Airpower's Response to Fundamental Surprise

A Monograph

by

Major Darin S. Elgersma
US Air Force

School of Advanced Military Studies
US Army Command and General Staff College
Fort Leavenworth, KS

2018

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
24-05-2018	Master's Thesis	JUN 2017 - MAY 2018

4. TITLE AND SUBTITLE

Airpower's Response to Fundamental Surprise

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Major Darin S. Elgersma

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

US Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Advanced Military Studies Program

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release, Distribution is Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The world is a perilous place. The twentieth century was arguably the most destructive epoch in human history and the twenty-first is already proving to be far from benign. In such an environment, states have every incentive to prepare themselves against security threats. However, the complexity of the world and the malignant nature of cognitive blindness both conspire to ensure that a nation will eventually face an unanticipated crisis. Some challenges will be minor, while others have the potential to be fatal.

The purpose of this monograph is to explore airpower's response to fundamental surprise. Using John Boyd's decision loop as a lens, the following chapters construct a case for airpower's efficacy in surprising situations, and then utilize the 1973 Yom Kippur War to test its application. This is not to say that airpower is a panacea, or that it is solely useful in situations of national astonishment. However, this project postulates that airpower has unique capabilities especially suited for surprising situations. In an uncertain world, this can mean the difference between survival and destruction.

15. SUBJECT TERMS

Fundamental Surprise; Airpower; The Yom Kippur War; The OODA Loop

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Major Darin S. Elgersma
(U)	(U)	(U)	(U)	43	19b. TELEPHONE NUMBER *(Include area code)*

Reset

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

Monograph Approval Page

Name of Candidate: Major Darin S. Elgersma

Monograph Title: Airpower's Response to Fundamental Surprise

Approved by:

_____, Monograph Director
G. Scott Gorman, PhD

_____, Seminar Leader
Richard A. Martin, COL

_____, Director, School of Advanced Military Studies
James C. Markert, COL

Accepted this 24th day of May 2018 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, PhD

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

Fair use determination or copyright permission has been obtained for the inclusion of pictures, maps, graphics, and any other works incorporated into this manuscript. A work of the United States Government is not subject to copyright, however further publication or sale of copyrighted images is not permissible.

Abstract

Airpower's Response to Fundamental Surprise, by Major Darin S. Elgersma, USAF, 43 pages.

The world is a perilous place. The twentieth century was arguably the most destructive epoch in human history and the twenty-first is already proving to be far from benign. In such an environment, states have every incentive to prepare themselves against security threats. However, the complexity of the world and the malignant nature of cognitive blindness both conspire to ensure that a nation will eventually face an unanticipated crisis. Some challenges will be minor, while others have the potential to be fatal.

The purpose of this monograph is to explore airpower's response to fundamental surprise. Using John Boyd's decision loop as a lens, the following chapters construct a case for airpower's efficacy in surprising situations, and then utilize the 1973 Yom Kippur War to test its application. This is not to say that airpower is a panacea, or that it is solely useful in situations of national astonishment. However, this project postulates that airpower has unique capabilities especially suited for surprising situations. In an uncertain world, this can mean the difference between survival and destruction.

Contents

Acknowledgements

I am grateful to the United States Air Force for allowing me the chance to attend the School of Advanced Military Studies at Fort Leavenworth. It may seem strange for an Air Force guy to attend an Army school, but I have found the experience to be invaluable. While here, I have chosen to write about airpower, which may come across as cliché coming from one of the few flightsuit-wearers in a mass of Army OCPs. However, if I have learned anything over the past year, it is that the US Army is a fearsome instrument of national power, but it cannot reach its full potential in isolation. All the Joint Services depend on each other for their unique capabilities, and I have written this monograph to highlight one aspect of that uniqueness.

To all my Army brethren, I have thoroughly enjoyed my time here. I do not presume to always understand you, but I am constantly impressed by your humor, your abilities, and your dedication to your craft. To Dr. Gorman and Col Martin, thank you for always being willing to take the time to provide me with valuable insight. You each teach with a skillful mix of professionalism, courtesy, and humanity. I feel privileged to have learned from you. To my dearest wife, thank you for your constant support and willingness to correct my grammar. You are my love and my joy. This journey is better together.

And to my Lord, I trust in you with all my heart and do not lean on my own understanding.

Acronyms

AOC   Air Operations Center

C2   Command and Control

IAF   Israeli Air Force

OODA   Observe, Orient, Decide, Act

Illustrations

Introduction

And you will know the truth and the truth will make you free.

—John 8:32, *New American Standard Bible*

The unofficial motto of the US Central Intelligence Agency is John 8:32. The statement establishes a strong link between the knowledge of the truth and actual freedom. However, truth can be elusive. The pages of history reveal several instances of misperception and downright blindness about the international security environment. For this reason, a nation must possess the ability to react to situations that it did not anticipate. This research paper explores whether airpower has specific characteristics that might aid the nation in responding to surprising situations. The culture, organization, and mobility of airpower all have distinctive characteristics that may yield capabilities uniquely suited to fundamentally surprising situations.

The United States has a habit of being chronically unprepared for war. The American historian Allan Millett describes this phenomenon as choosing security through internal development in lieu of a large standing army. A strong industrial base provides the resources for large-scale mobilization in times of crisis. When the crisis passes, the nation demobilizes and returns to business as usual.[1]

The post-World War II settlement has somewhat negated this trend as the United States has assumed more of a global leadership role. America spends more on its military than the next eight highest spending countries combined and theoretically should be more prepared for war than at any other time in its history.[2] Add to this fact the dissolution of the Soviet Union, which left the United States without an existential threat. However, in this era of comparatively limited peril, it is not out of the realm of possibility that an adversary could place the United States at a

---

[1] Alan Millet, Peter Maslowski, and William Feis, *For the Common Defense: A Military History of the United States from 1607 to 2012*, 3rd ed. (New York: Free Press, 2012), xiii-xviii.

[2] Stockholm Independent Peace Research Institute, "SIPRI Military Expenditure Database," 2016, accessed November 30, 2017, https://www.sipri.org/databases/milex.

strategic disadvantage before the nation could respond. It is also possible that the shock of the surprising situation could prohibit a coherent reaction altogether.

This exact scenario led Zvi Lanir to coin the phrase "fundamental surprise." Lanir, the former leader of the Center of Research and Political Planning for the Israeli Ministry of Foreign Affairs, describes instances where a subject has profound misunderstandings about themselves in relation to their environment. This is distinct from mere situational surprise, in which the subject can adapt to their new circumstances with relative ease. In cases of fundamental surprise, the subject must experience a necessary period of self-learning for it to remain viable in the environment. Before this self-learning occurs, the subject experiences shock and cognitive disorientation. The realities of time and shock make fundamental surprise gravely dangerous to a nation, even one as supremely powerful as the United States.

This paper evaluates airpower as an aid to surprising situations. Chapter One details Lanir's theory of fundamental surprise and elucidates its ramifications at a national level. Chapter Two provides a discussion of airpower theory. Specifically, it relies on the theory of John Boyd to consider cultural, organizational, and mobility components of airpower for their utility in surprising situations. Chapter Three delves into Israel's response to the Arab surprise attack in the 1973 Yom Kippur War. This historical case is especially useful because it offers a rare chance to observe a nation thrust from confident security into a fight for survival. Israel's extensive use of airpower in that situation provides several opportunities to examine this project's hypothesis. The final chapter summarizes the findings from this line of inquiry and offers recommendations for decision-makers as they consider mitigating an uncertain future.

Chapter One: Fundamental Surprise

> Surprises are inevitable; they come from the limits of people's knowledge and understanding of their environment and themselves.

<div style="text-align: right">

—Zvi Lanir, *Fundamental Surprises*

</div>

Startled Versus Astonished

A complex world breeds surprises. The billions of people on this planet each face a plethora of options each day as they interact with each other and their environment. There are an incalculable number of outcomes from these interactions and no person can foresee them all. This complexity means the world is hard to understand and full of unintended consequences.[3] In this setting, situational surprise occurs every time an actor confronts aspects of their ignorance. A car bomb in Iraq typifies a situational surprise as much as a young soldier discovering that the dining facility has changed its operating hours. These situational surprises or startles are common, probable, and easy to assimilate into a conception of normalcy.

In comparison, fundamental surprise or astonishment is something very different. The Battle of Jena-Auerstedt provides a good illustration of the disparity. In 1806, the French armies led by Napoleon and his corps commander Davout decisively defeated the armies of Prussia in two separate encounters. In this campaign, Napoleon experienced situational surprise when he realized the Prussian main body was not at Jena. The majority of the enemy had actually faced off with Davout's single corps at Auerstadt. The Prussians, on the other hand, experienced astonishment as their national power evaporated in a single day before a French army that they had imagined was their equal.[4] Fundamental surprises like this one occur when a subject has profound misunderstandings about themselves in relation to their environment.

---

[3] Robert Jervis, "Thinking Systemically about Geopolitics," *Geopolitics* 15, no. 1 (2010): 171.

[4] Robert M. Citino, *The German Way of War: From the Thirty Years' War to the Third Reich* (Lawrence: University Press of Kansas, 2005), 118.

