

THE FIGHTER MAFIA: VIETNAM, THE FIGHTER JET, AND THE FUTURE OF
THE AIR FORCE

by

Thomas West Hubbard

A thesis submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Master of Arts in
History

Charlotte

2014

Approved by:

Dr. James Hogue

Dr. Peter Thorsheim

Dr. Mark Wilson

©2014
Thomas West Hubbard
ALL RIGHTS RESERVED

ABSTRACT

THOMAS WEST HUBARD. *The Fighter Mafia: Vietnam, the fighter jet, and the future of the Air Force.* (Under the direction of Dr. JAMES HOGUE)

This thesis examines the role of fighter pilots and their shared culture in the United States Air Force. This thesis argues that as a result of the Vietnam War, fighter pilots fought back against the traditional power structures of the Air Force to force through new fighter jet designs. Through examining the fighter pilot experience in the Vietnam War, this thesis argues that the failure of the Vietnam air war served as a catalyst for change in the following years. In the aftermath of Vietnam, fighter pilots sought to correct mistakes by promoting new fighter jet aircraft. Fighter pilots also gained a more prominent role in the Air Force power structure as a result of the Vietnam War. This thesis focuses on the role of technology, in particular the fighter jet, in assuring the success of the USAF fighter pilot community. This research further analyzes the long-term ramifications of the growing influence and power of fighter pilot culture.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS	vi
CHAPTER 1: THE FIGHTER JOCK	1
Historiography	10
Methodology	16
CHAPTER 2: THE FIGHTER FAILURE OVER VIETNAM	18
16 January 1967. Udon Royal Thai Air Force Base, Thailand	18
2 March 1965. Osan Air Base, Republic of Korea	22
April 1966. George Air Force Base, California	24
February 1951, MiG Alley, the 38 th Parallel, Korea	28
The Fighter Jets	30
24 July 1965, 40 Miles West Of Hanoi, Republic of North Vietnam	33
The Rules of Engagement	37
2 January 1967. Udon Royal Thai Air Force Base, Thailand	40
3 March 1969. Miramar Naval Station, California	44
9 May 1972. Osan Air Base, Republic of Korea	48
29 March, 1973. Gia Lam Airport. Hanoi, Democratic Republic of Vietnam	51
CHAPTER 3: THE RISE OF THE FIGHTER MAFIA	54
June 1965. The Pentagon, Washington, DC	54
“Forty- Second” Boyd	55
The F-111 and a Change of Perception	57
The Need for Air Superiority of the F-X Program	61

The Lightweight Fighter and the Rise of the Fighter Mafia	65
7 June 1975. Le Bourget Airfield, Paris, France	74
The Rise of Tactical Air Command	80
The Unmanned Aircraft	82
16 January 1991. Pentagon, Washington, D.C.	87
CHAPTER 4: THE FUTURE OF THE AIR FORCE	98
The Fifth Generation	98
The End of the Era?	111
BIBLIOGRAPHY	116

LIST OF ABBREVIATIONS

DoD	Department of Defense
MiG	Soviet MiG (Mikoyan-Gurevich) Fighter Jet
MiGCAP	MiG Combat Air Patrol
NVNAF	North Vietnamese Air Force
OSD	Office of the Secretary of Defense
RPV	Remotely Piloted Vehicle
SAC	Strategic Air Command
SAM	Surface to Air Missile
TAC	Tactical Air Command
TFS	Tactical Fighter Squadron
TFW	Tactical Fighter Wing
UAV	Unmanned Aerial Vehicle
USAF	United States Air Force

CHAPTER 1: THE FIGHTER JOCK

As the armies dug trenches in the fall of 1914, it became evident that this European war would be conducted on a different scale and intensity than previous conflicts. The introduction of ever more powerful killing machines created a death toll of epic proportions. However, one technological advancement was not stuck in the mud and death of the trenches; rather soaring above the battlefield, introducing warfare to a new realm. The airplane, invented over 10 years earlier, entered combat during the conflict known as the Great War. The appeal of the airplane in warfare was easy to observe as it flew above the war-ridden landscape. The future of the military airplane and its impact was and still is a topic of fervent argument. Early theorists, such as Italian army officer Giulio Douhet and American Army pilot Billy Mitchell, predicted a future in which the airplane would bring war to the enemy homeland. The idea of strategic bombing has indeed changed the nature of conflict since its inception. Along with the advancement of military aircraft, a new combatant was born, the pilot. Many of these warriors would control aircraft to bring bombs and munitions to enemy targets as Douhet and Mitchell prognosticated. However, over the skies of Europe specialized combat pilots were making a name for themselves.

