAs but are limited in capabilities to those of tactical RPAs, will see moderate diffusion to states who require the aircraft for prestige or border defense purposes.

As RPAs spread and states integrate them into their existing force structures according to their own requirements, the nature of diffusion itself, rather than the capabilities of the airframes, is likely to be the most dangerous aspect of the RPA innovation. While this chapter has examined the rate and strategic choices dictating the diffusion of RPAs, the next chapter will examine the implications of diffusion over the next ten to twenty years, and how the changing roles of RPAs have the potential to lead to conflict, and provide insights on how the risk of conflict may be mitigated.
Chapter 7: Present and Future RPA Trends in Military Operations

The central purpose of this dissertation is to examine the true implications of the RPA on the future of warfare, to separate fact from fiction, and provide policymakers with greater insights going forward on the actual utility of RPAs in conflict and to aid in avoiding the pitfalls of their misuse. To that end, this chapter represents a thought piece applying the applications of RPAs to date with existing theories of warfare to contemplate the true implications of RPAs on the future of warfare looking at specific potential conflict zones. I examine the likely future evolution of U.S. RPAs based on existing planning documents and likely future crisis scenarios to show how the RPA will continue to evolve and attempt to expand to new roles beyond non-international conflicts, and what the consequences of such innovations might be.

Perceptions of RPAs differ greatly, and how policymakers and militaries of both adopters and their military rivals perceive the innovation is the most important factor in determining the near-term implications of the RPA innovation. Some countries will acquire small, tactical RPAs in the false belief that it will give them many of the same capabilities of strategic RPAs, leading to increased tension with adversaries and possibly leading even to war if the state’s calculations are based on a false belief in their own capabilities. Many more will do so knowing this will not match the U.S. RPA’s capabilities in terms of projecting power at a distance, but may believe such RPAs will give them a more limited capability for operations near their own borders. In time, however, they are likely to learn that the RPA offers no real advantage for these potential roles aside from not putting a pilot’s life in jeopardy, which for many of these states is not
necessarily their chief limiting factor in conducting such operations. Proliferation is likely to be accompanied by an expensive trial period for many states in which RPAs are shot down over a neighbor’s territory, potentially triggering conflict. RPA itself is unlikely to be principally at fault in such a scenario; rather it is the misunderstanding or ignorance of policymakers using RPAs in such roles.

In many cases, the main obstacles to effective employment of RPAs will not be the technological obstacles to RPA development, but the geopolitical implications and the low likelihood of successfully waging such campaigns. Anticipating these obstacles and shaping not just the conduct of war, but the expectations of the outcomes of conflict and the broader political bargaining process, will be critical to the successful employment of RPAs in these emerging roles. The areas highlighted in the Airpower RPA model represent the optimal strategies for targeting based not on the technological capabilities, but the likelihood of successfully achieving policy results based on successful strikes against those target sets. Technology enables the effective implementation of the targeting strategy; it does not change the underlying fundamentals of the wisdom of such a strategy.

The strategic RPA has potentially revolutionary implications for both limited wars once air superiority has been established and for small wars where insurgent forces lack a significant air threat as previously shown. Future strategic RPAs such as UCAVs will likely play a major role in shaping tactics for future limited wars by increasing the power of states that can integrate them into existing air forces, but are unlikely to revolutionize such wars. Outside of military conflict, Maritime RPAs have the potential to reshape the dynamics of disputed territories in East Asia owing to persistent flight in international or contested airspace. These roles are likely to be important, and even essential for future military operations in a number of environments, but are
unlikely to lead to as radical a change in warfare as many predict. Tactical RPAs, meanwhile, will widely proliferate and significantly impact tactics and planning at the operational level, but are unlikely to overturn the fundamentals of the Modern System. Although much of the fear surrounding tactical RPAs to date suggests their potential to undercut international law and provoke conflicts, recent experiences suggest the prospect of RPAs reinforcing existing norms as those who have been most aggressive in using RPAs have seen the least success with them to date.

**Strategic RPAs in Limited Wars**

Based on the existing published UAS roadmaps for the U.S. Air Force, Navy, and Army, the U.S. appears to be most interested in increasing the survivability of RPAs by increasing speed, stealth, and electronic protection of future RPAs. This suggest the U.S. is most interested in developing future RPAs with intervention in limited wars where the state has a viable IADS system capable of defending against current RPAs such as Predator and Reaper. Currently, technological barriers to the effective use of RPAs preclude such a shift, as I demonstrate with the example of proposals for RPAs in Syria. Technological advancements may make such military capabilities feasible in the future, however, and thus I examine the likely consequences of such an RPA-driven strategy assuming the technological feasibility of such a role.

**Problems with Current RPAs and the ‘Libya Model’ – The Syria Case**

One case study demonstrating the existing technological challenges to the RPA in limited wars is the challenges posed using strategic RPAs in Syria. Following the relative success of
coalition forces in Libya removing the Qaddafi regime through a combination of allied air power and coordination with ground opposition groups, a number of analysts in the United States spoke of the prospect of applying this ‘Libya Model’ to Syria. Although the international community has to date rejected military intervention under the Responsibility to Protect (RTP) doctrine, calls for outside intervention to stop the ongoing violence in Syria have continued. In February 2012, Anne Marie Slaughter outlined a strategy for intervention consisting of the creation of ‘no-kill zones’ near the Turkish, Lebanese, and Jordanian borders, the arming of opposition forces to create the zone, and for Turkey and Arab allies to enforce the zones “through the use of remotely piloted helicopters, either for delivery of cargo and weapons — as America has used them in Afghanistan — or to attack Syrian air defenses and mortars in order to protect the no-kill zones (Slaughter, 2012).” This proposal was reaffirmed in 2014, when Slaughter asserted in a blog post “But if he (Pres. Obama) is willing to contemplate using force against Al Qaeda without international authorization in the future, why not use drones now to strengthen the moderate Syrian opposition and force Assad into serious negotiations (Slaughter A.-M. , 2014)?”

257 In August of 2011, a Washington Post article on the Syria conflict began with the passage “[t]he success of Libya’s rebels in toppling their dictator is prompting calls within the Syrian opposition for armed rebellion and NATO intervention (Sly, 2011).” The New York Times ran a similar article outlining the prospects of such a model being applied elsewhere, noting President Obama’s March 2011 speech outlining principles for humanitarian intervention including a responsibility to stop ‘looming genocide,’ in that case in Benghazi, conditioned on the qualifier that the U.S. was not acting alone (Cooper & Myers, 2011). Though an anonymous senior administration source quoted in that article noted that it would be hasty to apply the ‘Libya model’ directly to Syria, they did caveat “[h]ow much we translate to Syria remains to be seen.”

258 The RTP has developed as an international norm over the past two decades, referenced by the United Nations in the 2005 World Summit Outcome as “the international community, through the United Nations, also has the responsibility to use appropriate diplomatic, humanitarian and other peaceful means...to help protect populations from genocide, war crimes, ethnic cleansing and crimes against humanity. In this context we are prepared to take collective action, in a timely and decisive manner...should peaceful means be inadequate and national authorities manifestly fail to protect their populations from genocide, war crimes, ethnic cleansing and crimes against humanity (2005 World Summit Outcome, 2005).” President Obama’s statement from 2011 mirrors this language as justification for intervention in Syria, relying on broad international support but not explicitly UN approval as the 2005 statement requires.
The works of Slaughter and others, proposing ‘no-kill zones’ for Syria, envisioned RPAs employed in what is categorized as ‘Peace Enforcement’ missions. Peace Enforcement is defined by U.S. military doctrine as “[a]pplication of military force, or the threat of its use, normally pursuant to international authorization, to compel compliance with resolutions or sanctions designed to maintain or restore peace and order (Joint Chiefs of Staff, 2012, p. 18).“ This is different from ‘Peacekeeping,’ which U.S. doctrine defines as operations “undertaken with the consent of all major parties to a dispute, designed to monitor and facilitate implementation of an agreement (cease fire, truce, or other such agreement) and support diplomatic efforts to reach a long-term political settlement (Ibid).”

The case of RPAs in Syria, or more accurately their non-use in Syria, is instructive in contrasting perceptions of what RPAs can do with their true limitations. The RPA appears advantageous to those who advocate for its use as it is seen by some as less of a violation of sovereignty than manned aircraft, or worse a ground force. This is likely due to perceptions of U.S. operations in Pakistan and elsewhere, where the U.S. has been regularly accused of violating the sovereignty of other nations with no recourse or justification. The realities of RPAs are more complicated, and the likelihood of tacit Pakistani approval of operations undercuts the likelihood of sovereignty actually being violated and which should in turn serve as a warning to future RPA operations actually violating sovereignty. Should an incursion by an RPA not rise to cause for war by itself, Syria would not be without recourse as the low speeds, lack of defenses, and mission requirements of extended loiter over a fixed area as Predator and

259 Slaughter, in her 2012 piece, noted “Turkey is rightfully cautious about deploying its ground forces, an act that Mr. Assad could use as grounds to declare war and retaliate. But Turkey has some of its own drones, and Arab League countries could quickly lease others.”

260 Prominent examples include the report Living Under Drones (Living Under Drones: Death, Injury and Trauma to Civilians from US Drone Practices in Pakistan) and UN Investigator Ben Emmerson’s report from March 2013 (Abbot, 2013).
Reaper are generally employed would make them easy targets for a state with an active air defense system and the will to employ it. Syria maintains a significant, though likely ill-maintained Integrated Air Defense System (IADS) capable of engaging a variety of targets.\textsuperscript{261}

RPAs, seeking to enforce a no-kill zone from inside Syrian airspace against the will of the Syrian government would find themselves highly vulnerable to Syria’s air defense network. The lack of a pilot on board the RPA might lead some to argue that the loss of RPAs could be absorbed, but the high costs associated with the platforms necessary for such enforcement missions would quickly make the operation prohibitively expensive and at the opportunity cost of other missions that are reliant on a finite RPA force.\textsuperscript{262} The likelihood of effectively deterring the shoot-down of RPAs would also appear to be low given the low resolve to respond militarily to the use of chemical weapons and the fact that the use of RPAs might be seen as a sign of weak resolve by not putting humans in danger.\textsuperscript{263} This leaves suppression of the Syrian IADS network as a necessary precondition for the use of RPAs to enforce no-kill zones or no-fly zones. Figure 38 shows the strategic surface-to-air missile component of the Syrian IADS system, which is complemented by an array of air-to-air fighter aircraft capable of operating throughout Syrian airspace. Successful RPA operations would require neutralizing this threat to RPAs, either by physical destruction or relying on deterrence through threat of escalations of military force should RPAs be attacked by the Syrian IADS system. Missiles could be temporarily thwarted by electronic jamming through a Suppression of Enemy Air Defense system, but this is unlikely to

\textsuperscript{261}The June 2012 shoot-down of a Turkish RF-4 which violated Syrian airspace briefly illustrates Syria’s general willingness to shoot down aircraft in defense of its territory, though Syrian sources at the times stated they believed it was an Israeli aircraft and had no desire at that time to shoot down a Turkish aircraft operating over the Mediterranean (Times of Israel Staff, 2012).

\textsuperscript{262}The Air Force missed repeated deadlines to increase its capacity to 65 Combat Air Patrol orbits, indicating an insufficient capacity to meet current requirements and prompting calls to lower the target (Lee, 2013).

\textsuperscript{263}While the lack of a pilot on board clearly impacts this calculus politically, the military utility of the RPA remains its persistent coverage of a given area vice the risk to a pilot. Nevertheless, the perception matters most with respect to signaling resolve.
work for sustained, 24-hr operations. In short, an RPA campaign would require a large-scale air campaign to destroy most of the Syrian Air Force before operations could proceed.