In his book on fundamental surprises, Zvi Lanir describes the key differences that make astonishing situations different from startling ones. In simple surprises, a subject usually only lacks a small piece of information about their environment, usually related to timing, location, or condition. They recognize the missing information as soon as it appears and once perceived, that information is easily adapted into their knowledge base.[5] In the example, Napoleon merely lacked a single piece of information: the location of the Prussian main body. When the results of the battle became clear, he was quickly able to understand the nature of his misperception. While the encounter did cause him begrudgingly to share accolades with Davout, there was no need for him to alter his view of himself and the world.[6]

Situational Surprise:	Fundamental Surprise:
• Caused by lacking individual pieces of information	• Caused by an inaccurate perceptual outlook
• Missing information is readily recognized	• Missing information is misidentified
• Recovery is quick and easy	• Recovery takes time
• Occurs frequently	• Occurs rarely, but inevitably

Contrastingly, subjects experiencing fundamental surprise had previously been blind to entire correlations in their environment, and not just individual specifics. They did not recognize warning signs because they were not looking for any. Rather than missing a single piece of information, they need an entirely new interpretation of the information that is already available. This reinterpretation requires a restructuring of the individual's worldview.[7] In 1806, Prussia still embraced Frederick the Great's model for the army. They clung to outdated tactics and weapons and held on to aging generals who lived in their glorious past and ignored the changes in Europe. Reform-minded leaders gained no traction because King Frederick William III saw little reason to tinker with the system that had established Prussia's military supremacy. It was not until this

---

[5] Zvi Lanir, *Fundamental Surprises* (Tel Aviv: Center for Strategic Studies, 1983), 25-26.

[6] Citino, *The German Way of War*, 118.

[7] Lanir, *Fundamental Surprises*, 25-26.

façade of invincibility was shattered that the King was ready to accept that Frederick the Great's system was obsolete.[8]

National Fundamental Surprise

The Jena-Auerstedt example appears anachronistic in the twenty-first century. With the surfeit of information available in the modern world, it seems impossible for any country to be fundamentally surprised. However, several factors actually make surprise much more probable as state apparatuses increase in complexity. Any group of people could construct a shared perception of the world around them that may differ from the complete truth. Misperceptions acquire their own inertia as individuals invest in them and loyally defend a position, never challenging the underlying false assumptions because the human brain subconsciously avoids hard questions. Complex organizations magnify this self-delusion as they manage information and filter out the seemingly inapplicable facts that are actually the initial warning signs that something is wrong. This elaborate chain of misperception deserves closer examination.

National surprise sprouts out of a collective consciousness that can differ from objective truth. Sociologists Peter Berger and Thomas Luckmann explored this concept in their seminal work, *The Social Construction of Reality*. In it, they describe the phenomenon in which human understanding of the world is an artificial interpretation overlaid atop actual reality. A river is a real thing, but the understanding of that river as an international boundary, transportation route, or religious symbol is a social contrivance.[9]

In the same way, national security is a synthetic perception. No one can really quantify the security of a country like the United States. As a personal abstraction, each individual that perceives it experiences it in a slightly different way. The abstraction becomes even more artificial as it drifts to reflect social undertones and undergoes deliberate political and economic

---

[8] Citino, *The German Way of War*, 110, 128-131.

[9] Peter Berger and Thomas Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge* (New York: Doubleday, 1966), 54-60.

manipulation. For example, the Las Vegas shooting in the fall of 2017 could cause many Americans to alter their perceptions of safety, even though nothing in their immediate physical environment actually changed from October 1 to October 2. Gun manufacturers or anti-gun activists may actively inflame or restrain those alterations as it suits their own purposes. In this way, abstractions can drift from reality.

Every time individuals who share similar understandings of this abstraction interact with one another, it reinforces the social reality. Berger and Luckmann call this reinforcement 'routine maintenance'.[10] Routine maintenance occurs anytime two New Englanders discuss Canada's plans to invade the United States. One party dismisses the idea as ludicrous because everyone knows that the United States has a much stronger military than Canada, and the two countries enjoy an amicable relationship. However, by appealing to what "everyone knows," the argument has just reinforced the abstraction. Few individuals are actually in a position to judge the relative military strengths of the two nations or to comment on their relationship. The accepted facts that "everyone knows" may be based on little more than self-reinforced perception. This is the national groundwork for fundamental surprise.

The chain of misperception continues when actors maintain faulty abstractions despite evidence that invalidates them. In national security issues, an operational paradigm like the *US National Military Strategy* is vital because it gives focus and allows for refinement and optimization to meet an expected threat. Functionally, it is the same as a scientific paradigm that allows scientists to tune experiments and adjust inquiries to get finer and finer results. Organizations resist anomalies that contradict the established paradigm because irregularities threaten to invalidate the enormous body of work paired to the paradigm.[11] US planners could easily ignore indicators from an increasingly bellicose Canada because they do not fit into the

---

[10] Berger and Luckmann, *The Social Construction of Reality*, 149.

[11] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1970), 76.

operational paradigm. Acknowledging those indicators would controvert the vast inertia of a military machine oriented against other threats.

This willful blindness often works in tandem with subconscious mental processing. The research of phycologist Daniel Kahneman illuminates a phenomenon in which humans unconsciously exchange a difficult question for an easier one. In this way, the brain takes a lazy route in evaluating the environment, which can contribute to fundamental surprise. Consider the New Englanders discussing the likelihood of a planned Canadian invasion into the United States. Complete comprehension of that issue would involve rigorous research and analysis, not to mention access to data that is not readily available. It is much simpler to sidestep the real question and instead consider whether one *thinks* Canada will invade. It is easy for an individual to assess what they themselves think. Thus, the easy question replaces the difficult question and the discussion reaches a verdict without real critical analysis.[12]

It seems infeasible that these cognitive blunders could persist in a diverse organization like the US military. However, complex organizations are actually more susceptible to fundamental surprise than their simpler counterparts are. Lanir cautions, "the more complex and technologically advanced the organization is, the greater the gaps between its ability to prevent the recurrence of situational surprise and its vulnerability to fundamental surprises."[13] The complexity of the organization is actually a liability.

As organizations increase in complexity, they filter out messages to keep the information flow to a manageable level, only sharing the pertinent items. These filters smooth over superfluous anomalies into coherent summaries. However, this distillation process removes the very incongruities that are critical indicators of a changing environment. There is a multitude of

---

[12] Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus, and Giroux, 2011), 12.

[13] Lanir, *Fundamental Surprises*, 28.

examples of this phenomenon, but the hours before the Japanese attack on Pearl Harbor typifies the process.

In her book on the subject, Roberta Wohlstetter describes instances of filtering before the attack. On the evening of December 6, 1941, Lieutenant Colonel George Bicknell, the assistant intelligence chief for US Army forces on Hawaii, approached his superiors with a report indicating that the local Japanese consulate was destroying their sensitive documents. His superiors assured him that "the message contained nothing alarming" and perhaps he was being a little too "intelligence-conscious." On the morning of December 7 at 6:45 a.m., the USS *Ward* reported an engagement with a Japanese submarine trying to enter Pearl Harbor. Supervisors at the next level of command did not do anything with this information other than send it back for confirmation. At 7:02 a.m., two privates at an Oahu radar control station located an unexpected flight of aircraft 137 miles north of the island. Their supervisor, Lieutenant Kermit Tyler, told them to forget it because he assumed it was a flight of American B-17s expected out from the continental United States. Forty-six minutes later, the first bombs began to fall.[14]

These three examples demonstrate how well intentioned midlevel supervisors can filter out critical information because it seems like simple noise in a sea of data. In hindsight, these warning signs seem obvious, yet they rarely are at the time. In Wohlstetter's words, "After the event, of course, a signal is always crystal clear; we can now see what disaster it was signaling, since the disaster has occurred. But before the event, it is obscure and pregnant with conflicting meanings." Despite a plethora of resources, complex organization may still not have a clear understanding of their environment.[15]

---

[14] Roberta Wohlstetter, *Pearl Harbor; Warning and Decision* (Stanford, CA: Stanford University Press, 1962), 11-18, 62.

[15] Ibid., 387.

These combined factors illustrate the likelihood of fundamental surprise at a national level. The only real antidote is to imagine the unimaginable…a daunting task.[16] In reality, the social construction of reality, paradigm loyalty, cognitive shortcuts, and organizational complexity all conspire to place every country at risk of astonishment. This vulnerable condition can quickly become devastating.

Consequences of Fundamental Surprise

Fundamental surprise is dangerous to a nation because of the effects of shock and the requirements of time. Lanir describes a six-phase process of adaptation that a subject must negotiate after experiencing astonishment. The first phase is crisis, when the subject realizes they need to reexamine themselves and their environment. From the earlier Prussian example, this is the moment when the two streams of survivors from both defeats converged on the road to Weimar and it became evident that the French had simultaneously destroyed both parts of Prussia's army.[17]
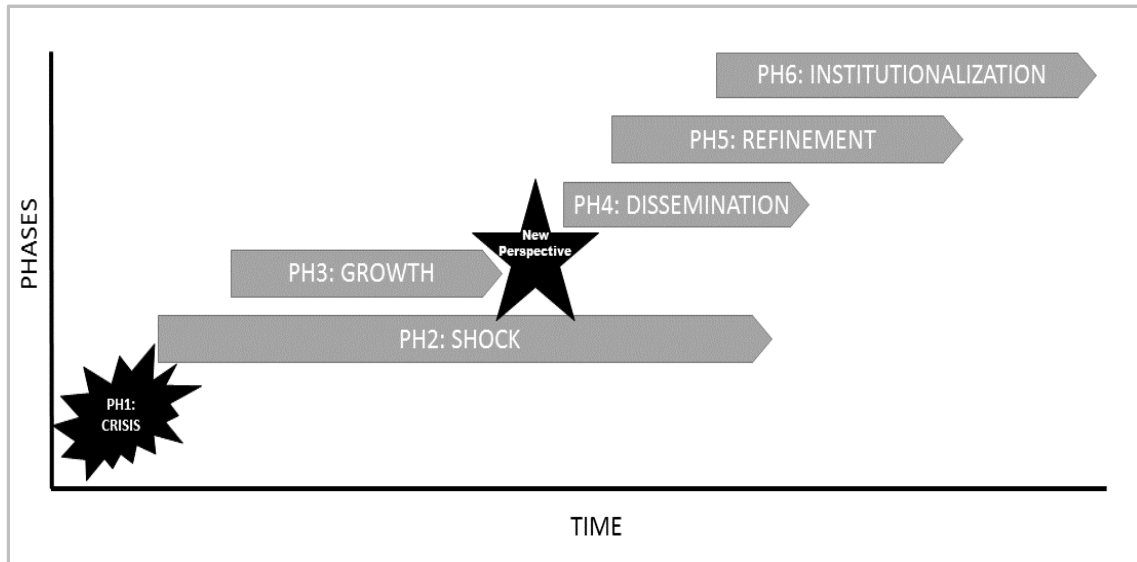

Figure 2. Lanir's Phases of Fundamental Learning. Created by author.