These pilots could trace their lineage to before the advent of mechanized warfare, despite controlling one of the most innovative machines of the day. Flying over the trenches, fighter pilots engaged in aerial combat, matching machine against machine and

man against man. These men were throwbacks to the time before large, nationalized armies, to a previous generation of warriors, the medieval European knights. These knights engaged in single combat, in which men fought directly against each other in a battle to the death. These knights possessed not only skill with sword and horsemanship, but bravery and a chivalrous code. The fighter pilots of World War I needed to possess skill with the rudder and gun, but also possess extraordinary bravery through a willingness to enter combat in the skies. No pilot represents the myth of the fighter jock that grew out of Great War more than Manfred von Richthofen, better known as “The Red Baron.” A German fighter pilot, von Richthofen earned fame for his sporty and deadly flying style, which earned him eighty confirmed aerial victories before his death in 1918. He became the most famous in a new class known as the ace, a fighter pilot who had achieved five or more aerial combat victories. Fighter pilots today continue the legacy begun during this period.

In *The Right Stuff*, his book on the Mercury space program and the test pilots who were part of it, Tom Wolfe argues that these pilots shared a certain quality. Wolfe states:

A young man might go into military flight training believing that he was entering some sort of technical school in which he was simply going to acquire a certain set of skills. Instead, he found himself all at once enclosed in a fraternity. And in this fraternity, even though it was military, men were not rated by their outward rank as ensigns, lieutenants, commanders, or whatever. No, herein the world was divided into those who had it and those who did not. This quality, this *it*, was never named, however, nor was it talked about in any way.

As to just what this ineffable quality was...well, it obviously involved bravery. But it was not bravery in the simple sense of being willing to risk your life. The idea seemed to be that any fool could do that, it was all that was required, just as any fool could throw his life in the process. No, the idea here (in the all-enclosing fraternity) seemed to be that a man should have the ability to go up in a hurtling piece of machinery and put his hide on the line and then have the moxie, the

reflexes, the experience, the coolness, to pull it back in the last yawning moment- and then to go up again *the next day*, and the next day, and every new day, even if the series could prove infinite- and, ultimately, in its best expression, do so in a cause that means something to thousands, to a people, a nation, to humanity, to God. Nor was there *a test* to show whether or not a pilot had this righteous quality. There was, instead, a seemingly infinite series of tests. A career in flying was like climbing one of those ancient Babylonian pyramids made up of a dizzy progression of steps and ledges, a ziggurat, a pyramid extraordinary high and steep; and the idea was to prove at every foot of the way up that pyramid that you were elected and anointed ones who had *the right stuff* and could move higher and higher and even- ultimately, God willing, one day-that you might be able to join that special few at the very top, that elite who had the capacity to bring tears to men's eyes, the very Brotherhood of the Right Stuff itself.¹

Wolfe's idea of a shared culture among fighter pilots is an essential aspect to this thesis. It is also an idea which is openly embraced, even today, by the fighter community. These pilots continually identify with the idea that they are special or more skilled than the average person, an idea that creates a shared bond. It is similar to the brotherhood of those medieval knights. Wolfe describes it as "manliness, manhood, manly courage...there was something ancient, primordial, irresistible about the challenge of this stuff, no matter what a sophisticated and rational age one might think he lived in."² But, this fighter pilot culture is not only about skill, bravado, and manliness, it is about being better than everyone else. Wolfe explains that this pilots often ignored certain rules as "somehow one got the message that the man who truly *had* it could ignore those rules—not that he should make a point of it, but that he *could*—and that after all there was only one way to find out—and that in some strange unofficial way, peeking through his fingers, his instructor halfway expected him to challenge all the limits."³ And in sharing these

¹ Tom Wolfe, *The Right Stuff*, (New York: Farrar, Straus and Giroux, 1979), 17-18.

² *Ibid.*, 21.

³ *Ibid.*, 22.

characteristics, “a fighter pilot soon found he wanted to associate only with other fighter pilots.”⁴

Fighter pilots refer to one another almost entirely by nickname or “callsign.” This name is assigned by superior officers and is usually based on some characteristic of the pilot. Apache warriors did the same thing, referring to each other by their battle names. It is a warrior tradition that has tangled roots, but Apache warriors earned their names by some deed or characteristic, a tradition modern fighter pilots carry on.⁵ But it is not only nicknames and flying; fighter pilots are expected to outperform their peers in everything. Whether it is driving the fastest car or drinking the most alcohol, a fighter jock is supposed to take it to the absolute limits without losing control. Of course the ultimate testing ground for all of this is aerial combat. To be able to beat another fighter pilot in aerial combat superseded all other of the aspects. It is where a fighter pilot became an ace, tracing his combat ancestry to the Red Baron. Jocks believed that even in combat the line between life and death was a matter of possessing the right stuff. Wolfe states that pilots truly think that “there are no *accidents* and no fatal flaws in the machine; there are only pilots with the wrong stuff.”⁶ This thesis asks the question, what if the flaw of a machine did in fact impede on *the right stuff*? What if fighter pilots did not possess the proper tools to maintain their lofty self-image?