Figure 38: Syrian Surface-to-Air Missile Systems

![Syrian Surface-to-Air Missile Systems](image)

While strategic RPAs as they currently exist are unlikely to be game changing in conflicts such as Syria, modest interim agreements to limit fighting, protect civilians, and achieve other objectives such as eliminating chemical weapons have occurred to achieve near-term objectives which in the future might be enhanced with the support of tactical RPAs. In such situations, the vulnerabilities of RPAs which reduce their potential utility as a strategic platform could be a virtue during a temporary ceasefire to aid in humanitarian aims.

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264 Map derived from *Air Power Australia* (O'Connor, 2012). Not all missiles depicted on this map would necessarily be threats to RPAs, as SA-5s would likely be reserved for other potential threats.

265 See “Drones for Peace” outlining how such tactical employment may be feasible and beneficial, but not revolutionary in its application (Kreuzer, 2014).
UCAVs and Future RPA Employment in Limited Wars

As technologies advance and RPAs become more survivable, the calculus for RPAs in limited wars will change. In part, this discussion parallels a larger debate that is occurring throughout the U.S. military coinciding with the drawdown from Afghanistan over the future of U.S. military operations. As the Army debates the need to pursue COIN doctrine versus a return to a conventional mission, the Air Force and Navy have been focused on the ‘pivot’ to the Western Pacific and developing capabilities and doctrines such as Air-Sea Battle. The move to the UCAV as a priority appears aimed at keeping RPA development relevant to these types of wars, but will likely come with a high price tag.

Recalling the utility of RPAs as for missions which are ‘dull, dirty, and dangerous,’ this mission set is aimed at expanding the utility of advanced, capable RPAs to the ‘dangerous’ missions vice the ‘dull’ missions of the COIN environment, likely with the aim of performing persistent missions in a dangerous environment. The future of such operating concepts can be seen in models being put forth by airmen today. In “The Swarm and the Cloud,” David Blair and Nick Helms hypothesize a future air war featuring fleets of UCAVs comprising a ‘cloud’ of defenders to hold friendly airspace, with parts of that cloud able to seamlessly transition to air defense of an advancing manned bomber strike package to provide defenses deep into hostile territory (Blair & Helms, July 2013).

The idea of a cloud air defense dates theoretically to a dissertation published by Nikola Tesla in 1915 (Shaw, 2012), and would appear to be the next natural progression for RPAs in an air-to-air role. Challenges to RPAs in contested environments include the problem of emissions from regular communications which can offset the potential stealth characteristics of an aircraft,

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and the legal/ethical issues of autonomous systems firing weapons. In a purely defensive counter-air environment, a cloud RPA model limits these challenges by allowing for a highly automated system of interconnected tactical RPAs with air-to-air capabilities linked to other sensors to identify threats within controlled airspace, with the tactical RPAs thus serving as nodes in a combined strategic system. Like the Navy’s Phalanx system, this system under supervisory autonomy would be able to monitor airspace, allow friendly aircraft to transit the airspace through a combination of air corridors and electronic identification, while automatically destroying identified threats.

**Figure 39: Swarm and Cloud simplified CONOP**
The package combining manned and unmanned assets would then allow an offensive force to overcome a significant obstacle to air-to-air RPAs in hostile environments, the data link delay which slows reaction time of operators. By building RPAs with semi-autonomous control over defensive systems which can also be controlled by pilots aboard the manned ‘mother ship,’ the RPA is positioned to go on offense to extend airspace control. Figure 39 illustrates how this operation would play out, layering tactical RPAs to increase battlespace awareness under line-of-sight control with a cloud of UCAVs in a defensive position to control and gradually secure friendly airspace, while parts of the cloud can peel off to support a strike package with the main manned aircraft serving as a mother ship to control a support package of UCAVs for air-to-air defense in hostile environments. One pilot/weapons officer aboard the mother ship could theoretically control a flight of UCAVs data-linked to provide nearly 360-degree awareness of the operating environment, exercising supervisory autonomy over the flight which follows the commander’s orders on routes, targeting, and engagement but where the UCAVs determine the best means of carrying out the operations or returning to base when contact is lost (similar to the automated RQ-4 schematic in Figure 9). RPAs data linked to the mother ship could perform a variety of functions for the strike package, to include suppression of air defenses as well as kinetic targeting.

Such a combination of manned and remotely piloted assets will allow RPAs to support operations in contested airspace with near-peer competitors, allowing them to expand beyond their current role of leadership targeting in low-intensity campaigns. Development in this direction is likely to proceed, but at significant cost, slow integration, and with numerous organizational challenges as the coming chapters will address. RPAs in roles identified here will allow for the removal of pilots from cockpits and therefore reduced costs in those training
pipelines, but ultimately the platform cost savings of trading an F-35/F-22 for a data-linked UCAV with the capabilities of an F-35 will likely bring minimal savings.

How revolutionary would such a capability be? The targeting revolution model suggests that, for limited wars against state actors, this would not be revolutionary in terms of fighting military forces, but could potentially be against leadership. Many of the mission sets hypothesized for RPAs striking at military forces, to include the ‘swarm and cloud,’ foresee RPAs taking on the roles of existing manned platforms in some cases and complimenting them in others. Such an innovation would likely be a significant force multiplier, but wouldn’t fundamentally alter the system of air warfare which has been in place since the Gulf War in terms of campaign planning and targeting strategies. The main difference would be the balance of the number of pilots and the number of aircraft involved, and given the low numbers of U.S. Air Force fixed-wing pilots lost to enemy fire in recent conflicts this even lower level of risk will likely only have a marginal effect on the calculus of strike packages. Automating command and control functions would play a key role to synchronizing more complex operations with fewer individuals involved, posing organizational challenges to completing the innovation. It is conceivable that the scale of assets and the character of this command and control automation could reach a threshold where net increase in power available to the state might prove revolutionary at least temporarily, but it is difficult to conceive of a potential conflict scenario against a fielded military force where the overall air warfare system would look fundamentally different to an observer even if all manned airframes were replaced by RPAs.

Leadership targeting, however, could be revolutionized by a combination of high-altitude stealthy RPA platforms such as the MQ-180 linked with satellites and both ground- and air-based
weapons systems, to include UCAVs.\textsuperscript{267} Under such a scenario, the high-altitude RPA provides the benefits of persistent coverage and monitoring of potential targets enabling a rapid-reaction strike package to engage the target. UCAVs or manned aircraft exploiting stealth and jamming capabilities of RPAs in the area could enable an environment conducive to extended operations for up to several hours, allowing the high altitude RPA to better develop the target to maximize the likelihood of a successful strike. This model could be repeated in multiple cases throughout the opposing state, with the command and control semi-automated under the commanding general’s supervision to maximize the idea timing for a simultaneous strike against all leadership targets designated.

This is a technically feasible future scenario for integrated RPA operations, but what are its implications? Existing literature and examples suggest that, for a nation state, such a strategy is unlikely to prevail by itself, and the presence of such a strategy in a state’s doctrine could be destabilizing. The model of leadership targeting is fundamentally a \textit{blitzkrieg} strategy, deep strategic penetration with the goal of paralyzing and demoralizing forces which are still largely intact. John Mearsheimer describes such a strategy as the most likely to lead to a breakdown in conventional deterrence (Mearsheimer, 1985, p. 203).\textsuperscript{268} He provides the examples of Germany and the Soviet Union (against Japan) in World War II, North Korea in 1950, Vietnam’s invasion of Cambodia in 1978, and the 1971 invasion of East Pakistan by India. To these examples, we can also add the 2003 U.S. invasion of Iraq, especially given the specific objective of leadership targeting employed, and the U.S. reliance on cruise missile strikes in the 1990s as an alternative

\textsuperscript{267} The UCAV could play this role, but it just as feasibly could be performed by an F-22 or future long-range bomber.

\textsuperscript{268} Interestingly, because Mearsheimer was writing in the first phase of the RMA during a period dominated by \textit{AirLand} doctrine, he saw the implications of PGMs inherently favoring the defense given their targeting limitations and association with standoff weapons. The platform innovation of the RPA changes this dynamic.
to land invasions. The perception of quick and easy victory alters the calculus for the decision to initiate conflict, potentially leading to an increase in the number of conflicts.

A move toward a leadership targeting strategy enabled by penetrating RPAs could push more states to seek nuclear weapons to maintain a deterrent capability or could lead them to seek counterbalancing alliances with U.S. adversaries in advance of a conflict. As Keir Lieber and Daryl Press have noted in their recent work, each major combat operation launched by the U.S. since the end of the Cold War has resulted in the destruction of the opposing government, making all wars engaged in by the U.S. limited from the U.S. perspective, but total from the adversaries perspective. This creates the challenge of deterrence for adversaries as the U.S. has demonstrated both the ability and willingness to cross the threshold of unacceptable losses in waging wars against smaller states without having to fear a similar counter-reaction, limited only by the calculus of what losses would be considered acceptable by the U.S. given limited objectives. Faced with such a challenge from a superior force, weaker states must find ways to unambiguously raise the costs of war. Thus, the pursuit of nuclear weapons, and possibly even their use in conflict once initiated, becomes a viable strategy to demonstrate willingness to escalate the conflict to total war for both sides, in the process shifting the calculus of decision-makers from the ‘Limited War/Leadership Targeting’ box to the calculus of total war.

Should non-proliferation regimes succeed despite the increased incentive for some states to acquire nuclear weapons and thus preventing those states from achieving an effective deterrence regime, problems would remain for leadership targeting strategies in the other direction. Nation states are likely to be more resilient than their leaders, with fielded forces often prepared to carry on with a fight and with a likely line of succession prepared to fill national leadership roles over time. A blitzkrieg strike against the leadership may disrupt leadership and
ultimately destroy the strategic effectiveness of fielded forces, but a significant force to destroy the military capabilities of the opposing state would likely still be required.\textsuperscript{269} It is conceivable that in a small set of circumstances, where the objectives of the war are fundamentally tied to the interests of the leader rather than the interests of the state and where regime elements could be isolated and empowered to negotiate a peace, then such a strategy might work. However, any states pursuing such a strategy must be prepared for the likelihood of a protracted conflict if a successful leadership strike leads not to successful regime change but to the collapse of the state.

\textbf{Figure 40: Adversary Reactions to Leadership Targeting}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
 & Population & Military & Leadership \\
\hline
Total Wars & & & \\
\hline
Limited Wars & & Conflict Likely to Shift & \\
\hline
Small Wars & & & \\
\hline
\end{tabular}
\end{table}

While technically feasible to envision future RPAs in a leadership targeting role, such a strategy is risky and likely to be far more cost intensive than initial theorizing would suggest. Sustaining a leadership entity is vital to keeping limited wars limited, rather than escalating to

\textsuperscript{269} See Robert Pape’s work on leadership targeting strategies in \textit{Bombing to Win} for a more detailed discussion (Pape, 1996). Most illustratively to this point is the divergence of opinion between the political and military leadership of Japan in World War II following the firebombing and atomic bombing campaigns, where the leadership was ready to terminate the war after the bombings alone while the military leadership needed to be convinced by the Soviet entry to the war. Had the leadership of Japan itself been targeted, this may have empowered those in the military establishment who still sought to resist.
total wars for both sides or causing the invaded state to collapse into a non-interstate conflict and a protracted ‘Phase 4’ operation, as was the case in Iraq, illustrated in Figure 40. Targeting of military forces and logistics chains is likely to remain the most efficient strategy for limited wars because the ultimate objective of such conflicts, if they are to remain limited, requires a political solution with a viable actor who has the credibility and capability to enforce a negotiated settlement. The RPA has the potential to radically reshape tactics and operational planning in those circumstances, but is unlikely to offer revolutionary change over existing systems of planning and targeting.