---

[16] James Rosenau, "Thinking Theory Thoroughly," in *The Scientific Study of Foreign Policy*, ed. James Rosenau (London: Frances Pinter, 1980), 35.

[17] Citino, *The German Way of War*, 104.

Immediately after this phase the subject enters phase two, where the consequences of their new reality sink in. This is a phase of shock and disorientation, where reverberations of the crisis ripple back and forth through the organization. This is when the Prussian Army panicked and morale completely vanished. Soldiers turned on their officers and sought ways to surrender. Rather than resist, fortress after fortress simply capitulated to Murat's advancing cavalry screen.[18] In a case of national astonishment, the confusion will be widespread although there will be variations in intensity and the confusion will last for different lengths of time.[19]

Phase three is a period of growth. The crisis has invalidated the old paradigm and has precipitated change. Cognitive filters come off as several new worldviews and hypotheses are proposed, evaluated, and potentially discarded. This is when Frederick William III, having fled to Konigsberg, reached a teachable moment. He accepted the domestic reforms of Friedrich Karl vom und zum Stain and Karl August von Hardenberg, upending the structure of Prussian society. The king also launched the Military Reorganization Commission led by Generals Scharnhorst and Gneisenau, charging them with revolutionizing the military.[20] At the end of phase three, the actor has chosen a new worldview.

Phase four encompasses the socialization period as this novel paradigm travels through the organization until it is widely accepted. Again, this may take different amounts of time for different aspects of the organization. For the Prussian Army, this phase culminated in the 1813 edict that placed a *Kriegsakademie* graduate alongside every commander. That year, Napoleon remarked after the battle of Lutzen that, "these animals have learned something."[21]

In phase five, this new understanding is refined and adapted to minor nuances in the environment. In phase six, the new understanding becomes more rigid. The organization becomes

---

[18] Citino, *The German Way of War*, 104, 118.

[19] Lanir, *Fundamental Surprises*, 36.

[20] Citino, *The German Way of War*, 128-131.

[21] Ibid., 131-132.

comfortable with the new paradigm and it becomes institutionalized. The arrival at this highly refined state allows for great efficiency in execution, but opens the door to recurring instances of fundamental surprise.

These phases illustrate the twin dangers facing an astonished nation: shock and time. The shock from phase two can be debilitating to the extent that it prevents critical analysis and a coherent reaction. If additional catastrophes directly follow the initial surprise, confusion may reverberate exponentially because the organization was already disrupted and less equipped to cope with further upheaval.[22] Time is also a factor. The time delay needed to move an organization through phases two, three, and four represent latency in the reaction cycle. If an adversary can keep a quick tempo of operations, the victim of surprise might constantly be reacting to an understanding that is already been outdated, sowing further disorder and confusion.[23]

Summary

Chapter One has established the concept of fundamental surprise. This phenomenon originates from a social construction of reality and perpetuates itself by paradigm loyalty and cognitive bias. It is especially common at the national level because the complex nature of national consciousness suppresses anomaly identification. When any subject experiences astonishment, it must navigate the phases of fundamental learning to move from crisis to new understanding. This process is time consuming and the subject will experience disorientation until it is complete. This vulnerable period represents a dangerous threat to any nation experiencing fundamental surprise.

---

[22] Shimon Naveh, *In Pursuit of Military Excellence* (Portland, OR: Frank Cass, 1997), 11-14.

[23] John Boyd, "Patterns of Conflict," Defense and the National Interest,1986, accessed August 30, 2017, http://dnipogo.org/john-r-boyd/.

Chapter Two: Airpower's Potential against Fundamental Surprise

Airpower intelligently prepared and employed can and should go a long way toward leveling a battlespace in context that otherwise would see friendly forces possibly fatally disadvantaged.

—Colin Gray, *The Airpower Advantage in Future Warfare*

The Nature of Airpower

Airpower may have the potential to mitigate some of the challenges posed by fundamental surprise. Using John Boyd's theory on decision making as a lens, this chapter specifically examines aspects of airpower's culture, organization, and mobility. The results are a summary of characteristics within those facets of airpower that can decrease the effects of shock and time stemming from astonishing situations.

Air Force doctrine defines airpower as "the control and exploitation of air, space, and cyberspace to achieve strategic, operational, or tactical objectives."[24] The air domain has an elemental reality that makes it distinct even though it affects the other warfighting domains just as they affect it. Operating in the air domain specifically means projecting power above the two-dimensional surface of the earth. As a result, the air domain cares less about terrain compared to the traditional domains of land and maritime. This gives airpower the triple benefit of speed, access, and freedom of maneuver. Although advances in the cyber and space domains have altered the understanding of these three characteristics, they remain strong advantages of aircraft.

Early airpower theorists such as Billy Mitchell echo this conclusion, describing airpower as, "the ability to do something in or through the air, and as the air covers the whole world, aircraft are able to go anywhere on the planet. They are not dependent on the water as a means of sustentation, nor on the land to keep them up. Mountains, deserts, oceans, rivers, and forest offer

---

[24] US Department of the Air Force, Air Force Doctrine Document (AFDD) 1, *Basic Doctrine* (Maxwell AFB, AL: Curtis E. Lemay Center for Doctrine Development and Education, 2015), 25.

no obstacles. In a trice, aircraft have set aside all ideas of frontiers."[25] As Mitchell alludes, airpower can be pervasive. While actual access can be limited by air defenses, available basing, and overflight rights, airpower can rapidly reach anywhere on the earth. This could apply to an island nation like Japan or a landlocked mountainous country such as Afghanistan.

Boyd's Reaction Cycle

Airpower theorist John Boyd conceptualized his OODA loop to describe an actor's environmental reaction cycle. OODA is an acronym standing for Observe, Orient, Decide, and Act. Essentially, entities observe unfolding circumstances in their environment. They orient to those circumstances by analyzing new information through the lens of their previous experiences and traditions. Based on that understanding, they decide on a preferred course of action, and then act by testing or implementing their decision.[26] An actor can seize the initiative by accomplishing their OODA loop quicker than their adversary can. At the same time, the actor denies their adversary a coherent course of action because they have changed the situation in the time it takes the adversary to move from Observation to Action.

While Boyd originally conceived the OODA loop to describe the reaction cycle of individuals in aerial combat, he later expanded its application to organizations. Just as humans use their senses to observe cues in their surroundings, organizations have input mechanisms that harvest data from the environment. A human orients and decides within their own mind and then acts with their muscles. In a similar way, an organization orients and decides within its structure, and then acts with its various components. Airpower organizations can exploit the concept of the OODA loop to arrest the effects of fundamental surprise.

---

[25] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power, Economic and Military* (Mineola, NY: Dover Publications, 2006), 3-4.

[26] John Boyd, "The Essence of Winning and Losing," Defense and the National Interest, 2010, accessed August 30, 2017, http://dnipogo.org/john-r-boyd/.
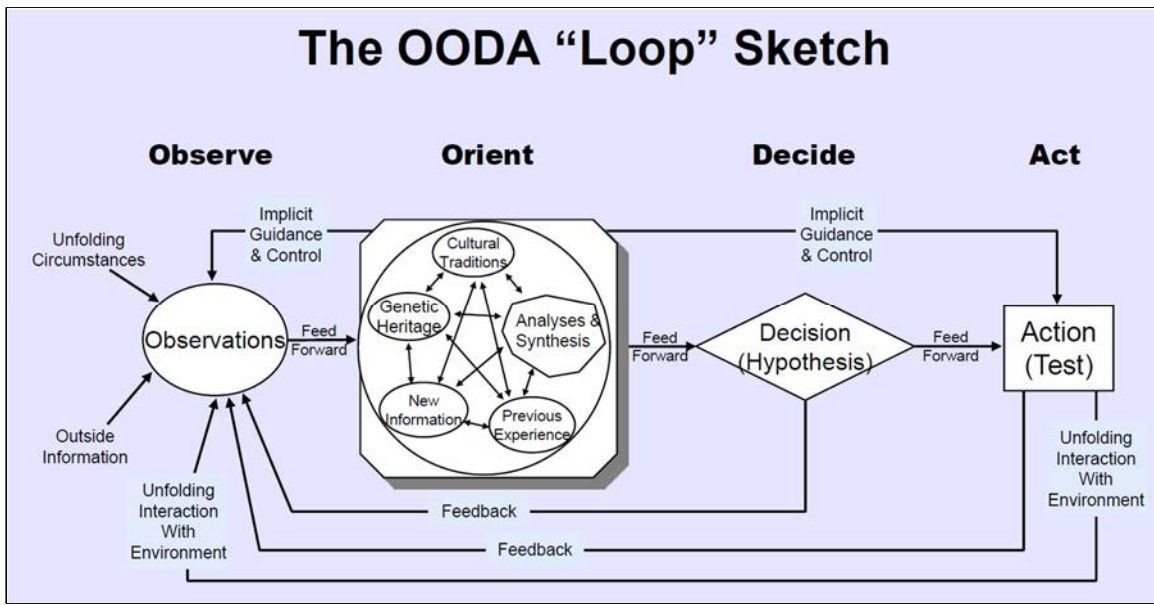
Figure 3. The OODA Loop. John Boyd, "The Essence of Winning and Losing," Defense and the National Interest, 2010, accessed August 30, 2017, https://dnipogo.org/john-r-boyd/.