This is a history of the United States Air Force and the role fighters pilots have held within this institution. It is a history of war, those who fight wars, the machines used by these warriors, and their thoughts of war. It is a history of the institution, but

⁴ Wolfe, *The Right Stuff*, 25.

⁵ Peter Alshire, *Eye of the Viper: The Making of an F-16 Pilot*, 109.

⁶ Wolfe, *The Right Stuff*, 25.

more importantly it is a history of the individual fighter pilots who affected that institution. It is a history that attempts to leave the traditional view of warfare behind and examine how cultures within a structure affect how people fight. It is a history of technological progress, how it is achieved, and at what costs. It is a history of death, a history of struggle, a history of triumph, and a history of uncertainty. This history opens with the aerial operations of the Vietnam War and closes by contemplating the future of aerial warfare itself.

This thesis argues that fighter pilot culture sought to directly change technological decisions as a result of the Vietnam War. The Air Force, more than the other branches, has tended to reach for technological answers as a panacea for any problem. Fighter pilots proved no different as they blamed technology for failures and pursued new technology in correcting the past. This pursuit for fighter pilots was often individualistic, a representation of their nature as single combat warriors. Individual fighter pilots grew frustrated by the results of Vietnam and individual fighter pilots fought back against the traditional Air Force structures in the aftermath of that war. Yet as members of this unique culture, they changed the Air Force collectively. By asserting greater influence and creating new aircraft, fighter pilot culture has become a crucial aspect of the USAF.

In the early 1960s, United States Air Force fighter pilots were the best in the world and they knew it. The Air Force had grown out of the Army Air Force in World War II and the new branch proved its worth in the skies over Korea. Fighter jocks flying the F-86 Sabre, one of the greatest aerial tools in history, decimated less-skilled Korean fighter pilots, who flew Soviet MiG aircraft. As the United States escalated military actions to protect South Vietnam from communist expansion, it appeared that

American fighter jocks would have the opportunity to prove *the right stuff* over the skies of Vietnam. Pilots who had missed the Korean War waited eagerly for the opportunity to prove their skills in combat and hopefully become aces alongside the legendary warriors of previous conflicts. However, what they experienced over the skies of Vietnam would change not only their perspective, but their role in the Air Force and the future of the branch itself.

The Air Force had justified its worth as an independent service during the Second World War in strategic aerial campaigns against Nazi Germany and Imperial Japan. Fighters had defended heavy bombers such as the B-17 and B-29 as destroyed the enemy's will and capability to continue fighting. Following the atomic attacks against Hiroshima and Nagasaki, the prospect of large-scale nuclear warfare changed the nature of combat forever. As the Cold War began to escalate, delivering nuclear weapons to halt possible Soviet aggression became the primary task of the United States Air Force. Due to these experiences, the early Air Force was dominated by the Strategic Air Command (SAC), led by former bomber pilots. These men, such as legendary General Curtis LeMay, held leadership roles controlling doctrine and technology within the Air Force. The result was that fighter pilots, under the command of Tactical Air Command (TAC), occupied a secondary role and whose missions received lesser funding to SAC. This would have devastating effects on fighter jocks during the Vietnam War.

Fighter pilots had flown the F-86 in Korea, a fighter designed specifically to engage other aircraft. However, in the Vietnam conflict, they piloted jets designed to complete a wide array of missions. The designers of the F-105 Thunderchief had intended the jet to serve as a fast delivery system for smaller nuclear weapons. The F-4

Phantom II had been designed for the Navy to defend aircraft carriers and bomb enemy targets. The idea of engaging other aircraft at close range was not part of either of these jets' intended design. Although these planes were some of the most advanced machinery in the world, the fighter jocks soon discovered their lack of aerial ability led them into a quagmire unlike other conflicts. Flying over heavily defended areas and being engaged by smaller Soviet MiG aircraft, USAF fighter jets fell out of the skies in astonishing numbers. Beyond this, the political nature of the Vietnam War impeded on their capability to complete successful missions. The war was a failure for the fighter jocks, but how could they have failed when they possessed *the right stuff*?

This thesis examines individual fighter pilots to obtain a sense of the frustration held within the Air Force. In their minds, they felt they were better than their Vietnamese enemies. But they had been beaten, and the fighter pilots knew the reason why. The blame could be placed on the fighter aircraft and the political nature of the war. Although they were supposed to overcome the odds through skill, fighter pilots had discovered that their wings had been clipped by the dominance of SAC and the priorities of the Air Force and the Department of Defense. Every good fighter pilot knew that as soon as they were not on the attack, they had lost the battle. It was not in the nature of such warriors to sit idly by following such a defeat. The fighter pilots would strike back against the Air Force itself.