**Tactical RPAs in Limited Wars and Small Wars**

The speculation over the future of RPAs is in many ways reminiscent of the early airpower advocates who saw endless possibilities for the future of aviation in warfare. Mitchell and Douhet firmly believed that the airplane would always get through, that it would be impossible to defend against such a threat, and thus the only defense was to build up a sufficient offense to defeat your enemy before they could defeat you. To read talk of today’s RPAs setting off an arms race with almost purely offensive implications invokes these very arguments without the benefit of learning from the shortcomings of those very arguments back then. Defenses against aircraft were feasible, the utility of the aircraft in war was more limited than its proponents believed at the time, and the costs of fielding a force capable of producing the kind of damage they envisioned was as a result significantly higher than they projected. RPAs are likely to suffer a similar fate for the foreseeable future.

Although much of the discussion surrounding RPAs focuses on the Predator and Reaper model, the vast majority of RPA proliferation and operations both in the world today and for the
foreseeable future will be with smaller and more limited tactical RPAs. These RPAs have been a part of conflict scenarios since at least the 1980s, and since 2000 have already played a heightened role in the Middle East and Caucasus region. Their misuse has at times threatened international incidents and fears of escalation of conflict situations, but in many cases the reactions to their use beyond initial decrying of either the airspace violation or the shoot-down of the aircraft has been the reduction in RPA activities. In this regard, states are learning the lessons of the limited value of RPAs in a number of scenarios.

Swarm Tactics

Among the tactics suggested for RPAs in a tactical role are ‘swarm’ tactics designed to overwhelm an adversary force by sheer numbers, potentially pushing back a conventionally superior force’s basing and logistics under threat of attack. This would be similar to the discussed role RPAs could play in the aforementioned Chinese carrier attack scenario rather than the U.S. ‘swarm and cloud’ model, but on a smaller geographic scale. The Defense Science Board’s report on the role of autonomous systems noted “While all vehicles sizes are possible, the threats from smaller platforms, particularly small UAVs, that can be launched covertly from the ground, may be an especially difficult threat to counter - even in the presence of U.S. air superiority (The Role of Autonomy in DoD Systems, 2012, p. 13).” In this and similar scenarios detailed throughout the RPA literature, a weaker state or a non-state actor could rely on a fleet of smaller tactical RPAs to overwhelm a superior force and inhibit operations.

As the Defense Science Board’s report implies, however, this threat exists mainly so long as the U.S. does nothing proactively to deter or plan to defeat such an option, and numerous weaknesses with the tactical RPA make such a strategy a potential vulnerability to an adversary.
A cursory review of the cost of off-the-shelf RPAs which could be easily procured shows a dramatic increase in cost as the range of RPAs increases, with most of the cheaper quad-copters highlighted for their low price having an effective range of less than 200 feet.270 The limited range of many of these lower-end RPAs places the operators themselves in a position of vulnerability, undercutting the utility of such systems. That, however, is only the most straightforward of many challenges to employing RPAs in such a manner.

RPA swarm operations would require a large number of aircraft, which would present logistical challenges for staging an operation (they must take off from somewhere) and acquiring the aircraft. A large number of purchases of either aircraft or components could be monitored through various intelligence collection sources, providing insights to the financial and acquisitions processes of the organization, allowing a sophisticated adversary to target the network itself rather than the fielded RPAs. Tasking the purchases to a number of sources would be a possibility, but would require a sophisticated network that likely would not want to risk having their acquisitions process re-engineered after an RPA swarm attack was launched.

In the event that an organization could successfully acquire, plan, and stage a swarm operation, there are a number of potential defenses that could be employed to negate the threat. As the threat of automated systems such as RPAs rise, automated defenses like the Navy’s Phalanx system can be modified for land defense purposes against an air swarm threat, likely using smaller caliber weapons given the speed, nature, and likely low altitudes employed by the RPAs. For remotely piloted systems, the link from the aircraft to the operator is an even greater vulnerability, as simple RPAs have been shown to be vulnerable to capture via ‘zombie drones’ in the U.S., where the WiFi frequency of the RPA was intercepted by another RPA which took

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270 The DJI Phantom 2, a popular quadcopter for commercial purposes, has an effective range of 1,000 feet and retails online for just under $1,200 as an example (DJI Phantom 2 Vision Quadcopter with Integrated FPV Camera)
control of the aircraft (Liebelson, 2013). This vulnerability to electronic attack will likely drive up the cost of future tactical RPAs as the need to protect the asset from adversaries is a consideration for military hardware that is less applicable for civilian applications.

Further, if offensive swarm clouds could be produced cheaply by an adversary, it is likely that defensive swarms would be even cheaper given the proximity to the RPA increasing the defenses of the data links, higher situational awareness of operators, and greater likelihood of more autonomy for defensive systems under supervision as is the case with the Phalanx. In this sense, the future trajectory of RPAs would in many ways mirror the experience of pursuit fighters in World War I. As opposing sides built increasingly sophisticated weapons systems, the scale of conflict increasingly rose to the point where battles for air superiority were necessary before air operations could be waged. As the need to protect the logistics, the base of operations, and the RPAs in flight raises the cost to implement an effective swarm strategy, the odds of it being employed in large numbers in war decline.

This obstacle does not rule out the potential of states using the strategy in a cross-border raid scenario to initiate hostilities, which is likely where the risk of such a tactic would be highest both due to the dangers posed when a state or actor perceives a blitzkrieg strategy as likely to succeed and to the set of challenges posed by such a scenario. The tactic would be unlikely to succeed by itself and would likely be paired with artillery and missile barrages combined with a ground offensive, but if executed properly the RPA could play a key role in confounding air defense regimes and threatening a coordinated ground response. As a war proceeded, however, such a tactic would be less likely to be successful over time given the challenges to staging and the lack of surprise.
Support Roles for RPAs

As with strategic RPAs, the most likely uses for tactical RPAs in the future will be to complement existing operating concepts in roles where the RPA is uniquely suited and where the cost-benefit analysis suggests the investment in RPAs would be value-added given the risks. This will be dependent on the capabilities of the adversary with less capable adversaries being more vulnerable to swarm-type strategies, but in general the RPA will fill far less glamorous roles, continuing the ISR collection mission in increasingly greater roles and increased close-air support roles for ground forces. Micro RPAs, rather than an offensive weapons system, are likely to be utilized by special operations teams for missions such as clearing buildings and increasing situational awareness in urban environments.

One of the most likely areas for RPA expansion in the future is in logistics and other missions operating in permissive and semi-permissive environments, from air-to-air refueling to resupply. In 2011, RAND conducted a study of potential RPA missions for the U.S. Army, concluding future RPAs may be well suited for finding cargo that misses its intended drop zone and for pre-deployment theater surveillance (with some concern over potential OPSEC issues), while they are less suited for other missions such as river navigability and in theaters with adverse weather concerns (Unmanned Aircraft Systems for Logistics Applications, 2011). Projects currently exist to extend the loiter time of RPAs with a separate class of remotely-piloted air-to-air tankers, and the prospect of RPAs capable of long-term loiter and able to convert to higher speed for midair refueling of fighters and transport aircraft to serve as air bridges for future global strike appears to be a mission well suited for RPAs in the future. At the 271 One example is advertised by Cobham, which show 25 years of experience in research and design of “autonomous air-to-air refueling” on their website and lists support to DARPA’s KQ-X Global Hawk air-to-air refueling program (http://www.cobham.com/about-cobham/mission-systems/about-us/mission-equipment/air-to-air-refuelling/products-and-services/autonomous-air-to-air-refuelling.aspx), accessed 17 January 2014.
more tactical level, RPAs could resupply forces at outposts under fire with what are commonly referred to by soldiers as ‘speedballs,’ generally a body bag full of essential gear and food/water. Current operations require manned helicopters to drop these supplies under fire, in some cases unable to land, and dropping the equipment from the air.  

**Tactical RPAs in Action Today - Middle East & Caucasus Scenarios and Implications**

Just as the Middle East region provided many insights to the tactical applications of non-nuclear ballistic missiles with the wide proliferation and use of such weapons systems in the late 20th Century, the proliferation and uses to date of tactical RPAs in the Middle East and Caucasus region today provide many insights into the evolution of tactical RPAs in the battlespace. While the U.S. use of RPAs in Pakistan and Yemen has received the most attention in the ‘drone wars’ discussion, smaller scale ‘drone wars’ are already under way in the region, with less significant results to date than many observers have predicted for the future of RPAs. RPAs have violated airspace and been shot down both in international airspace and violating the territorial airspace of other countries, but to date these incidents have neither sparked a conflict nor led to escalation. In fact, the experiences of these incidents may have had the reverse effect, demonstrating the limits of these assets and increasing caution over their use.

Tactical RPAs have widely proliferated throughout the region, both with smaller RPAs for limited battlefield uses and large long-dwell RPAs similar in many ways to strategic RPAs but for the range used for cross-border operations. Israel was an early mover in RPAs due in part to its circumstance of a defense budget capable of investing in emerging technologies and an

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272 One example of speedballs being employed in Afghanistan can be seen in Michael Yon’s dispatches online (Yon, 2011). A broader discussion of tactical airdrop can be seen in the Wall Street Journal’s article on the subject (Phillips, 2011).
immediate border threat which blurred the line between tactical and strategic reconnaissance. This, as Tom Ehrhard noted in 2000, created a more broad-based RPA constituency in Israel than existed in other states (Ehrhard T. P., 2000, p. 593). Given that set of circumstances, relatively unsophisticated RPAs could support strategic initiatives. The Israeli Hermes 450 is among the most widely used medium altitude RPAs in the world, with even the U.S. purchasing some for use in the U.S.-Mexico border region as the mission lacks the range requirements of the more expensive Predator. The Hermes has also been sold to Georgia and Azerbaijan, while Iran has also made strides in developing and deploying tactical RPAs such as the Mohajer-series (similar in size and appearance to the U.S. Hunter) which has likely been transferred to Hizb’allah.

One of the first examples of the ‘drone wars’ in the region came in April of 2008 over the Black Sea, when a Georgian Hermes 450, monitoring activity in the Abkhazia region, was shot down by what video from the aircraft showed to be a MiG-29 aircraft, likely of Russian origin. This incident was hotly debated at the time, with Georgia accusing Russia of unlawfully shooting down a Georgian aircraft in Georgian airspace, while the Russians and Abkhazians declared the presence of the aircraft to be a violation of neutral airspace in a ‘conflict zone’ which it claims was prohibited under the 1994 monitoring agreement (BBC News, 2008). This was the most well publicized of seven RPA incidents in the April-May timeframe, which the UN ultimately found Russia responsible for but also found Georgia to be in violation of the 1994 agreement, finding “a reconnaissance mission by a military aircraft, whether manned or unmanned, constituted 'military action' and therefore contravened the Moscow Agreement (Finn, 2008).” Though the shoot-down briefly heightened tensions, the adjudication of the process led to the cessation of flights and RPAs played a minimal role in the remainder of the Georgia-Russia crisis.
RPAs have also played a role in the Caucasus region with the ongoing border dispute between Azerbaijan and Armenia. Azerbaijan has imported the Hermes 450 just as the Georgians have, and have used them on several occasions supporting operations in the area of the disputed Nagorno-Karabakh territory. In September of 2011, one Hermes 450 was shot down over the disputed territory by Armenian forces, while other Armenian sources have reported seeing RPAs scouting territory in advance of ground incursions.