Observe: Airpower and an Environmental Stimulus

The OODA loop begins with Observe. The observation step corresponds to Lanir's phase one of fundamental learning and occurs when the subject realizes that there is stimulus in the environment that needs a reaction. The origin of this information could come from a variety of sensors not necessarily related to airpower. However, the source of the information is irrelevant when compared to the significance of the message. Whereas all previous information had been misdiagnosed or overlooked because of a misunderstanding of the environment, the observe step signifies the first time the message broke the threshold of consciousness into comprehension.[27] The message may arrive with jarring abruptness, such as explosions all around Pearl Harbor on a quiet Sunday morning. At this point, airpower can start to intervene.

Orient: Airpower and Quick Learning

The second step in Boyd's OODA loop is Orient. This is where the actor must make sense of unfolding circumstances using the lens of their traditions and experiences. To place it

---

[27] Lanir, *Fundamental Surprises*, 25-26.

parallel in time with Lanir's model of fundamental learning, this is where the subject must overcome their shock and disorientation and begin learning about their new environment. The question relevant to this discussion is whether aspects of airpower's flexibility and culture encourage aviators to learn quickly and orient to their surroundings.

Victims of a surprise attack face extreme challenges. A massed attack without warning results in bewilderment, mental confusion, and psychological disorientation. Information is scant and fragmented. There may or may not be standing orders or procedures to provide some semblance of instruction, but the world is one of confusion and crisis.[28]

In this context, Kahneman describes the mental blindness experienced during periods of extreme concentration. The human brain focuses all mental capacity on the primary task, so there is diminished capacity for any other task until the brain returns to a lower state of arousal.[29] Anyone experiencing the crisis of unfolding national astonishment on the front lines is likely to have a degree of tunnel vision as they focus simply on survival. This channelized attention and task saturation can inhibit the orientation function.

In this context, the flexibility of the airplane may provide some assistance to orientation because airpower has the unique ability to easily break contact with the enemy and exit a crisis. When aviators depart a theater and return to the relative safety of a base area, circumstances may uniquely provision them to learn quickly about the environment. Physical reality dictates that aircraft will have to leave the fight to refuel and rearm at some secure area. While any rear areas may be physically under attack as well, the odds are that the danger of exposure is likely to be less among widely dispersed operating locations compared to the epicenter of the crisis. Aviators

---

[28] Raymond G. Funnell, "Air Power Strategy," in *Air Power: Global Developments and Australian Perspectives*, ed. Desmond Ball (Rushcutters Bay, Australia: Pergamon-Brasseys Defense Publishers, 1988), 99.

[29] Kahneman, *Thinking, Fast and Slow*, 35.

will likely be the earliest warfighters in any conflict that actively engage in the fight, completely exit the battle zone, and then return to reengage.

This iteration from chaos to safety and then back again can aid the aviator in orienting. As their brain throttles down from its state of hyper-arousal, there is a chance to 'stop and think', allowing airmen to grasp the situation quicker than a warfighter who is in constant contact.[30] This break in the action can also allow forces to regain a sense of momentum and composure. A flying unit that lost all sense of cohesion can exit the fight in a state of chaos, rally at their home airfield, and return with a regained sense of order.

In this environment, airpower culture can also be a significant resource. The average individual possesses a baseline tolerance to stress stemming from a variety of factors, ranging from mental outlook and physical fitness to emotional security and social connectedness.[31] This baseline exists not only as a measurable quantity, but also as an attribute capable of enhancement. Stress inoculation training can increase an individual's tolerance to stress in the same manner that a medical vaccine increases resilience against a pathogen.[32] Through exposure, an individual enhances their capacity. Many organizations, both military and civilian, use some form of stress inoculation during their accessions process. Airpower organizations are no different, but there are unique aspects of airpower culture that act as a forcing function that both screens and trains inductees to orient quickly under stress.

Before the start of World War II, Army Air Corps General Hap Arnold remarked on the qualities of the airman. In the first quarter of the century, he says airmen were reckless thrill seekers stemming from the fact that fifty percent of flights dealt with an engine failure and one

---

[30] Neville Brown, *The Future of Air Power* (New York: Holmes & Meier, 1986), 98-99.

[31] Sean Robson and Thomas Manacapilli, *Enhancing Performance Under Stress: Stress Inoculation Training for Battlefield Airmen* (Santa Monica, CA: RAND Corporation, 2014), 13-14.

[32] Donald Meichenbaum, "Stress Inoculation Training: A Preventative and Treatment Approach," in *Principles and Practice of Stress Management*, ed. Robert L. Woolfolk and Wesley S. Sime, 3rd ed. (New York: Guilford Press, 2007), 497-518.

third of active pilots died each year. As aircraft became safer and more complicated, there was less need for daredevils, but flyers still had to face the isolation and unsustainability of flight. Arnold asserted of aviators, "There is no military man outside the realms of command upon whom military requirements place a heavier load and a greater responsibility."[33]

To prepare for this responsibility, many flight-training programs have utilized the concept of the 'solo flight' early in training. On these flights, trainees with only a handful of hours act as the aircraft commander and fly completely alone. This specific forcing function demands self-reliance. As Billy Mitchel put it, "The air man's psychology of war depends on the action of the individual. He had no man at his elbow to support him; no officers in front to lead him, and no file closers behind him to shoot him if he runs away…"[34] There is no option to be overcome with panic on a solo flight, because there is simply no one else who can fly the aircraft for you.

Besides this isolation, the physical reality of flight means that any airborne vehicle exists in an unsustainable state. Gravity will prevail and that aircraft must return to the earth, one way or another. If there is an emergency or the aircraft is running low on fuel, there may be no option to delay decision-making until there is perfect information. This is even more important in combat, where a delay of seconds could mean total destruction. Airpower culture began at a time when airplane designers needed to select construction materials that were lightweight and consequently offered little protection from enemy ordnance. Destruction was more common than damage and an uninhibited fall from any height was fatal.[35]

To compensate for these environmental dangers, training programs drill young pilots with the requirement to continue to 'aviate' in any crisis, placing the need for action before the requirement for perfect understanding. This is reminiscent of the chaotic quadrant in the Cynefin

---

[33] Henry H. Arnold and Ira Eaker, *Winged Warfare* (New York: Harper and Brothers, 1941), 34-36.

[34] Mitchell, *Winged Defense*, 160-161.

[35] Ibid., 163.

framework. The Cynefin framework, as described by Snowden and Boone, depicts the appropriate leadership styles for simple, complicated, complex, and chaotic environments. In a chaotic environment, a leader must primarily take action and build their understanding even as they are making decisions.[36] This same mentality has fostered a culture that demands quick orientation from flyers.

The clarity of individual aviators also applies to airpower organizations as a whole. To begin with, airmen typically lead airpower organizations, and those leaders have been raised in the flying culture mentioned above and have had ample practice with rapid orientation. General Willian DePuy, the first commander of the US Army Training and Doctrine Command, argued that the only way to inculcate the organizational initiative needed for crisis response is to train officers in decision making by repeatedly putting them in positions where they must make choices on the spot.[37] Flight school definitely meets this requirement.

In addition, organizations typically reflect the character of their members. Speaking of militaries in general, organizational behaviorist Meir Finkel asserts, "Armies whose basic concept or doctrine is flexible tend to demand cognitive flexibility of their commanders, and tend to develop a C2 system that grants a large degree of leeway to commanders on the battlefield."[38] Aviators value flexibility and quick orientation, and have built their organizations to support this. Now, no one should assert that only purveyors of airpower see clearly in the midst of national astonishment. It is merely worth noting that airpower culture and flexibility might provide some unique capacity for airmen and their organizations to learn quickly and orient in a fundamentally surprising situation.

---

[36] David Snowden and Mary Boone, "A Leader's Framework for Decision Making," *Harvard Business Review* 85, no. 11 (November 2007): 68-76, accessed January 29, 2018, https://hbr.org/2007/11/a-leaders-framework-for-decision-making.

[37] Meir Finkel, *On Flexibility: Recovery from Technological and Doctrinal Surprise on the Battlefield*, trans. Moshe Tlamim (Stanford, CA: Stanford University Press, 2011), 104.

[38] Ibid., 98.

Decide: Airpower and Rapid Resolution

Continuing with Boyd's model, the next step in the reaction cycle is Decide. Once individuals have recovered from their shock enough to orient on the situation, the next logical step is determining what to do about it. At this stage, airpower may enable rapid decisions for the simple reasons that the flexibility of the airplane allows for less-complicated planning and because airpower organization favors simple flat hierarchies.

In a crisis, any reaction time is a combination of the time of recognition in addition to the time needed to reach a decision.[39] All things being equal, decision-makers can decide on airpower responses rapidly because airpower effects call for less-demanding plans than other aspects of military power. For one thing, planners can expedite options because of the decreased importance of terrain. No ground force can put together a combat plan without having a detailed understanding of the terrain involved and planning on unknown terrain must start from scratch. Airpower effects reduce this requirement because the transient medium (airspace) is featureless. Planners can essentially start their work on a blank piece of paper.[40] This is not to say that distances, terrain elevation, air defenses, target characteristics, and even weather are not important factors in planning air effects. However, these factors are generally more straightforward to plan around than the complexities of terrestrial terrain.

Airpower planning also benefits from centralized logistics support. Air effects typically originate from fixed locations, even if those locations are expeditionary in nature. As stationary targets, these bases come with some significant challenges. For example, in 1941 the Soviet Union lost 1,200 aircraft in a single morning when Germany launched Operation Barbarossa, destroying the Red Air Force at its forward operating bases.[41]

---

[39] William Naslund, *NATO Airpower: Organizing for Uncertainty* (Santa Monica, CA: RAND, 1993), 5.