The Azerbaijan-Armenia experience is instructive both for the potential perils of RPA proliferation and the limited strategic value attached to many of these operations. The disputed territory in question, Nagorno-Karabakh, has provoked sporadic fighting over the past decade with at least 60 people from 2010-2012 fighting in the region (Clayton, 2012). The introduction of the RPA represents one more potential source of friction with their introduction as one analyst noted that the Azerbaijanis were interested in “playing with their new toys (Ibid.).” The Azerbaijani purchase of RPAs and cooperation with Israel also set off alarms in Iran, where reports during the same time period indicated Israel was planning to use Azerbaijan as a base for their own RPA operations to monitor Iran, which led to a period of protests by the Iranian government. Since this initial bluster and following the shoot-down in 2011 of the Hermes 450, the Nagorno-Karabakh conflict has entered a period of relative calm similar to the pre-2010 flare-up of violence. Rather than escalate the conflict from artillery exchanges to a full-blown war, the introduction of the RPA may have led to a return to the status quo through a combination on the Azerbaijani side of demonstrating resolve and increasing visibility, while at

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273 In March of 2012 Azerbaijan signed an arms deal with Israel worth a reported $1.6 billion, with the goal of Azerbaijan building an RPA force of approximately 100 aircraft in addition to a more robust air defense system (Clayton, 2012). The 2012 deal included five Heron TP-II RPAs, which comes on top of ten Hermes 450s Azerbaijan acquired from 2009-2012 (Long War Journal Staff, 2012).
the same time limiting offensive operations by the costs associated with loss or airframes and the telegraphing of movements.

One final area where RPA operations have increased visibility in the region is with Iranian RPA operations. On at least two occasions, Israel has shot down RPAs within its territorial airspace, in both cases linked to Iran through Hizb’allah. On October 6, 2012, the Israeli Air Force intercepted a surveillance RPA which entered the country in the vicinity of the Gaza Strip, and followed it for 35 miles before shooting it down over the northern Negev Desert. Then, on April 25, 2013, Israel shot down another RPA operating five miles off the port of Haifa, possibly scouting Israeli drilling rigs in the area. In each case, the Israelis suspected Hiz’ballah of being involved in the flights, and in each case the RPAs were successfully intercepted and shot down on the grounds that they were aircraft unlawfully violating Israeli airspace. Hizb’allah is believed to be in possession of approximately 200 RPAs acquired from Iran, many of which are being used in both Syria and Lebanon in ISR collection roles (Kais, 2014). To this point, they have been used most effectively in Syria and Lebanon as ISR collectors in uncontested airspace. Hiz’ballah RPAs aided Assad’s forces in foiling an attempted suicide attack, and have likely been used to monitor Hiz’ballah opponents in Lebanon itself.

The success Hiz’ballah has had with ISR collection in regions where its ground forces operate freely versus its challenges operating in Israeli airspace demonstrate both the utility and limits of tactical RPAs for the foreseeable future. When combined with the experiences of Georgia and Azerbaijan, this demonstrates how many of the concerns about RPA proliferation are likely overblown. Rather than allowing a state to routinely violate the sovereignty of another

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274 The Israelis say they first identified the aircraft while still over the Mediterranean but chose to allow it to continue its flight until it was no longer over populated areas to avoid casualties on the ground (Associated Press, 2012).
state with low cost involved, Georgia and Azerbaijan have paid a high financial cost for the loss of their aircraft.\textsuperscript{275} Georgia, meanwhile, was reprimanded by the international community for violating the terms of the monitoring agreement for flying military aircraft in the contested airspace. Had the reconnaissance aircraft been a manned airframe, Russia theoretically might have paid a higher cost in the eyes of the international community for escalation. But, as the aircraft was an RPA, Georgia paid the cost in international reputation for the violation of international law while receiving no meaningful support for the loss of the airframe. This is the opposite of the cost/benefit analysis that is normally portrayed with RPA operations, and Georgia ended up weaker as a result in the run-up to the August 2008 South Ossetia/Abkhazia conflict. This to an extent confirms Ehrhard’s observation from 2000 relating to both RPAs and cruise missiles, that “The unmanned attack communicates shallow commitment, even fecklessness (Ehrhard T. P., 2000, p. 628).”

Rather than RPAs violating airspace freely and flaunting international law, the examples of Georgia-Russia, Armenia-Azerbaijan, and Israel-Hizb’allah demonstrate the vulnerability of RPAs to a defense network and reinforce the norm that airspace, not men in aircraft, is the critical factor. The U.S. has aided in reinforcing this norm in the other direction, regularly defending its RPAs flying in international airspace in much the same way it would a manned ISR collection asset.\textsuperscript{276} The lessons learned from these scenarios has apparently demonstrated the constraints on RPAs in contested airspace and violating territory, with the number of such incidents declining following their introduction to each conflict region. This will likely be the pattern for the introduction of RPAs to areas for the foreseeable future, but likely with fewer

\textsuperscript{275} Each Hermes 450 aircraft costs an estimated $2 million per unit, while the more advanced Heron TP costs $35 million per unit (Flesher, Oni, & Sassoon, 2011).

\textsuperscript{276} One of the most famous cases came in March of 2013 when an F-22 was sent to support an MQ-1 Predator flying in international airspace when the Iranians sent aircraft to intercept it (Cox, 2013).
incidents that are potentially escalatory over time as the tactical RPA is normalized within global militaries.

**Strategic RPAs and Near-Peer Competitors**

With future RPA development discussion in the U.S. focused around the UCAV, the potential for an unmanned variant of the next generation Long Range Bomber, and continued advancements in strategic ISR RPAs such as the rumored RQ-180, much of the speculation on future RPAs deals with future missions in non-permissive environments against near-peer competitors, with China being the elephant in the room always eluded to but seldom named in official channels. The Unmanned Systems Integrated Roadmap highlights President Obama’s statement on shifting priorities, where he stated “Indeed, as we end today’s wars, we will focus on a broader range of challenges and opportunities, including the security and prosperity of the Asia Pacific (U.S. Department of Defense, 2013, p. 9),” and cites in its vision for future RPA missions to emphasize “missions according to strategic guidance from intelligence, surveillance, and reconnaissance (ISR); counterterrorism; counter-weapons of mass destruction (WMD); and operations required to operate across all environments, including antiaccess and area denial (A2/AD) (U.S. Department of Defense, 2013, p. 1).”

The implication of this discussion suggests a key role for RPAs against near-peer competitors armed with nuclear arsenals, and the potential for RPAs to play a decisive role in

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277 The RQ-180 is believed to be a successor to the ‘Beast of Bagram’ RQ-170 which was captured by the Iranians. A cover story by Aviation Week in December 2013 postulating that the RQ-180 was smaller, stealthier, and more capable than the RQ-170 and may be used to penetrate contested airspace for ISR collection (Butler, 2013).

278 The Air-Sea Battle concept paper goes out of its way to say “The Concept (ASB) is not an operational plan or strategy for a specific region or adversary (Air-Sea Battle Office, 2013, p. 4),” and the words China and Asia do not appear anywhere in the document.
such a campaign potentially negating the risk of nuclear escalation. In this model, a force employing electronic and precision warfare using stealth technology, advanced cruise missiles, and supported by airframes such as UCAVs could strike first at the opposing state’s command and control network, missile launch sites, weapons storage areas, and communications nodes effectively paralyzing operations and forcing a quick and decisive end to the conflict given the state’s vulnerability. This is roughly in line with Douhet’s model for strategic warfare rendering the opposing state vulnerable through lack of defense and deterrent, but is likely to come with a number of unintended consequences. From a technological standpoint striking leadership, command and control, and strategic missile sites are within the future capabilities of RPAs, but as with targeting strategies in limited wars it is likely that a move toward such a strategy would cause counter-reactions that in turn would limit the utility of such a strategy. A shift toward a major preemptive strike against a near-peer competitor like China would encourage that state to increase its own defenses and deterrent capabilities, in effect making the execution decision for the U.S. to risk initiating total war and a potential counter-value campaign in response.

The U.S. AirSea Battle Concept, designed to ensure freedom of access in opposition to an A2/AD strategy, proposes to “attack-in-depth, but instead of focusing on the land domain from the air, the Concept describes integrated operations across all five domains (air, land, sea, space, and cyberspace) to create advantage (Air-Sea Battle Office, 2013, p. 1).” The capabilities of future UCAVs combined with available data suggest that future RPAs may be designed with such an ‘attack-in-depth’ mission in mind against military infrastructure and command-and-control assets. Leadership strike alone would likely be dangerous as the destruction of the leadership element may cross an unstated red line for nuclear use by strategic forces.\textsuperscript{279} Should

\textsuperscript{279} China has for years maintained a rigid ‘no first use’ policy, but advancements of precision munitions and some recent ambiguities in both Chinese statements and the viability of an effective deterrence force with a no first use
China maintain a small, land-based nuclear force for minimal deterrence, adding advanced UCAVs to the Air Force inventory for the purpose of destroying strategic missiles would appear to be a more viable option, but only assuming China maintains its current capabilities and stated doctrinal limitations. Any mission tasked with destroying such strategic weapons would have to ensure the complete destruction of such weapons through conventional strike. Otherwise the state being attacked would have little recourse other than to escalate with a portion of its remaining arsenal in order to force a resolution to the conflict through the threat of further escalation with additional nuclear strikes.

One possible mission for future UCAVs to supplement a strategy based on destroying strategic arsenals would be as a boost-phase missile defense platform. This has been suggested and studied over time, with one 2012 study examining the implications of both manned and unmanned aircraft for boost-phase ballistic missile defense. The program with the most direct application for RPAs is the Network Centric Airborne Defense Element (NCADE), which would place a modified AIM-120 air-to-air missile on board either a manned or unmanned platform. This missile would be modified with an infrared seeker, a hit-to-kill warhead replacing the AIM-120’s standard fragmentation warhead, and a rocket motor to replace the standard propulsion system. As the name implies, this system would be networked with other assets to provide greater cueing to the missile from a variety of sources, which would integrate well with existing RPA concepts of split operations.

The central challenge for missile defense is the proximity required to missile sites at the time of launch in order to successfully intercept the missile in the boost phase. According to the policy has led many to question if it still maintains this policy and under what conditions China may result to a first use (Oswald, 2013).

See the report “Making Sense of Ballistic Missile Defense” for a full brief on the prospects of boost-phase missile defense and the technical obstacles to an effective boost-phase system (Committee on an Assessment of Concepts and Systems for US Boost-Phase Missile Defense in Comparison to Other Alternatives, 2012).
2012 study aircraft must be within 50 kilometers to intercept a target, making such an option unworkable against virtually any safeguard programs against ‘rogue state’ programs such as North Korea and Iran where the concern is a launch with little to no advanced warning as RPAs would have to be violating airspace to put them in range of the surprise missile launch. In the event of a conflict where violating airspace is no longer as significant a limitation, a UCAV could become the ideal platform for such a system to decrease the proximity to suspected missile sites. With a relatively small force such as China, a fleet of UCAVs could theoretically be positioned early in a conflict over Chinese territory sufficient to destroy in the boost phase any missile systems that would survive an initial cruise missile strike to destroy them on the ground.

However, such a fleet would require a large number of UCAVs to threaten even a small missile force; and by building such a capability the U.S. would likely be encouraging China to both expand and diversify their nuclear force to ensure survivability, possibly including placing warheads on alert status and at sea in nuclear submarines. The number of RPAs required for the existing force would likely exceed 100 orbits for the current mission set, and combined with the arming of modified AIM-120s which are estimated to cost approximately $1 million each, such a system would likely be cost prohibitive for the U.S. even against the relatively small estimated Chinese force that exists today given the budget limitations for the other aspects of missile defense systems which this would be supplementing. A move toward such a system would likely just move adversaries like China to expand their forces to ensure survivability. Thus, RPAs in total wars are unlikely to alter Jervis’s central observation that “advances in technology…will not have a revolutionary effect because they cannot counteract the effects of mutual vulnerability (Jervis, 1989, p. 79).”

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281 This assumes the platform has been designed for survivability to include maneuverability, speed, and stealth.
282 (Defense Industry Daily staff, 2008)
Given these considerations, the capabilities of U.S. RPA are unlikely to revolutionize the prospect of wars between great powers any more than they are to revolutionize limited wars. Figure 41 shows the challenges to total war and coercive bombing campaigns, while the remaining two categories (leadership targeting in limited wars and military targeting in small wars) remain potentially viable under certain conditions but less likely to be successful. With the stakes involved, the key for planners remains to find ways to keep wars limited, which in the case of potential conflicts in Southeast Asia means either preventing conflict through increased transparency, or in the event that a conflict emerges ensuring that the conflict is limited to one between opposing military forces. When one state sees the conflict as a potential total war and the other as a limited war, the pre-war strategy for the state planning for a total war must in turn be to ensure that the other state feels the risk of escalation to total war or collapse to insurgency in order to significantly raise the perceived costs to the other state. Rather than seeking ways to win total war, airpower should for the foreseeable future focus primarily on means to keep wars
limited through reliable deterrence and means of utilizing the tools of the targeting revolution to keep the focus of the conflict on limited objectives.

**Envisioning Possible RPA Roles in Southeast Asia**

The RPA’s role as an asset in total war appears nearly nonexistent given the likelihood of escalation, and its role in limited wars appears to be limited to building on capabilities within existing systems of warfare. How might the RPA be utilized by the U.S. and its allies and by the Chinese in future roles in Southeast Asia? In many cases, the most significant changes will not occur in a wartime environment, but in monitoring activities and projecting power as a potentially coercive tool in peacetime operations. The potential for future RPAs to play a role in maritime operations may be one area outside the targeting revolution model in which the impacts of the RPA could be a game-changer, as operations in international airspace make for the ideal environment for persistent RPA operations.

The peacetime maritime environment is the first and most likely area of expansion for RPAs in the region for the coming decade. The U.S. and Japan are jointly working to expand RQ-4 Global Hawk and Triton capabilities in the region, with the U.S. announcing in January 2014 that two Global Hawks would be based at Misawa beginning in March 2014 (Robson, 2014). China has similarly launched operations in the vicinity of contested areas and in international airspace near military sites such as Okinawa using their own indigenously produced answer to the MQ-1 Predator, the BZK-005 (Panda, 2013). These RPAs can provide extended loiter over maritime territory, and with future advancements such as BAMS can potentially de-escalate future crises by providing greater visibility and tracking of vessels for the purposes of
accountability, in the process deterring future aggressive maritime actions on both sides of the disputed territories.

RPAs are not without their challenges to the region, as overly aggressive moves by early movers such as China\textsuperscript{283} could potentially escalate a crisis situation. The common fear of cheap RPAs combined with the lack of risk involving a pilot onboard are often invoked to show that RPAs are potentially riskier than other airframes, especially when the risk of a software error is added to the mix.\textsuperscript{284} This overlooks the already low costs of aircraft employed by the Chinese military and the risks they have already historically taken with aircraft among other factors.\textsuperscript{285} RPAs are a potential challenge in this regard, but likely not more so than the existing airspace challenge that already existed in the region. Speculation of Chinese RPAs being used to ‘swarm’ aircraft carriers overlooks this comparison as well,\textsuperscript{286} as manned aircraft were long speculated to be used in a similar mission and at a roughly comparable cost using older airframes. As with speculation of a U.S. ‘swarm and cloud’ model, it is more likely that RPAs and manned airframes will work together to provide decoys and support for strike packages to improve the odds of a successful attack. In such a model, a cloud of decoy RPAs could draw the fire of defensive missile systems, undermining their denial capability.

\textsuperscript{283} China is itself not a newcomer to the RPA, having developed programs like the U.S. dating to the 1950s. The U.S. demonstration of RPAs like Predator and Reaper forced their hand to rapidly catch-up with U.S. technologies.\textsuperscript{284} “Unmanned systems could be just this trigger (for unintentional escalation). They are less costly to produce and operate than their manned counterparts, meaning that we’re likely to see more crowded skies and seas in the years ahead. UAVs also tend to encourage greater risk-taking, given that a pilot’s life is not at risk. But being unmanned has its dangers: any number of software or communications failures could lead a mission awry. Combine all that with inexperienced operators and you have a perfect recipe for a mistake or miscalculation in an already tense strategic environment. (Brimley, Fitzgerald, & Ratner, 2013)

\textsuperscript{285} See the 2001 EP-3 incident as one example. One big problem with U.S. persons analyzing the need for other states pursuing RPAs is a mirror-imaging problem assuming they have the desire to limit human casualties as much as the U.S. and other Western democracies do. Given the history of war in the region this would appear to be a highly dubious assumption and therefore not as important when considering the utility of RPAs for their planners.\textsuperscript{286} Several articles were written in March 2013 examining advances in Chinese RPA development, with a great deal of speculation about this potential mission (Koebler, 2013).
In terms of conventional deterrence to conflict, RPAs could play a role in enabling continued maritime access under threat of an adversary A2AD capability. Should the U.S. be concerned about threats to aircraft carriers, RPAs could enhance fleet protection supporting a NCADe-type strategy with a narrowly tailored scope to ensure potential adversaries that the target of such a system would be anti-ship missiles such as the DF-21D, rather than the state’s deterrent force. Under such a scenario, RPAs armed with modified AIM-120s and networked to AEGIS destroyers and satellite collection platforms could operate in international airspace near suspected DF-21 sites in southern China, prepared to strike missiles in the launch phase. This would make the RPA an effective tool of countering one potential major military innovation with another. Advanced persistent RPAs with BAMS could effectively extend the standoff range of aircraft carriers, enabling operations to monitor the South China Sea and Taiwan Strait from outside the second island chain. Such RPAs would be less vulnerable to A2AD capabilities such as the DF-21 due to their smaller size and greater maneuverability, but would likely trigger counter innovations to monitor and potentially counter such a capability. The challenge for executing such a strategy would be to credibly demonstrate the limited aims of such an aircraft without exacerbating the security dilemma. Further, demonstration of such a capability would likely result in the Chinese simply moving their DF-21s further inland, slightly reducing their range in the Pacific but dramatically reducing their vulnerability.

While most of the focus of RPAs in the region is on their potential for added value in a kinetic attack, the added value of persistent ISR and the potential to build new norms for their use could be a stabilizing factor more than a destabilizing one. As critics readily show, the dangers of escalation in Asia stem from a security dilemma which is exacerbated by low information. RPAs operating in international airspace offer the prospect of increasing
information and normalizing interactions between states. One area of benefit for the U.S. alliance is the likelihood of increased cooperation between the U.S. and Japan on RPA operations. To date, many U.S. allies have been unable to purchase strategic RPAs due to their high costs. Partnership with the U.S. to provide initial RPA platforms and building acceptance of their role in the region is a critical first step to the Japanese Self Defense Forces and other allies such as Korea and Australia acquiring their own RPA capabilities. A joint procurement process of allied states purchasing U.S. RPAs would serve multiple interests, driving down per-unit costs of RPAs, allowing the U.S. to shift its own limited RPA fleet elsewhere, and reinforcing intelligence sharing and organizational ties between the allied forces. A Pentagon spokesperson noted in 2013 that South Korea’s proposal to purchase a Global Hawk “will further U.S. national security interests not only by strengthening the [Republic of Korea]’s capabilities, but also by allowing us to refocus our assets in the region and together monitor and deter regional threat (Axe, Drone coalition: Key to U.S. security, 2013).”

As the RPA can play an increased role in international airspace, states in the region are pre-emptively taking actions to enforce the norm that RPAs, like other aircraft, may not unilaterally violate the territorial airspace of other states. Japan has issued statements that RPAs which violate its airspace may be shot down in reaction to RPA flights outside their airspace near Okinawa, and manned fighter escorts have been dispatched to monitor RPAs within the Japanese ADIZ in a manner similar to how they have historically treated manned bomber flights (Panda, 2013). While a miscalculation with RPAs may lead to a new international incident if there is a collision or shoot-down involving RPAs, re-enforcing the norm that RPAs will be viewed the

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287 The issue was raised in discussion I had with planners for the Japanese Defense Forces in 2013. The U.S. move to put Global Hawk RPAs on Okinawa is likely the first step in a broader partnership to build a Japanese RPA capability over time through alliance policies.
same as manned aircraft is an important step to refocusing the RPA discussion to the true unique capabilities provided by RPAs with persistent operations in peacetime environments.

Just as the U.S. could build RPAs to monitor maritime access, the Chinese could build extended-dwell RPAs to monitor the locations of U.S. RPAs and U.S. vessels, both for situational awareness and potentially for targeting purposes. The major Chinese RPAs constructed to date such as the Chengdu Pterodactyl and the BZK-005 appear to closely resemble U.S. RPAs such as the Predator and Global Hawk, and will likely mirror many capabilities in terms of sensors and weapons platforms as well.\textsuperscript{288} However, while the U.S. has focused RPA development on counterinsurgency missions and only more recently on maritime surveillance, the Chinese would appear to have a greater interest in maritime applications for RPAs. China has no strategic requirement to project forces in a counterinsurgency role outside of their own territory, and the one occasion where they discussed using an RPA for such a role appeared a stretch solely to show they had the capability to mirror the U.S.\textsuperscript{289} China’s interest in airspace control and the utility of RPAs for such a role indicate one potential area for expanded Chinese RPA operations.

The Chinese announcement of an Air Defense Identification Zone (ADIZ) in November 2013 aggravated relations with both the U.S. and Japan by including airspace over the disputed Senkaku islands. China’s ultimate objective in declaring such a zone remains unclear,\textsuperscript{290} but has

\textsuperscript{288}See Kimberly Hsu’s report on the Chinese RPA industry for details of production status, existing capabilities, and acknowledgments from Chinese producers of the similarities to U.S. platforms (Hsu, 2013).

\textsuperscript{289}In 2012 China reportedly considered using an RPA to strike drug kingpin Naw Kham in Laos, but ultimately opted to capture him alive. The operation would have armed the RPA with 20 kilograms of TNT and by most accounts suggest the RPA would have functioned more like a guided missile than a true RPA dropping a precision guided munition (Bangkok Post, 2013). Erickson and Strange actually use the Chinese decision not to use an RPA in this situation as a possible example of Chinese caution to using RPAs in Asia and suggest it may be part of the beginning of a larger norms development process to limit their use in potentially escalatory circumstances.

\textsuperscript{290}David Welch noted the conventional wisdom is to help bolster China’s claims to the islands, but shows the faulty logic behind such a claim given the historical reasons for declaring and utility of maintaining an ADIZ (Welch, 2013). A more sinister reading along those lines by Michael J. Green framed the move as one part of an ongoing
significant implications for RPAs operating in the area. If China is in fact attempting to use control of airspace to assert control of land, then the persistent characteristics of the RPA would be the ideal airframe to maintain control of the airspace. Similarly, U.S. Global Hawks conducting regular operations in the airspace would be ideal to challenge Chinese control of the airspace should that be their objective. Though the potential for escalation exists in this standoff, the potential for growth and cooperation may just as easily emerge. The regular presence of aircraft in the area presents the need for increased transparency of air operations, ostensibly the ultimate goal of an ADIZ. Information sharing between the U.S., Japan, China, and South Korea, all of which except for the U.S. have an ADIZ in the vicinity, could lead to de-escalation of the contested airspace situation as it currently exists and separate the issue of airspace from the contested status of the islands.