[40] Brown, *The Future of Air Power*, 256.

[41] David M. Glantz and Jonathan House, *When Titans Clashed: How the Red Army Stopped Hitler* (Lawrence: University Press of Kansas, 1995), 37-49.

Despite the risks, there are several advantages to fixed bases. For the purposes of planning, the sustainment and communications infrastructure only needs to supply these central hubs and often already exists pre-conflict. The critical lines of communication are generally all back in rear areas and are less vulnerable to interdiction or sabotage.[42] As a result, many planning considerations are preset quantities regardless of the crisis at hand.

In addition to having the option for simpler plans, airpower's precept of centralized control, decentralized execution can also increase the speed of decisions. The more complex the organization, the slower it is at making decisions. This is a natural consequence of the increased span of control of large organizations. As more items need consideration, the reaction speed decreases.[43]

Any given airpower organization is not necessarily more or less complex than any other instrument of national power. However, if it is operating under the tenet of centralized control, decentralized execution, the complexity at each level of hierarchy decreases because decision-making authority resides at lower levels. This delegation increases agility at the expense of synchronization. The result is that lower levels can freely operate within their natural decision cycle timing, while remaining loosely nested under the broad direction of a central command. In this way, different components of the organization can navigate the stages of fundamental learning without waiting for the rest of the organization to catch up. Individuals demonstrate this phenomenon when they orient to a crisis and take precautionary measures before receiving orders from their chain of command.

However, for a coordinated response, the entire organization needs to reach the same level of understanding. This is a matter of connecting those with information to the decision-makers. In the US Air Force, the Air Operations Center (AOC) fulfills this data exchange

---

[42] Funnell, "Air Power Strategy," 98.

[43] Boyd, "Patterns of Conflict," 72.

requirement. Ideally, these control hubs act as a place to consolidate information, sift through considerations from all levels of war, and then rapidly act.[44] The decision makers at the AOC have a direct link to the tactical units that will be delivering airpower effects without having to work through intervening layers of hierarchy, allowing for a quicker response time. The decentralized execution by the tactical units allows them to employ their effects in a manner that suits the situation, which relieves the central command authority from having perfect information and dictating detailed orders to the operators.

To put it plainly, organizations with simple structures have the capability to make rapid decisions. A central command authority like the AOC has both adequate resources to gain information, and then a simple apparatus to contact the executing units. This is especially true if the command node bears the responsibility and authority to act, driving a small team to be proactive in seeking and processing the information they need to make a decision.[45]

The drawbacks to this system are not hard to imagine. Any highly complex task requires a complex system to perform it.[46] Shortcuts made for speed inevitably degrade the sophistication of the final product, increasing the risk a commander must accept. This tension is visible in US Air Force doctrine, which predicts a seventy-two to ninety-six hour targeting cycle to allow for adequate planning before any mission. However, the system allows this contract to be shortened from days to minutes under the dynamic targeting process should circumstances require it.[47]

Operation Iraqi Freedom provides an illustration of how the transition to dynamic targeting might look. During the rapidly changing ground situation after the first week of

---

[44] Michael W. Kometer, "Command in Air War: Centralized vs. Decentralized Control of Combat Airpower" (PhD diss., Massachusetts Institute of Technology, 2005), 100.

[45] Ibid., 111-116.

[46] Yaneer Bar-Yam, *Making Things Work: Solving Complex Problems in a Complex World* (Cambridge, MA: NECSI Knowledge Press, 2004), 99.

[47] US Department of the Air Force, Annex 3-0, *Operations and Planning* (Maxwell AFB, AL: Curtis E. Lemay Center for Doctrine Development and Education, 2016), 117-118.

operations, the standard Air Tasking Order cycle did nothing but provide aircraft with basic mission details. Execution fell to the aviators themselves and the twenty-five person Time-Critical Targeting Cell as they determined exactly what targets to hit, allowing for real-time airpower effects.[48] Along these lines, airpower can leverage its flexibility and organization to empower rapid decision-making. Following national astonishment, this quality of airpower can reduce the time it takes for the country to respond thus minimizing the vulnerable window between crisis and countermove.

Act: Airpower and Swift Response

The fourth step in Boyd's reaction cycle is act. The final way that airpower may offer a response to national astonishment is in its capacity to act swiftly and flexibly. These responses mitigate fundamental surprise through deterrence, counter-response, and versatility.

The simplest way that airpower can act directly against fundamental surprise is as a deterrent. At the outset, this claim poses a logical paradox, because surprise deterred is no surprise at all. In some ways, deterrence can actually make the issue of fundamental surprise more insidious, because strong deterrence gives a country a feeling of security and convinces them that no rational enemy would dare attack them. In a similar way, defense preparations that prevent war appear to be wasted and frivolous expenditures when no war actually occurs.[49]

Despite these difficulties, there is still a strong case to assert that deterrence theory has value in the realm of fundamental surprise. An adaptable force compounds the strength of deterrence because when a nation is ready to respond to a surprise attack, then its enemy has nothing to gain from attempting one. They are more likely to decide that the costs of peace

---

[48] Kometer, *Command in Air War*, 183-184.

[49] Richard Betts, *Surprise Attack: Lessons for Defense Planning* (Washington DC: The Brookings Institution, 1982), 19-20.

outweigh the costs of war.[50] In this manner, clear and credible deterrence may preclude a surprising situation from even occurring.[51]

The nature of this deterrence can take different forms. Nuclear deterrence is typically the most blatant, and airpower plays a critical role in that regard because it can bypass frontiers and directly threaten strategic targets. Any actor who might have an opportunity to surprise the United States cannot ignore the fact that the response could be a devastating attack against the aggressor's own homeland. However, the national calculus, since the time of President Kennedy's flexible response, has centered on the understanding that the variety of situations in the world demands conventional deterrence alongside of nuclear. In this, airpower plays a significant role.

It is not practical to place large forces in every troubled spot around the globe. This approach would be expensive, politically unfeasible, and may inadvertently escalate the situation. As an alternative, a nation can hold a variety of airpower assets in readiness discretely dispersed away from the conflict areas.[52] If diplomatic maneuvering requires a more visible escalation, those assets can easily relocate in a politically calculated display of power to reassure allies and deter potential aggressors.[53] Contemporary examples of this dynamic are evident in the air-policing missions in the Baltics, the freedom of navigation flights in the South China Sea, and displays of force over the Korean peninsula.

Should deterrence fail, the speed at which airpower can deliver effects allows this aspect of military power to quickly be brought to bear against an enemy. If possible, airpower can bypass fielded forces to strike directly at any vulnerabilities in the adversary's basic strategy. This

---

[50] Betts, *Surprise Attack,* 311.

[51] Colin S. Gray, *The Airpower Advantage in Future Warfare: The Need for Strategy*, vol. 2007-2 (Maxwell AFB, AL: Airpower Research Institute, 2007), viii.

[52] Brown, *The Future of Air Power*, 256.

[53] Ibid., 103.

quick counterstrike can seize the initiative and disrupt the enemy decision cycle.[54] It removes an opponent's freedom to maneuver while increasing one's own.[55] In a fundamentally surprising situation, this disruption can earn friendly forces the critical time they need to adapt to their new environment.

Besides this quick reaction, the speed and maneuverability of airpower can give commanders at all levels increased alternatives. The same assets can quickly transition to perform multiple roles and switch between the tactical, operational, and strategic levels of war.[56] The flexibility that allows transitions vertically along the levels of war also applies in a geographic sense. Normally, engaged units have difficulty transitioning to other locations on the battlefield where the need might be greater.[57] However, the ability of airpower assets to break contact means aircraft can assemble from dispersed locations around the theater and then mass at a critical point. Those aircraft can conduct surge operations to deliver effects repeatedly in the same theater or can even swap between various theaters.

This inherent versatility is especially important in places where the distances involved do not allow an actor to trade space for time such as in South Korea or Israel.[58] In those cases, airpower can mass firepower to give the commander options. Consider the words of Air Marshall R.G. Funnel, former vice-chief of the Australian Defense Force and founding principal of the Australian College for Defense and Strategic Studies. He states, "If combat power is required, airpower is often the form most readily available to plug the gap or hold the line, especially if the

---

[54] Funnell, "Air Power Strategy," 108.

[55] Boyd, "Patterns of Conflict," 128.

[56] US Air Force, AFDD 1 (2015), 29.

[57] Boyd, "Patterns of Conflict," 154.

[58] Brown, *The Future of Air Power*, 23-25, 102-103.

crisis had developed rapidly and military action had occurred in an unpredicted way or in an unpredicted place."[59]

The Air Marshall's endorsement here is appropriately limited. He did not promise that airplanes were going to win the war or control the countryside. He did not pretend that airpower could maintain sway over an ocean or seize a beachhead. He merely said, "Plug the gap." Of all the facets of military power, airpower has uniquely responsive potential to offer the victims of fundamental surprise.

Summary

Chapter One made the case that every nation risks facing fundamental surprise. The chief dangers emanating from this situation are the inherent shock of the crisis and the ensuing period of vulnerability while the entity undergoes fundamental learning. Airpower has capabilities that may mitigate the effects of fundamental surprise. A decisive culture and the ability to break contact facilitate quick orientation among airpower operators even in the midst of shock. Based on this orientation, simple planning and flat hierarchies allow for rapid decision-making. Couple this decision-making speed with the deterrent threat of airpower, the ability for a quick counter-response, and the versatility of aircraft. The combination allows for swift action against an adversary. The overall result is that airpower has the potential to secure time for the rest of the nation, reducing its vulnerability to fundamental surprise.