As with RPAs in limited wars, RPAs in the maritime environment in many ways will simply increase the power of existing systems of both wartime and peacetime operations through the added benefit of persistence, in the process serving as a key demonstration of both resolve and capabilities for both the U.S. and China. As with any emerging technology this has some potential for destabilization through overly aggressive action, but just as easily can be a force for stability. Even in critiquing RPAs in the region, journalist Richard Parker acknowledged this potential given a naval arms race not exclusively about RPA technology. “By themselves, naval
rivalries do not start wars. During peacetime, in fact, naval operations are a form of diplomacy, which provide rivals with healthy displays of force that serve as deterrents to war. But they have to be enveloped in larger political relationships, too (Parker, 2013).” Andrew Erickson and Austin Strange made a similar point looking at the Chinese side of the equation, saying that in building RPAs “Beijing has cleared only a technological hurdle -- and its behavior will continue to be constrained by politics (Erickson & Strange, 2013).” RPAs provide a new technology that allow states to do a number of things they were already doing more efficiently and possibly in greater numbers over time, but despite the focus on the lack of a pilot meaning lower risk, the risks for all states involved remain elevated and the RPA has not fundamentally changed the underlying stakes or means of engaging in coercive diplomacy.

The RPA and the Nation-State – Domestic Roles of RPAs

As my emphasis is the impact of RPAs on international relations, I have generally not addressed what I consider the larger issue of the domestic applications of RPAs. However, given the likely proliferation of smaller RPAs with both commercial and government applications, the tactical RPA employed by governments is likely to have a great impact on the international system. A common concern from the security literature is the prospect it may be used by non-state actors as tools of terrorism, but I believe it is more likely to function as a means of reinforcing the role of the nation state. This is likely because the issue of uncontested airspace dramatically increases the potential roles of the RPA while keeping costs low. In this case, RPAs could be revolutionary in their implications for international relations outside of the context of war, by reversing the trend toward non-state actors and pushing it back towards the nation state.
The prospect of RPAs being used by terrorists is not new nor has any use of the RPA by the U.S. or other nation states been in any way critical to setting a ‘precedent’ for such a use. In February of 2003, in the run-up to the war in Iraq, Secretary of State Colin Powell referenced the potential terrorist applications of RPAs in his speech to the UN making the case for the U.S. campaign. "UAVs outfitted with spray tanks constitute an ideal method for launching a terrorist attack using biological weapons…Iraq could use these small UAVs, which have a wingspan of only a few meters, to deliver biological agents to its neighbors or, if transported, to other countries, including the United States (Baier & Porteus, 2003)." The model Powell presented had Iraq as a state-sponsor of terrorist elements launching attacks from within the U.S., and since then similar ideas have been proposed being sponsored by al Qa’eda, Hizb’allah, and other entities.

As with tactical RPAs in contested airspace, the challenges to an RPA terrorist attack become clear once the vulnerability has been identified and steps can be taken to defend against such a scenario. The threat of biological weapons themselves is probably overstated, and without the prospect of weapons of mass destruction the prospect of using an RPA for an attack seems minor compared to the cheaper and easier prospects of using conventional weapons such as long-range rifles or homemade explosives. The RPA can serve potentially as a delivery vehicle for any of those types of weapons, but in most cases law enforcement has had success monitoring the acquisition of the materials and organizational planning for such attacks. As RPAs become more capable, similar monitoring for the acquisition of more capable RPAs will likely be added to the list of items law enforcement agencies look for in counter-terrorism scenarios, but they are likely to continue to have more success with a holistic approach to

292 See Dr. Lynn C. Klotz and Edward J. Sylvester’s analysis of the challenges to conducting an effective terrorist campaign with bio-weapons even using larger manned crop-duster aircraft, which was a prospect also discussed in the early 2000s (Klotz & Sylvester, 2010).
analysis focusing on the organizations and individuals who would launch such an attack rather than looking at purely technical solutions to what is framed as a technical problem. More realistically, RPAs are likely to emerge as a tool for states to extend their power within their own territory leveraging the control of airspace and the opportunities presented by RPAs in uncontested airspace to increase surveillance, extend communications, and ultimately to decrease the risk of internal revolt before it becomes an issue. In this domestic role, small unarmed RPAs can facilitate a strategy similar to the U.S. counter-terrorist/counterinsurgency role in support of the state acting within their own territory. Numerous such RPAs, interlinked via a cloud system to other ground-based technologies and police forces on standby can provide a central government the capability to monitor both citizens and local governments like never before, increasing the collective action problem to would-be insurgent forces. RPAs could similarly be used by insurgents and anti-government entities to spread their own information and highlight atrocities committed by the government, but only if the government itself is not effective at quashing such dissent early and grounding such RPAs when they take flight. As with the challenges posed organizationally by strategic RPAs, tactical RPAs used for such a purpose domestically would represent only one node of a broader strategic system of intelligence gathering, analysis, and selective execution of enforcement which will pose challenges for many states to successfully adopt.

This is likely to be of greater impact in authoritarian regimes than liberal democracies with constitutional protections, but the release of information surrounding existing government programs suggest both an indirect threat to collection through private entities who collect data using RPAs (who are probably more likely than government agencies to regularly use such RPAs

\[293\] See Kathleen Vogel’s work on assessing bioweapons threats post-9-11 for more on biosocial analysis (Vogel, 2013)
in liberal democracies) and an accountability problem within governments concerning the checks and balances of collection versus individual liberty. These are policy problems for which the RPA is but one emerging technology that poses a dilemma for intelligence collection and security in the future, but one that must be accounted for as RPAs become more widespread commercially in the near future.

Final Thoughts

“True revolutions in war may take decades and require not merely new technologies but new forms of organization and behavior to mature,” wrote Thomas Keaney and Eliot Cohen in evaluating the 9119 Gulf War (Keaney & Cohen, 1995, p. 211). At the time, they concluded that it could not be stated that a revolution in warfare had occurred, but that the signposts were there that both technologies and organizations were changing, to include the beginnings of reachback command, control, and intelligence infrastructure as well as increased vulnerability of targets owing to stealth, increased standoff range of missiles, sensors, and suppression of enemy air defenses. Keaney and Cohen argued at the time that aspects of the war were not so revolutionary as the target sets themselves did not change, but with hindsight I argue that by the 1990s technology had finally caught up to the theory sufficient to successfully execute the types of air campaigns that had been envisioned for nearly a century.

The targeting revolution represents a century of evolution of doctrines and technology, at times uneven and detached from one another that has yielded inefficient results over the century. By the 1990s and 2000s, these evolutionary changes came together in two epochs which transformed the system of air warfare. The first change began in the early 1990s and progressed throughout the decade as stealth, precision, and globally networked C^4ISR enabled effective
targeting strategies against military forces and adversary command and control in limited wars. The second began in the late 1990s and emerged in 2007, whereby RPAs added the element of persistent airspace coverage and fused intelligence collection, C^{4}ISR connectivity, and precision strike to allow for the regular use of precision targeting in small wars.

There is a temptation with the emergence of new military technologies to liken them to the significant military revolutions of the 20^{th} century, especially the nuclear revolution. The link between the proliferation of RPAs and the proliferation of nuclear weapons have been made explicit on a number of occasions, with the implication that the progress of technology represents an existential threat to relative global stability that has existed since the latter half of the 20^{th} Century. While the RPA presents a number of challenges for tacticians and policymakers alike, my research shows their overall impact is likely to be much smaller than many critics predict, while consequently their military utility will also be far less than advocates of cheap, unmanned warfare project.

The RPA will have a profound impact on international relations as the character of foreign intervention in small wars has dramatically shifted, potentially enabling a much smaller ground footprint aimed at supporting existing governments rather than a large intervention as the government approaches collapse. This sentence is caveated with ‘potentially’ as the RPA is still maturing. While the technological capability exists and the military organizations to support the technology exist, mechanisms to define the intervention sufficient to exploit the tactical gains of military operations remain underdeveloped. This reality will shape the ongoing development of international norms and laws surrounding the use both of RPAs and of intervention in small wars more broadly for the coming years, forcing states to look closely at how they perceive war and
the utility of force to achieve political objectives, and what constrains the use of force outside of the traditional nation-state structure.

The RPAs that are likely to see the greatest room for innovation and diffusion, tactical RPAs, are also the least likely to be revolutionary in terms of their impact, though they will have significant planning implications at the tactical level of war. Tactical RPAs can increase ISR collection, improve logistics and resupply, improve communications, and extend the benefits of close air support to the smallest units, increasing the effectiveness of small units. This will have a multiplier effect on the power of small units within the Modern System, and potentially could sway the relative power balance of states as they attempt to integrate the capability within their existing systems. Larger and more advanced RPAs can similarly complement existing air forces capabilities by making some of the most dangerous missions such as SEAD unmanned in the future, and supplementing manned air superiority fighters with RPAs to increase radar coverage, firepower, and air defenses.

Outside of conflict zones, RPAs are also likely to profoundly impact international relations, especially in the maritime environment in international airspace. Contested areas in the Asia-Pacific region are likely to see a dramatic increase in RPAs for intelligence collection and monitoring of maritime activity, which has the potential for both positive and negative impacts depending on how various states adopt and use these new technologies. Aircraft have historically caused problems in the region, with the shoot-down of Korean Airlines flight 007 in 1983 and the 2001 collision of a Chinese fighter and a U.S. EP-3 being examples of what can go wrong. At the same time, the RPA may have a net positive impact on international relations in the area owing to the increase in information available to all sides on movements in contested areas and the prospect that congested airspace may force regional cooperation to increase
awareness of flying operations international airspace. The unilateral declarations of Air Defense Identification Zones may be potentially destabilizing, but a real-time sharing of uniform identification in a multinational airspace identification zone may have the opposite effect.

While my study is confined to examining the impact of RPAs on international relations, it is difficult to separate the domestic implications from the international implications. As the RPA is of greatest utility in uncontested airspace, and as range is often a primary limitation on control and exploitation of RPAs due to the costs of line-of-sight controls versus satellite data link, a key implication is that RPAs within the state are likely to have the greatest implications. Many RPA critics have noted the dangers of increased surveillance with RPAs, and given the use of RPAs for targeting in small wars it is conceivable that authoritarian regimes could use a similar, but non-kinetic, surveillance and targeting strategy to apprehend dissidents and thereby extend state control. This would in effect be a state-centric counter to other technological innovations such as social media which have been perceived in recent times as empowering individuals, and thus the true net effect of technology on state power likely remains to be seen. Should such technology be used by states to tighten their grip on power, however, that is likely to have a far greater impact on international relations stemming from the RPA innovation than even the most advanced RPAs employed in civil wars and failing states.

As with other technologies, the RPA is most likely for the foreseeable future to compliment manned assets and in doing so increase the efficiency of operations. Their initial roles will be expanding tactical capabilities in ISR and logistics to missions that previously were either of such a low priority that they were not worth the risk, both human and financial, of conducting such missions. Over time advanced RPAs will gradually supplement and partially replace manned assets in complex strike and air defense missions, but this is likely to remain a
high-cost endeavor as adversaries continue to improve capabilities to counter the emerging technologies. Finally, overcoming the technological obstacles to timeliness and precision of strikes has only historically represented one obstacle to the success of military operations. The same political constraints that limit a state from bombing other states still exist despite the fact that the bombing mission itself might be easier. The consequences for such actions remain. These include both the prospect of retaliation and the inability to control with certainty the popular perception of the justification for the strike. The tactical success of a strike remains secondary to the strategic effects the strike produces. The challenge of exploitation remains the true challenge of building systems to successfully incorporate emerging technologies.

During the Battle of Fredericksburg, Confederate General Robert E. Lee is said to have remarked the Gen James Longstreet “‘It is well that war is so terrible, or we should grow too fond of it (Blount, 2003).’” The danger of air warfare from its inception has been that a state capable of employing dominant airpower may in fact become too fond of war by limiting their own exposure to the horrors of war given the prospects of easy victory through aerial bombing. The experience of history and the logical implications of the targeting revolution as outlined here demonstrate that is unlikely to be the case, however. For the operators of RPAs, the process of targeting and killing individuals remains a stressful endeavor, possibly even more due to the deliberate nature of monitoring and targeting vice the traditional dynamic targeting approach. Further, the potential for destabilization from such a system would inevitably lead to countermeasures, from the threat of escalation to devolution into small wars, both with the aim of driving up the costs of operations for a potential attacker. As the U.S. has learned the strengths and limitations of cruise missiles over the past two decades, it and other states must recognize the similar constraints on the RPA moving forward. The RPA has the potential to
revolutionize the way some wars are fought, but at the end of the day Mark Clodfelter’s reflections on Clausewitz remain correct. "War is an act of violence to compel our enemy to do our will. There's no such thing as a pristine war. . . . As long as you fight human beings, it's not going to be bloodless. It's going to be violent and people are going to die (Achenbach, 2003)." Even as our systems grown in standoff range, automation of controls, and with increased precision to limit collateral damage, this enduring nature of war will remain, that the passions that lead peoples to war require death and destruction sufficient to end it.
### Appendix 1: RPA Database Comparison, 2006-2009

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\(^{294}\) Database published by Bureau of Investigative Journalism (Woods, 2013)

\(^{295}\) Data accessed from New America Foundation database current as of 29 July 2013.

\(^{296}\) Data accessed from BIJ database current as of 29 July 2013.

\(^{297}\) Dates do not always match from database to database likely due to report sourcing. Pakistan internal document serves as primary source, strikes reported in database matched to those dates. Some databases subdivide single date into multiple strikes, which are combined to a single entry when all databases appear to be describing same combined event.
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<td>12-25 (0-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8/21/2009</td>
<td>13</td>
<td>12-21 (8-9 civ, 1-9 unk)</td>
<td>17-21 (9-13)</td>
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<tr>
<td>8/27/2009</td>
<td>8</td>
<td>4-8 (0)</td>
<td>8-10 (0)</td>
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</tr>
<tr>
<td>9/7/2009</td>
<td>8</td>
<td>4-7 (3 unk)</td>
<td>5-8 (3)</td>
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<tr>
<td>9/14/2009</td>
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<td>no report</td>
<td>5 (0)</td>
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</tr>
<tr>
<td>9/24/2009</td>
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<td>3-12 (0)</td>
<td>10-12 (0-12)</td>
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</tr>
<tr>
<td>9/29/2009</td>
<td>5</td>
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<td>5-6 (0)</td>
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<tr>
<td>9/29/2009</td>
<td>7</td>
<td>5-7 (4 unk)</td>
<td>4-9 (0-4)</td>
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<tr>
<td>9/30/2009</td>
<td>6</td>
<td>5-9 (0)</td>
<td>6-9 (0)</td>
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<td>10/15/2009</td>
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<td>4 (0)</td>
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<tr>
<td>10/21/2013</td>
<td>no report</td>
<td>no report</td>
<td>3 (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/24/2009</td>
<td>30</td>
<td>5-24 (0)</td>
<td>20-30 (0)</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>746 (166)</td>
<td>640-1144 (169-205 civ, 70-154 unk)</td>
<td>801-1234 (239-521)</td>
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<td></td>
</tr>
</tbody>
</table>
## Appendix 2: Terrorist Plots in U.S. After 9/11/2001

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Description</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Shoe bomber</td>
<td>British man tries to blow up a US-bound airliner with explosives in his shoes but is subdued by passengers and crew</td>
<td>4</td>
</tr>
<tr>
<td>2002</td>
<td>Dirty bomb</td>
<td>American (Padilla) connected to al-Qaeda who had discussed a dirty bomb attack returns to US and is arrested—Allison Barbo</td>
<td>2</td>
</tr>
<tr>
<td>2002</td>
<td>Mt Rushmore</td>
<td>Two men in Florida, one of them possibly connected to an al-Qaeda operative, plot, crucially aided by an informant, to bomb local targets as well as Mt. Rushmore before 9/11, and are arrested and tried the year after</td>
<td>1</td>
</tr>
<tr>
<td>2002</td>
<td>LAX</td>
<td>His business and marriage failing dismally, a depressed anti-Israel Egyptian national shoots and kills two at the El Al ticket counter at Los Angeles airport before being killed himself in an act later considered to be one of terrorism</td>
<td>4</td>
</tr>
<tr>
<td>2002</td>
<td>Lackawanna</td>
<td>Seven Americans in Lackawanna, NY, are induced to travel to an al-Qaeda training camp, but six return disillusioned, all before 9/11, and are arrested the next year—Blaise Katter</td>
<td>2</td>
</tr>
<tr>
<td>2003</td>
<td>Paracha</td>
<td>A young Pakistani seeks to help an al-Qaeda operative enter the country to attack underground storage tanks and gas stations</td>
<td>3</td>
</tr>
<tr>
<td>2003</td>
<td>Abu Ali</td>
<td>A US citizen joins a terrorist cell in Saudi Arabia and plots to hijack a plane in the US and to assassinate President Bush when he is arrested by the Saudis and extradited to the US for trial</td>
<td>3</td>
</tr>
<tr>
<td>2003</td>
<td>Columbus and Brooklyn Bridge</td>
<td>American connected to al-Qaeda discusses shooting up a shopping mall in Columbus, OH, with two friends, then plots taking down the Brooklyn Bridge for al-Qaeda, but decides it's too difficult</td>
<td>3</td>
</tr>
<tr>
<td>2004</td>
<td>Barot and Financial Buildings</td>
<td>Group in London tied to al-Qaeda scouts out financial buildings in US with an eye to bombing them, but never gets to the issue of explosives</td>
<td>3</td>
</tr>
<tr>
<td>2004</td>
<td>Albany</td>
<td>Two men in Albany, NY, effectively help fund an informant's terror plot</td>
<td>1</td>
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<tr>
<td>2004</td>
<td>Nettles</td>
<td>An American with a long history of criminal and mental problems plots under the nickname of &quot;Ben Laden&quot; to blow up a federal courthouse in Chicago and reaches out for help to a Middle Eastern terrorist group, but gets the FBI</td>
<td>1</td>
</tr>
<tr>
<td>2004</td>
<td>Harold Square</td>
<td>Loud-mouthed jihadist in New York and a schizophrenic friend attract informant who helps them lay plans to bomb Herald Square subway station</td>
<td>1</td>
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<tr>
<td>2005</td>
<td>Grecula</td>
<td>An American with visions of being an modern day Spartacus agrees to build a bomb to be exploded in the US for undercover agents claiming to be al-Qaeda</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>Lodi</td>
<td>An American in Lodi, California, who may have attended a training camp in Pakistan but with no apparent plan to commit violence is arrested with the aid of an informant</td>
<td>2</td>
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<tr>
<td>2005</td>
<td>JIS</td>
<td>An American in jail masterminds a plot by three others to shoot up military recruitment centers, synagogues, and a non-existent military base in the Los Angeles area but, although close to their first attack, the plot is disrupted when they leave a cell phone behind at a funds-raising robbery</td>
<td>3</td>
</tr>
<tr>
<td>2005</td>
<td>Pipelines and the terrorist hunter</td>
<td>An American offers on the internet to blow up pipelines in Canada as an aid to al-Qaeda, and attracts the attention of free-lance informant</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>UNC</td>
<td>To punish the US government for actions around the world, a former student, after failing to go abroad to fight or to join the Air Force so he could drop a nuclear bomb on Washington, drives a rented SUV onto campus to run over as many Americans as possible and manages to injure nine</td>
<td>4</td>
</tr>
<tr>
<td>2006</td>
<td>Hudson River Tunnels</td>
<td>Angered by the US invasion of Iraq, several men based in Lebanon plot to flood railway tunnels under the Hudson river, but are arrested overseas before acquiring bomb materials or setting foot in the US</td>
<td>3</td>
</tr>
<tr>
<td>2006</td>
<td>Sears Tower</td>
<td>Seven men in Miami plot with an informant, whom they claim they were trying to con, to take down the Sears Tower in Chicago, then focus on closer buildings</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>Trans-Atlantic airliner</td>
<td>Small group in London, under intense police surveillance from the beginning, plots to explode liquid bombs on US-bound airliners</td>
<td>3</td>
</tr>
<tr>
<td>2006</td>
<td>Rockford Mall</td>
<td>Loud mouthed jihadist attracts attention of an informant and together they plot exploding grenades at a shopping mall in Rockford, IL</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>Fort Dix</td>
<td>Small group target practices, buys guns, and plots to attack Ft. Dix with the aid of an informant who joins the group when the FBI is told they took a jihadist video into a shop to be duplicated</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>JFK Airport</td>
<td>Small group, with informant, plots to blow up fuel lines serving JFK airport in New York</td>
<td>1</td>
</tr>
<tr>
<td>2008</td>
<td>Vinas</td>
<td>New York man travels to Pakistan, is accepted into al-Qaeda, and plots to plant a bomb in the US, but is being watched and talks after being arrested.</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>Bronx Synagogue</td>
<td>Four men, with crucial aid from an informant, plot to bomb synagogues in Bronx, NY, and shoot down a plane at a military base</td>
<td>1</td>
</tr>
<tr>
<td>2009</td>
<td>Little Rock</td>
<td>American man travels to Middle East to get training, but fails, and on return, working as a lone wolf, eventually shoots and kills one soldier at a military recruitment center in Little Rock, AK</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>Boyd and Quantico</td>
<td>Complicated conspiracy in North Carolina, including an informant, gathers weapons and may have targeted Quantico Marine Base</td>
<td>3</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Event Description</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Zazi</td>
<td>Afghan-American and two friends travel to Pakistan to join Taliban, but are recruited by al-Qaeda to plant bombs on NY subways instead, and are under surveillance throughout.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Springfield</td>
<td>Loud-mouthed jihadist plots, with informants, to set off a bomb in Springfield, IL.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Dallas</td>
<td>Jordanian on a student visa rouses interest from the FBI in internet postings and, together with three agents, tries to detonate a fake bomb in the basement of a Dallas skyscraper.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Mehanna</td>
<td>Well-educated Muslim jihadist may have plotted briefly to shoot up a shopping center in the Boston area and tried to join insurgency in the Middle East, but is arrested for spreading jihadist propaganda.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Fort Hood</td>
<td>Military psychiatrist, acting as a lone wolf, shoots up a military deployment center in Ft. Hood, TX, killing 12 soldiers and one civilian, shortly before he is supposed to be deployed to the war in Afghanistan.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Underwear Bomber</td>
<td>Nigerian man tries to blow up a US-bound airliner with explosives in his underwear but is subdued by passengers and crew.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Times Square</td>
<td>Pakistani-American gets training in Pakistan and on his own tries, but fails, to set off a car bomb at Times Square in New York.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Alaska</td>
<td>Muslim convert in a remote Alaska town plots the assassination of 20 with the aid of an informant.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Parcel bomb</td>
<td>An effort by al-Qaeda in the Arabian Peninsula to set off parcel bombs implanted in printer cartridges on cargo planes bound for the United States is disrupted.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>DC Metro</td>
<td>Pakistani-American aids FBI operatives posing as al-Qaeda in plot to bomb DC Metro.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Oregon</td>
<td>Teenaged Somali-American jihadist, unable to go abroad to fight, works with FBI operatives, apparently alerted by his father, to set off a van bomb at a Christmas tree lighting ceremony in Portland, OR.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>DC Metro-Facebook</td>
<td>Virginia man brags without substance to a female Facebook correspondent that he will bomb the Washington Metro soon, and is quickly arrested for making interstate threats.</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Baltimore</td>
<td>Baltimore man seeks allies on Facebook for violent jihad, and the FBI supplies him with an informant and with a fake SUV bomb with which he tries to blow up a military recruitment center.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Texas</td>
<td>2011 Saudi student in Texas, flaking out and displaying intense new discontent on his blog and Facebook profile, is arrested after buying bomb-making materials and considering potential targets including crowded streets in distant New York and a local residence of former President George W. Bush.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Manhattan’s pair of lone wolves</td>
<td>Mentally ill American citizen, upset with how the US treats Muslims around the world and with accomplice and undercover officer, purchases weapons as first step in plot to blow up synagogues, the Empire State Building, and other targets in NY/NJ.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Pentagon shooter</td>
<td>US marine reservist with jihadist literature shoots at military buildings in DC area and is arrested as he seeks to desecrate the graves of veterans of the wars in Iraq and Afghanistan.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Seattle</td>
<td>Two financially-destitute men, exercised over US foreign policy, are arrested in Seattle after they purchase an FBI-supplied machine gun that they plan to use to attack a military recruiting center after they save up enough money to purchase bullets and other material.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Abdo</td>
<td>A US Army Private, unwilling to wage war on Muslims, is arrested after he buys ammunition and bomb materials to explode in a restaurant popular with soldiers.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Model planes</td>
<td>Seeking to &quot;decapitate&quot; the US &quot;military center,&quot; a mentally-ill hobbyist plots with police operatives to attack the Pentagon and Capitol with remote-controlled model planes bearing explosives and then to assault the buildings.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Iran and Scarface</td>
<td>Iranian-American used-car salesman from Texas, nicknamed &quot;Scarface,&quot; arrested for engaging in a movie-like plot with another man (still at large), with members of the Iranian government, and with a police operative to hire a Mexican drug cartel to blow up Saudi Arabia's ambassador in a Washington restaurant for $1.5 million (wiring the operative $100,000 as a down payment) and to bomb the Israeli embassy in that city.</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>Pimentel’s pipe bomb</td>
<td>A naturalized US citizen and Muslim convert, hostile to US military ventures in the Middle East, seeks to make pipe bombs using match heads to attack various targets.</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Tampa</td>
<td>Under suspicion after he walked into a store seeking to purchase an al-Qaeda flag, an Albanian-American loner plots in Tampa with a police operative to detonate a car bomb, fire an assault rifle, wear an explosive belt, take hostages, and bomb nightclubs, a police center, a bridge, and a Starbucks's coffee shop in order to avenge wrongs against Muslims and to bring terror to his &quot;victims' hearts.&quot;</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Capitol bomber</td>
<td>A Moroccan man who had overstayed his visa for years and had been thrown out of his apartment for non-payment of rent, concludes that the war on terror is a war on Muslims, plots with FBI operatives, and is arrested as he seeks to carry out a suicide bombing at the Capitol.</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Chicago bar</td>
<td>Drawn by the violent jihadist emails and internet postings composed by an unemployed and apparently retarded 18-year-old Egyptian-American who felt the US was at war with Islam, FBI agents gain his confidence, supply him with a fake bomb which he parks outside a Chicago bar he said was filled with &quot;the evilest people,&quot; and then arrest him when he attempts to detonate it from a nearby alley.</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Federal Reserve</td>
<td>A college flunk-out from Bangladesh uses his parents' life-savings to study in the US and, while working as a busboy in Manhattan, reaches out on Facebook, obtains the help of the FBI to do something that will &quot;shake the whole country,&quot; and is arrested when he tries to set off an FBI-supplied bomb planted at the Federal Reserve Bank from a nearby hotel room.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3: Link Analysis of al Qa’eda Organization