The following chapter chronicles a nation experiencing fundamental surprise. This case study examines the Israeli Air Force (IAF) in their attempts to orient quickly in the face of shock, rapidly decide on a course of action, and then swiftly act to buy time for their nation. As substantiation to this project's hypothesis, the case study exhibits real world examples of the characteristics described in this chapter.

---

[59] Funnell, "Air Power Strategy," 98.

Chapter Three: Case Study of the Yom Kippur War

In the five minutes between 1403 hours and 1408 hours, I underwent the greatest change of my life. From complete confidence in Israeli Defense Force, and particularly Israeli Air Force initiative and intelligence, I encountered this bubble of confusion and doubt that gnawed away at all strata of the country and revealed the dimensions and disgrace of the situation. I suddenly saw four quartets of aircraft headed straight for us at low altitude. 'Affirmative identification!' the antiaircraft commander shouted, 'All Egyptian SU-7s!'

—Eliezer Cohen, *Israel's Best Defense*

Background

In 1973, Israel stood as a miniature superpower in the Middle East. The tiny nation fought for survival since the day of its inception, defeating hostile neighboring coalitions in 1948, 1956, and 1967. In the latest major conflict, dubbed the Six Day War, the Israeli Defense Forces had achieved stunning success with minimal losses, adding vast amounts of territory including the Golan Heights, West Bank, Gaza Strip, and the Sinai Peninsula. The ease of their victory convinced many Israelis of the invincibility of their armored units, the dominance of their air force, and the omniscience of their intelligence service. Although enemies still lurked all around them, the nation felt secure from attack.[60]

Not everyone was content with the status quo, however. The Egyptian President Anwar Sadat developed a bold plan to reestablish the balance of power in the Middle East. Coordinating with Syria, Sadat envisioned a strategy aimed to undermine Israeli prestige. His overall objectives would be limited. Unlike the previous wars, Sadat would not attempt to overthrow the Jewish nation completely. However, he planned to wisely play to the strengths of the Arab nations and inflict maximum damage on Israeli forces through a surprise attack. Sadat envisioned Egypt reestablishing a favorable bargaining position compared to their Hebrew foe.[61]

---

[60] George Gawrych, *1973 Arab-Israeli War: The Albatross of Decisive Victory* (Fort Leavenworth, KS: Combat Studies Institute, 1996), 1-9.

[61] Ibid., 10-13.

Figure 4. Israeli Territory in 1973. Modified by the author, accessed February 6, 2018, http://www.lib.utexas.edu/map/index.html.

To achieve this goal, Sadat engaged in several stratagems to lull his adversary into a state of complacency. Egyptian officials publically stated that the nation would need years of rebuilding before they could challenge Israel again, especially in the air. During the frozen conflict known as the War of Attrition, Arab deployments purposely targeted Jewish defensive preparations and frightened the nation into costly military mobilizations. This heightened state of

alert disrupted Israel's economy and became politically embarrassing to its leaders. At the same time, Israel's intelligence apparatus became desensitized to the Arab's threatening posture.[62]

As a counter to this danger, the nation of Israel developed a defensive scheme to meet its security needs. Along the Suez Canal, engineers constructed thirty-one fortresses and a sixty-foot tall sand rampart dubbed the Bar-Lev line. The Golan Heights were similarly fortified with tank traps, minefields, and concrete bunkers. Artillery and mobile armored units supplemented these manmade obstacles and the Israeli Air Force stood ready to support any weak areas. War planners believed that these defenses would delay any minor incursion for at least forty-eight hours, giving the tiny Jewish nation adequate time to deploy its massive reserve army. Those same planners assumed that if a more serious attack were imminent, the Israeli intelligence service would provide ample time to prepare.[63]

There were some rumblings in the fall of 1973 that something was amiss. For example, a young Israeli intelligence officer predicted an Egyptian surprise attack with amazing accuracy. On October 1, 1973, Lieutenant Benjamin Siman-Tov submitted his report on Egyptian intentions but his superiors suppressed the findings because they seemed to be an anomaly. Siman-Tov filed an updated report two days later and it met the same fate. His superiors, like most Israelis, were wedded to the paradigm that Israel's strength precluded any serious threat from her neighbors.[64]

Observe: The Arabs Attack

At roughly 1400 on 6 October 1973, the Arab nations launched their surprise attack. As air raid sirens across the nation disrupted Yom Kippur services, three Syrian divisions with 800 tanks attacked the two understrength Israeli Brigades defending the Golan Heights with their 176 tanks. That day, a single understrength battalion with 600 men manned the entire Bar-Lev line.

---

[62] Frank Aker, *October 1973: The Arab-Israeli War* (Hamden, CT: Archon Books, 1985), 9.

[63] Ibid., 8.

[64] Insight Team of the Sunday Times, *The Yom Kippur War* (New York: Ibooks, 1974), 107.

They faced an assault of five Egyptian Divisions.[65] Two-thousand howitzers and heavy mortars dropped more than 10,000 shells on the Israeli strongpoints in that first minute, and more than 200 Egyptian aircraft streaked over the canal to strike airfields and command nodes across the Sinai.[66]

As alerts passed throughout the country, Israelis displayed mixed reactions. Some reservists were incredulous, baffled at the sudden mobilization. The common gripe was, "The generals are playing games again."[67] Some frontline soldiers were similarly nonplussed. Soldiers along the Golan Heights went out to repulse the Syrian attack nonchalantly, thinking the attack would be defeated so quickly that they did not even deign to call off their religious fast.[68] Similarly, a transcript from one of the Bar-Lev fortifications catalogues cheerful speculation as the men estimate how long it will take Israeli tanks to be victorious and pass their position on the road to seize Cairo.[69]

The words of Maj Gen Adan, a division commander assigned to the Sinai, summarized the feelings of many Israelis when he expressed the sentiment, "That the Egyptians and Syrians would dare to launch a war against Israel seemed incredible. I couldn't believe that they were unaware that the Israel Defense Forces were far superior to theirs, and they would be risking a painful defeat."[70] That feeling of invincibility would deflate in a few hours when a tank battalion commander, facing overwhelming odds on the Golan Heights, would call down artillery on his own position to stem the attack. The same sanguine group in the Bar-Lev fort that joked about the

---

[65] Aker, *October 1973*, 20-22.

[66] Lon Nordeen, *Fighters Over Israel* (New York: Orion Books, 1990), 118-122.

[67] Aker, *October 1973*, 48-49.

[68] Ibid., 25-26.

[69] Insight Team of the Sunday Times, *The Yom Kippur War*, 5-7.

[70] Gawrych, *1973 Arab-Israeli War*, 28.

road to Cairo would evacuate their position after hearing soldiers in the neighboring forts burned alive as Egyptian tanks cleared the defenses with flamethrowers.[71]

That evening, Israeli leaders expressed confidence that the war was going well. However, they had no concept of the gravity of the situation. Syrian forces had broken through on the Golan and nothing prevented them from crossing the Jordan River. To the South, the Egyptians had utilized sixty bridge and ferry sites to push more than 500 tanks and a complete air defense system across the Suez Canal. This force had the initiative and was poised to seize the critical passes in the center of the Sinai Peninsula.[72] As these implications became clear, the shock of fundamental surprise began to sink in. One historian observed, "Mobilization of the Israeli army had started less than twenty-four hours before the Arab attack and was still in its initial states when the Syrian armor breakthrough on the Golan Heights, combined with the Egyptian's crossing of the Suez, threw the army into a panic and dislocation from which it never really recovered."[73]

This was much more than simple tactical surprise. The Israeli Defense Forces had already encountered all of the newest Arab weapons during the War of Attrition, including the devastating anti-tank and anti-aircraft missiles. Israel's leadership actually knew that the attack was coming hours before the assault and even obtained a copy of the enemy's plan.[74] The real surprise was much deeper than battlefield tactics. As the image of Israeli invincibility shattered, Jews across the nation confronted the reality that they had fundamentally misunderstood their position in the environment.

This realization produced shock and disorientation. In the words of Egypt's Chief of Staff, Saad el-Shazli, "the element of surprise was clearly manifest in the lack of coordination and

---

[71] Insight Team of the Sunday Times, *The Yom Kippur War*, 159, 198.

[72] Ibid., 143-153.

[73] Aker, *October 1973*, 50.

[74] Lanir, *Fundamental Surprises*, 57.

response on the part of the enemy for at least two days."[75] Ariel Sharon, future leader of Israel, was more specific in his assessment on October 7 as he reviewed troops retreating from the Suez. "I…saw something strange on their faces—not fear but bewilderment. Suddenly something was happening to them that had never happened before. These were soldiers who had been brought up on victories—not easy victories maybe, but nevertheless victories. Now they were in a state of shock. How could it be that these Egyptians were crossing the canal right in our faces? How was it that *they* were moving forward and *we* were defeated?"[76] Israel would need time to reestablish its equilibrium.

Orient: The IAF Regains its Composure

The initial question is whether the Israeli Air Force showed any special ability to orient in this tumultuous environment. Compared to the rest of the Jewish nation, the IAF had a head start in dealing with the chaos of that October. The service has the distinction of being the nation's response force, and as such, it maintains a higher state of alert than the rest of the armed forces.[77] Reflecting this charter, in 1973 the IAF only contained about 10 percent reservists compared to 86 percent amongst the Defense Forces at large.[78] In addition, recent experience had kept the service from complacency. Cross-border conflict had continued even though the War of Attrition technically ended in 1970. In fact, the IAF fought a major aerial engagement against the Syrians as recently as September 1973.[79]

Despite these advantages, the Israeli Air Force was just as shocked as the rest of the nation by the force and severity of the Arab attack on Yom Kippur. Aviators expressed disbelief

---

[75] Insight Team of the Sunday Times, *The Yom Kippur War*, 164.

[76] Gawrych, *1973 Arab-Israeli War*, 40.

[77] Eliezer Cohen, *Israel's Best Defense: The First Full Story of the Israeli Air Force*, trans. Jonathan Cordis (New York: Orion Books, 1993), 389.

[78] Stanley M. Ulanoff and David Eshel, *The Fighting Israeli Air Force* (New York: Arco Publishing, 1985), 157.

[79] Nordeen, *Fighters Over Israel*, 115.

that their adversary could threaten the heart of the country and faced confusion at having to fight defensively, instead of their standard practice of taking action immediately to enemy territory. In the chaos, one IAF flight erroneously received vectors to attack another formation of Israeli planes. The pilot, Michael "Mickey" Katz, acknowledged, "This war is not starting well." One base commander's request for information received the response, "We know your situation, but we have no time for you. The Syrians and the Egyptian are attacking at every corner. You're on your own. Shalom!"[80]

Despite this initial lack of cohesion, the IAF displayed some remarkable ability to orient, both individually and organizationally. Two young crews were sitting alert at Qfir Air Base at Sharm-a-sheikh in the Sinai. The pilots were so inexperienced they were not fully qualified in their F-4 Phantoms and the navigators were barely out of flight school. These fresh aviators presumably drew alert duty due to their lack of seniority, so older crews could enjoy the holiday with their families. This typifies the tradeoffs a nation makes when the risk of real war is low.

These young Jews should have had the most difficulty orienting to an unexpected environment, yet the culture of the IAF provided them with the foundation they needed to adapt. Both crews launched that morning in violation of their orders and collectively downed eight enemy aircraft that were attacking the base.[81] Capt Amir Nahumi, one of the pilots, is quoted as saying, "I decided to takeoff. The controller was screaming that there were orders not to takeoff. However, I decided that the orders were from 400 kilometers away and they didn't know what was going on."[82]

This grasp of the situation was also evident in the fight for the Golan Heights. Pre-war doctrine dictated the neutralization of the enemy air defenses before any attempts to fly close air support. However, the critical ground situation on the Golan Heights necessitated a new strategy.

[80] Cohen, *Israel's Best Defense*, 325-327.

[81] Cohen, *Israel's Best Defense*, 332-333.

[82] Nordeen, *Fighters Over Israel*, 119.

The IAF began flying air support missions that first afternoon and sustained catastrophic losses from the Syrian surface-to-air missiles. The surviving fighters tried a new approach, and utilized low altitude ingresses that protected them from the missiles, but exposed them to the punishing fire of the Z-23-4 antiaircraft artillery batteries. Forty aircraft were lost over the Golan Heights on that first afternoon.[83] Undeterred, the IAF attempted yet another strategy by the second day. Utilizing Jordanian and Lebanese airspace, they conducted slashing flank attacks, minimizing their exposure to the enemy defenses. Losses decreased considerably.[84] In this manner, the iteration of subsequent flying sorties allowed the aviators to sample their environment and arrive at an appropriate understanding.

The story of the crews at Qfir and the changing strategies over the Golan Heights both substantiate the claim that airpower can quickly orient to an uncertain problem. This does not minimize the rapid orientation occurring in many other components of the Israeli Defense Force during those early critical hours. However, the culture of the IAF and airpower's ability to break contact allowed pilots to manage shock and quickly grasp the reality of their surroundings.

Decide: The IAF Planning Process

The next question is whether the Israeli Air Force was also able to gain time for their nation through rapid decision-making enabled by simple air plans and a flat organizational structure. At the first indication of trouble, Chief of Staff David Elazar had asked the Air Force to conduct a preemptive strike against the Arab airfields. Although they were not currently planning for such a mission, the IAF commander, Benny Peled, was able to promise execution in six

---

[83] Nordeen, *Fighters Over Israel*, 146. Some sources have a much lower initial loss rate, with Israel only losing six aircraft on the first day and twenty-two on the second. The disparity in numbers might be due to only accounting "losses" for aircraft who did not return from their mission. This method discounts battle damaged aircraft deemed unrepairable after landing.

[84] Aker, *October 1973*, 24-25.

hours.[85] Even though Israel's civilian leadership eventually discarded the preemptive strike for political reasons, the quick planning process gave those leaders more options to work with.

Centralized control with decentralized execution also allowed the IAF to reach rapid decisions. Using their central authority, the IAF directed extra reconnaissance flights over the Suez Canal on their own initiative. Data from those flights allowed the Air Force high command to determine collectively that war was imminent by the evening of October 4 despite the fact that the political government was unconvinced. Based on that insight, the service discreetly began to call in its own reserves, even though the nation was not mobilizing.[86]

This centralized control linked directly into tactical units, allowing for quick responses. After Syrian Frog surface-to-surface missiles hit Israeli civilian areas, the IAF was able to send a tactical unit on a strategic strike against Damascus on that same day.[87] In the course of that strike, decentralized execution led to more refined decision-making. When half of the attacking aircraft were unable to approach Damascus due to low clouds, they proactively were able to change missions. The pilots contacted a forward command post that reassigned them to targets on the Golan Heights in support of the ground forces.[88]

At times, decentralized execution meant acting on local information despite the orders from central headquarters, such as the flight launching from Qfir without orders on October 6. This same scenario occurred again at Refidim Air Base on October 8 when a flight of Mirages launched without orders and shot down four enemy aircraft attacking the airfield.[89] Simple plans and a flat organizational hierarchy allowed the IAF to make decisions rapidly in an uncertain environment. To be fair, this characteristic played out in many facets of the armed forces during

---

[85] Cohen, *Israel's Best Defense*, 322.

[86] Insight Team of the Sunday Times, *The Yom Kippur War*, 114-115.

[87] Aker, *October 1973*, 44.

[88] Cohen, *Israel's Best Defense*, 359.

[89] Ibid., 356.

those first critical days. For example, Brigadier General Rafael Eytan took direct control of the Golan Defenses and adopted a similar centralized control, decentralized execution mentality. His simple plans allowed the surviving meager tank forces to respond with maximum effect.[90] However, what General Eytan did as an expedient represented standard operating procedure for the IAF.

Act: The IAF takes back the Initiative

The third factor considered in this case study is airpower's ability to act. To support the proposed hypothesis, there should be evidence of Israeli airpower mitigating fundamental surprise through deterrence, quick response, and versatility. At the outset, it appears that airpower failed in the ability to deter. In fact, one of the reasons that the outbreak of the war was so unexpected was because Jewish defense planners thought the threat of Israeli strategic attack was enough to keep the enemy nations at bay. While that assumption clearly proved to be invalid, deterrence was not without any effect. Historians speculate that fear of Israeli airstrikes kept the country of Jordan from taking a more active role in the conflict. Jordan's participation would have given Israel a three-front war.[91]

With war clearly underway, airpower provided Israel with a way to seize back some initiative by attacking the Arab strategy. The first IAF counterattacks took place less than an hour after the war began.[92] Attacks against the Suez crossing sites were ultimately ineffective in significantly altering the Egyptian war plan. However, strikes against the Syrian forces had more effect. Israeli aviators interdicted logistics convoys as they moved from Syrian territory to support the advancing armored forces. The loss of these supplies seriously handicapped the Syrian

---

[90] Insight Team of the Sunday Times, *The Yom Kippur War*, 162.

[91] Ulanoff and Eshel, *The Fighting Israeli Air Force*, 89.

[92] Nordeen, *Fighters Over Israel*, 124.

strategy. After the battle, analysts estimated that a roughly a quarter of Syria's tanks were abandoned on the Golan Heights because they ran out of fuel.[93]

In addition to this counter-response, the IAF also showed remarkable versatility while on the defensive. In the war's first afternoon, the IAF only directed 11 percent of their total sorties to the much smaller northern theater. However, as Syrian tanks broke through the southern Golan defenses, priorities changed. The Air Force seamlessly began to apportion much more aircraft to the north and that percentage spiked up to 51%. When Israel's ground forces began their counterattack towards Damascus, the ratio would climb as high as 84%, only to drop back down to 17% three days later as the IAF pivoted back south to confront Egypt's second offensive.[94] This versatility across theaters clearly shows airpowers reactive ability as it buys time for the nation. In the words of one historian, "until reserve Israeli armor could be properly marshaled and organized for a counterattack, the Air Force was the only effective military force opposing the Syrians in the Golan Heights area."[95]

Perhaps the best example of versatility in this conflict originated, not with the Israeli Air Force, but with the US Air Force. As the Israeli Defense Forces rapidly exhausted their wartime stockpiles, the United States decided to intervene and the Military Airlift Command opened an air bridge between the United States and Israel. Over a thirty-two day period, 566 flights moved twenty thousand tons of supplies more than six thousand miles. This included small items like handgun ammunition all the way up to large tanks and aircraft fuselages. The criticality of this air bridge is apparent by the fact that some combat units were firing ammunition that had only arrived in Israel earlier that same day.[96] Deterrence, quick response, and versatility all were present in the air component's actions that served to gain time for the nation.

---

[93] Insight Team of the Sunday Times, *The Yom Kippur War*, 182-183.

[94] Nordeen, *Fighters Over Israel*, 146.

[95] Aker, *October 1973*, 50.

[96] Ulanoff and Eshel, *The Fighting Israeli Air Force*, 87-88.

Summary

Israel clearly faced a fundamental surprise in 1973. Their underestimation of Arab strength threatened all their defensive assumptions and resulted in nation-wide shock. Due to its culture and ability to break contact with the enemy, the Israel Air Force was able to recover rather quickly. It exploited simple plans and a flat organizational hierarchy to develop reactive options. The IAF also utilized the deterrence, quick response, and versatility of the airplane to seize back initiative from the attackers. Relying on all of these factors, airpower was a critical component in Israel's response to fundamental surprise.