Link diagram derived from the FMS Advanced Systems Group (Social Network Analysis (SNA) Diagrams)
Appendix 4: The World’s Aircraft Carriers

Depiction derived from GlobalSecurity.org’s overview of the world’s aircraft carriers (Aircraft Carriers). The UK’s Invincible Class is slated for full decommissioning in 2014, with only one of the listed three still on active service. The RFA Argus is a hospital ship with a heliport capability, and the HMS Queen Elizabeth class is slated to become operational in 2020 (House of Commons Transcript, 2012). Thus the UK has two active VTOL carriers.
### Appendix 5: List of Cruise Missiles by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Years Operational</th>
<th>Speed</th>
<th>Payload</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGM-158A/-B (JASSM/JASSM-ER)</td>
<td>2011</td>
<td>Subsonic</td>
<td>Single warhead, 1,000 lb</td>
<td>200/500 nm</td>
</tr>
<tr>
<td>Brazil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV/MT 300</td>
<td>Development</td>
<td>Subsonic</td>
<td>200 kg</td>
<td>300 km</td>
</tr>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HN-1/-2/3 / DH-10/CJ-10</td>
<td>1996</td>
<td>Subsonic</td>
<td>Single warhead</td>
<td>600-3000 km</td>
</tr>
<tr>
<td>KD-63</td>
<td>2005</td>
<td>Subsonic</td>
<td>513 kg</td>
<td>200 km</td>
</tr>
<tr>
<td>Finland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGM-158A/-B (JASSM/JASSM-ER)</td>
<td>2013</td>
<td>Subsonic</td>
<td>Single warhead, 1,000 lb</td>
<td>200 nm, 500 nm</td>
</tr>
<tr>
<td>France</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APACHE AP</td>
<td>2003</td>
<td>Subsonic</td>
<td>&lt;560 kg</td>
<td>140 km</td>
</tr>
<tr>
<td>ASMP-A</td>
<td>2004</td>
<td>Supersonic</td>
<td>200 kg</td>
<td>500 km</td>
</tr>
<tr>
<td>SCALP EG/Storm Shadow/Black Shaheen</td>
<td>2004</td>
<td>Subsonic</td>
<td>400 kg</td>
<td>250-400 km</td>
</tr>
<tr>
<td>SCALP Naval/MdCN</td>
<td>Development</td>
<td>Transonic</td>
<td>300 kg</td>
<td>1,000 or 1,400 km</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>V-1 Flying Bomb</td>
<td>1944-1945</td>
<td>Subsonic</td>
<td>Single warhead, 847 kg</td>
<td>285 km</td>
</tr>
<tr>
<td>Taurus KEPD 350</td>
<td>2006</td>
<td>Subsonic</td>
<td>450 kg</td>
<td>500 km</td>
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<tr>
<td>Greece</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SCALP EG/Storm Shadow/Black Shaheen</td>
<td>2004</td>
<td>Subsonic</td>
<td>400 kg</td>
<td>250-400 km</td>
</tr>
<tr>
<td>India</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BrahMos</td>
<td>2005</td>
<td>Supersonic</td>
<td>300 kg (SSM), 200 kg (ASM)</td>
<td>300 km (SSM), 500 km (ASM)</td>
</tr>
<tr>
<td>Nirbhay</td>
<td>Development</td>
<td>Subsonic</td>
<td>Single warhead, 450 kg</td>
<td>800-1,000 km</td>
</tr>
<tr>
<td>Iran</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ra’ad</td>
<td>2004</td>
<td>Subsonic</td>
<td>150 km</td>
<td>150 km</td>
</tr>
<tr>
<td>Moshk</td>
<td>Development</td>
<td></td>
<td>2,000 km</td>
<td></td>
</tr>
<tr>
<td>Iraq</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ababil</td>
<td>Terminated, non-op</td>
<td>Subsonic</td>
<td>500 km</td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Delilah</td>
<td>1994</td>
<td>Subsonic</td>
<td>Single warhead, 30 kg</td>
<td>250-400 km</td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCALP EG/Storm Shadow/Black Shaheen</td>
<td>2004</td>
<td>Subsonic</td>
<td>400 kg</td>
<td>250-400 km</td>
</tr>
<tr>
<td>Pakistan</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Haft 8</td>
<td>2007</td>
<td>Subsonic</td>
<td>350 km</td>
<td>350 km</td>
</tr>
<tr>
<td>Haft 7</td>
<td>2010</td>
<td>Subsonic</td>
<td>450-500 kg</td>
<td>750 km</td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KH-90 (AS-X-19)</td>
<td>1976-1992</td>
<td>Supersonic</td>
<td>450 kg</td>
<td>3,000 km</td>
</tr>
<tr>
<td>Kh-55/55S5/55S5/65SE</td>
<td>1984</td>
<td>Subsonic</td>
<td>Single warhead, 410 kg</td>
<td>2,500 km</td>
</tr>
<tr>
<td>RK-55 (SS-N-21/SSC-X-4)</td>
<td>1984</td>
<td>Subsonic</td>
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<td>300 km (SSM), 500 km (ASM)</td>
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299 Information derived from the George C. Marshall and Clairemont Institute’s database on cruise missiles (Missiles of the World - Cruise Missiles)
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<td>Wan Chien</td>
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# Appendix 6: RPA Diffusion

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<td>Russia</td>
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<td>China</td>
<td>1956</td>
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<td>Canada</td>
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<td>1969</td>
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<td>1972</td>
<td>2013</td>
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<td>Israel</td>
<td>1981</td>
<td>2008</td>
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<td>Iran</td>
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Bibliography


Air Medal. (n.d.). Retrieved August 1, 2013, from U.S. Navy:

Aircraft and Weapons. (n.d.). Retrieved August 7, 2013, from Naval Air Systems Command:
http://www.navair.navy.mil/index.cfm?fuseaction=home.display&key=D365BAA4-E29B-4DEA-B543-BA14BB930B7F

http://www.globalsecurity.org/military/world/carriers-intro.htm


Hamdan v. Rumsfeld, 05-184 (Supreme Court of the United States June 29, 2006).


INS v. Chadha, 462 U.S. 919 (Supreme Court of the United States June 23, 1983).


Officials: American al-Qaeda can be targeted and killed. (2002, December 3). Retrieved June 11, 2013, from USA Today: Officials: American al-Qaeda can be targeted and killed


http://www.9-11commission.gov/staff_statements/staff_statement_6.pdf

http://counterterrorism.newamerica.net/drones/methodology


Thiel, T. (n.d.). *Yemen’s Arab Spring: From Youth Revolution to Fragile Political Transition*. Retrieved August 6, 2013, from London School of Economics:

http://abcnews.go.com/WNT/story?id=129090&page


http://www.airforcemag.com/MagazineArchive/Pages/2001/March%202001/0301space.aspx

http://www.airforcemag.com/MagazineArchive/Pages/2010/August%202010/0810RPA.aspx


http://www.tomdispatch.com/blog/175454/tomgram%3A_nick_turse%2C_mapping_america%27s_shadowy_drone_wars


Two Sentenced in Los Angeles Terror Plot against Jewish Institutions. (2008, August 26). Retrieved August 6, 2013, from Anti-Defamation League:
http://archive.adl.org/main_Terrorism/los_angeles_sentenced.htm