Chapter Four: Implications for the Future

Dangers that are extremely improbable but extremely intense deserve as much worry as ones that are more likely but do not threaten to lead to the destruction of American society.

—Richard K. Betts, *Surprise Attack*

The details of the case study demonstrate how airpower can mitigate some of the dangers of national fundamental surprise. The airmen of the Israeli Air Force showed the ability to quickly orient to an unknown environment, rapidly reach decisions about possible courses of action, and then swiftly act to disrupt the enemy strategy. The IAF achieved their charter and bought time for the nation. In the end, they held the front lines and kept clean skies over the country long enough for the nation to mobilize.[97] The IAF was able to "plug to gap" when no other aspects of national power were ready to respond. In doing so, they kept their nation from being fatally disadvantaged.

These conclusions should not oversell the impact of airpower. Ultimately, the ground units of the Israeli Defense Forces had to drive back the invading armies and secure conditions for conflict resolution. It would be wrong to say that airpower was the only significant factor in the war, or even the first among equals. This project merely intended to affirm that there are certain qualities that make airpower a useful tool in addressing national astonishment. However, if this tool is to be viable, there are several considerations worth addressing.

First, secure basing is a prerequisite. Airpower has no ability to orient to a new environment if an adversary destroys it in the opening moments of a conflict. Pearl Harbor, Operation Barbarossa, and the Six Day War all offer cautionary tales about the vulnerability of aircraft stranded on the ground. Survivable basing, within operational reach of the theater of conflict are an essential requirement for airpower to be of any use in a surprising situation.

---

[97] Ulanoff and Eshel, *The Fighting Israeli Air Force*, 16.

In the same way, the construct of centralized control, decentralized execution is equally at risk. A centralized command authority needs to be able to accept imperfect information if they intend to provide decisions in any reasonable amount of time. In a surprising environment, the rapidly evolving nature of the situation could easily paralyze a centralized authority if they are not prepared to push decision-making to subordinates.[98] This command entity also needs to be survivable, with secure communication links to its tactical units.

Of equal concern, decentralized execution could easily degenerate into something unusable. Israel benefited from a national culture that exhorted its young, "don't just stand there, do something!" This sentiment is evident in the proactive individuals present at all levels of the military structure throughout the conflict.[99] However, the same initiative that spurred young pilots to disobey orders and defend their bases could easily devolve into reckless adventurism if the individual operators do not fully understand the wider picture. For decentralized execution to operate effectively in surprising situations, then subordinate organizations must clearly understand the limits to their authority and the imperatives of their responsibility. This ensures that individual actions remain coherent even when communication with the central authority is compromised or when that central authority has a flawed understanding about the immediate context.[100]

All of these caveats are moot if airpower loses its freedom to maneuver. In the case study, the Arab's air defense system came close to delivering unsustainable losses to the IAF. In fact, it was not until ground units began to overrun the enemy's actual air defense sites that the Air Force achieved air superiority.[101] This illustrates the fact that an unsolved air defense puzzle could keep an air force from leveraging its versatility in response to national surprise.

---

[98] Kometer, *Command in Air War*, 233.

[99] Aker, *October 1973*, 137.

[100] Naslund, *NATO Airpower: Organizing for Uncertainty*, 24.

[101] Ulanoff and Eshel, *The Fighting Israeli Air Force*, 81-82.

Readiness is the final indispensable ingredient for airpower to be a reactive tool. The IAF could only respond as quickly as it did because it was prepared to do so. Unfortunately, reaching that level of preparedness requires significant lead-time; time a nation experiencing fundamental surprise may not have. For one thing, training the operators themselves can take years. Additionally, as airpower systems increase in complexity, they take increasingly longer to design and produce. For example, in the 1950s the US Air Force produced six new fighters in just a few years. By the 1970s, this pace dropped to two in a ten-year period.[102] Now, the United States' current aeronautical projects span decades. The readiness of airpower will be a direct reflection of how it was prepared in peacetime.

In the end, a nation must decide if this cost is worth paying. There are too many unknowns to prepare for every eventuality. While history has shown that any country can be the victim of fundamental surprise, the incidents are still rare. In the end, each must decide how it will insure itself in an uncertain world.

---

[102] Benjamin Lambeth, "Future Airpower Developments," in *Air Power: Global Developments and Australian Perspectives*, ed. Desmond Ball (Rushcutters Bay, Australia: Pergamon-Brasseys Defense Publishers, 1988), 66-67.

Bibliography

Aker, Frank. *October 1973: The Arab-Israeli War*. Hamden, CT: Archon Books, 1985.

Arnold, Henry. H., and Ira Eaker. *Winged Warfare*. New York: Harper and Brothers, 1941.

Bar-Yam, Yaneer. *Making Things Work: Solving Complex Problems in a Complex World*. Cambridge, MA: NECSI Knowledge Press, 2004.

Berger, Peter, and Thomas Luckmann. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York: Doubleday, 1966.

Betts, Richard. *Surprise Attack: Lessons for Defense Planning*. Washington DC: The Brookings Institution, 1982.

Boyd, John. "The Essence of Winning and Losing." Defense and the National Interest. Accessed August 30, 2017. http://dnipogo.org/john-r-boyd/.

———. "Patterns of Conflict." Defense and the National Interest, 1986. Accessed August 30, 2017. http://dnipogo.org/john-r-boyd/.

Brown, Neville. *The Future of Air Power*. New York: Holmes & Meier, 1986.

Citino, Robert M. *The German Way of War: From the Thirty Years' War to the Third Reich*. Lawrence: University Press of Kansas, 2005.

Cohen, Eliezer. *Israel's Best Defense: The First Full Story of the Israeli Air Force*. Translated by Jonathan Cordis. New York: Orion Books, 1993.

Finkel, Meir. *On Flexibility: Recovery from Technological and Doctrinal Surprise on the Battlefield*. Translated by Moshe Tlamim. Stanford, CA: Stanford University Press, 2011.

Funnell, Raymond G. "Air Power Strategy." In *Air Power: Global Developments and Australian Perspective*s, edited by Desmond Ball, 93-114. Rushcutters Bay, Australia: Pergamon-Brasseys Defense Publishers, 1988.

Gawrych, George. *1973 Arab-Israeli War: The Albatross of Decisive Victor*y. Fort Leavenworth, KS: Combat Studies Institute, 1996.

Glantz, David M., and Jonathan House. *When Titans Clashed: How the Red Army Stopped Hitler*. Lawrence: University Press of Kansas, 1995.

Gray, Colin S. *The Airpower Advantage in Future Warfare: The Need for Strateg*y. Vol. 2007-2. Maxwell AFB, AL: Airpower Research Institute, 2007.

Insight Team of the Sunday Times. *The Yom Kippur War*. New York: Ibooks, 1974.

Jervis, Robert. "Thinking Systemically about Geopolitics." *Geopolitics* 15, no. 1 (2010): 165-171.

Kahneman, Daniel. *Thinking, Fast and Slo*w. New York: Farrar, Straus, and Giroux, 2011.

Kometer, Michael W. "Command in Air War: Centralized vs. Decentralized Control of Combat Airpower." PhD diss., Massachusetts Institute of Technology, 2005.

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1970.

Lambeth, Benjamin. "Future Airpower Developments." In *Air Power: Global Developments and Australian Perspectives*, edited by Desmond Ball, 65-92. Rushcutters Bay, Australia: Pergamon-Brasseys Defense Publishers, 1988.

Lanir, Zvi. *Fundamental Surprises*. Tel Aviv: Center for Strategic Studies, 1983.

Meichenbaum, Donald. "Stress Inoculation Training: A Preventative and Treatment Approach." In *Principles and Practice of Stress Management*, edited by Robert L. Woolfolk and Wesley S. Sime. 3rd ed., 497-518. New York: Guilford Press, 2007.

Millet, Alan, Peter Maslowski, and William Feis. *For the Common Defense: A Military History of the United States from 1607 to 2012*. 3rd ed. New York: Free Press, 2012.

Mitchell, William. *Winged Defense: The Development and Possibilities of Modern Air Power, Economic and Militar*y. Mineola, NY: Dover Publications, 2006.

Naslund, William. *NATO Airpower: Organizing for Uncertaint*y. Santa Monica, CA: RAND, 1993.

Naveh, Shimon. *In Pursuit of Military Excellence*. Portland, OR: Frank Cass, 1997.

Nordeen, Lon. *Fighters Over Israel*. New York: Orion Books, 1990.

Robson, Sean, and Thomas Manacapilli. *Enhancing Performance Under Stress: Stress Inoculation Training for Battlefield Airmen*. Santa Monica, CA: RAND Corporation, 2014.

Rosenau, James. "Thinking Theory Thoroughly." In *The Scientific Study of Foreign Polic*y, edited by James Rosenau, 19-31. London: Frances Pinter, 1980.

Snowden, David, and Mary Boone. "A Leader's Framework for Decision Making." *Harvard Business Review*, 85, no. 11 (November 2007): 68-76. Accessed January 29, 2018. https://hbr.org/2007/11/a-leaders-framework-for-decision-making.

Stockholm Independent Peace Research Institute. "SIPRI Military Expenditure Database," 2016. Accessed November 30, 2017. https://www.sipri.org/databases/milex.

Ulanoff, Stanley M., and David Eshel. *The Fighting Israeli Air Forc*e. New York: Arco Publishing, 1985.

US Department of the Air Force. Annex 3-0, *Operations and Plannin*g. Maxwell AFB, AL: Curtis E. Lemay Center for Doctrine Development and Education, 2016.

———. Air Force Doctrine Document (AFDD) 1, *Basic Doctrin*e. Maxwell AFB, AL: Curtis E. Lemay Center for Doctrine Development and Education, 2015.

Wohlstetter, Roberta. *Pearl Harbor; Warning and Decisio*n. Stanford, CA: Stanford University Press, 1962.