The fight back was led by a fighter pilot who represented all the traditional characteristics, and also proved to be an incredible thinker and technician. John Boyd entered the service in the 1950s because of his desire to fly fighter jets. He moved up the ranks to major and became a top-notch instructor in the art of aerial warfare at Edwards

Air Force Base, the home of Chuck Yeager and the right stuff ethos. At Edwards, Boyd began to develop ideas about air-to-air combat, which he would hone to form a new theory to define aircraft capabilities, known as Energy-Maneuverability or E-M Theory. Rather than being shipped off to Vietnam to fly the F-4 in combat (something he greatly anticipated), Boyd took a desk job at the Pentagon to aid in fighter aircraft development. In the mid-1960s at the Pentagon, he met like-minded individuals and converted others to his E-M theory. Angered by the course of the Vietnam War, these men sought justification for their theory by explaining the failures of the air war. This group took the self-appointed name of the “Fighter Mafia” and set on a course to design the greatest fighter jet in the world.

In the early 1960s, the Air Force and the Navy had set about a program to design a new fighter/bomber aircraft with capabilities to complete a cadre of missions. Following a similar philosophy as the F-4, the Department of Defense argued these multi-role aircraft were the best allocation of funds. The procurement of this aircraft, the F-111, became John Boyd’s first battle within the Pentagon. His ideas of E-M theory proved that the F-111 was no good in a fight and events in Vietnam were proving him right. Due to a variety of factors, the F-111 lost steam and a new Air Force program grew out of its ashes, the F-X program. This program began as the Vietnam dilemma was growing and people realized the need for a fighter jet that could guarantee air superiority. Boyd and the Fighter Mafia set out to attack the original design and greatly influenced the resulting aircraft, the F-15. The F-15 served admirably for over 40 years, but it was not the true aerial fighter machine the Mafia envisioned. Against the desires of the Air Force, the Fighter Mafia set their sights on creating the greatest air-to-air jet.

The lightweight fighter program was designed to be test of technology by the Air Force without the intention of procurement. Deputy Secretary of Defense David Packard issued the use of prototyping new aircraft as a means of investigating new aerial technologies. However, the Fighter Mafia set about to create an aircraft the Air Force could not refuse. The result was the F-16, a lightweight fighter, which is more maneuverable and capable than any of its predecessors. This fighter intended to correct the mistakes of Vietnam; designed to outmaneuver and outfight any aircraft the Soviets could create. It is an aircraft that has served in the Air Force for over 35 years and is still in service today. It has proven its worth in battle again and again. Despite the wishes of the Fighter Mafia, it has served excellently as a bomber as well as a fighter aircraft. It is truly one of the greatest fighter jets in history.

The mission in which the F-16 proved its worth more than any other was Operation Desert Storm, the 1991 military action against Saddam Hussein's Iraq. The actions of the Air Force represented changes in strategic thinking, which had occurred as a result of Vietnam. Accredited with the planning of the aerial operation is a former Vietnam F-4 fighter pilot, who applied lessons learned in that war. Colonel John Warden III is one of the greatest strategic thinkers in modern military history. His plan known as Instant Thunder crippled Iraq's capability to fight and assured victory for the Coalition forces. He reimagined and reasserted the power of strategic bombing and helped to usher in an era of aerial dominance by the United States. By channeling the frustration of Vietnam and fighting back against the traditional power structure, fighter pilots had created an institution more powerful than many could have previously imagined. However, this thesis does not end in triumph, but rather with questions for the future.

The US Air Force is currently pursuing two of the most expensive defense programs in history, the F-22 fighter jet and the F-35 Joint Strike Fighter. These jets are calculated to replace existing fighters and assure continued US dominance of the air. However, these programs have been marred by continuing setbacks and extraordinarily high costs. Not only that, but without the great nemesis of the Soviet Union, they appear to lack a clear mission purpose. All of this has occurred in an Air Force dominated by fighter pilots and their culture. It has also occurred during the development and proliferation of unmanned aircraft, known as drones. Is it possible that in their ever-constant battle to prove *the right stuff*, the fighter jocks have led their service down an unattainable path?

Historiography

This thesis builds on an idea originally developed by Tom Wolfe in his essay on Vietnam fighter pilots, “The Truest Sport: Jousting with Sam and Charlie.” Published in *Esquire* magazine in 1973 and then later included in a collection of essays by Wolfe entitled *Mauve Gloves & Madmen, Clutter & Vine* in 1975.⁷ This essay follows a mission in Vietnam of two F-4 fighter pilots. Here Wolfe develops his idea of fighter pilots as “single-combat” warriors who harken back to the chivalry and bravery of medieval knights. Central to this work is this theory that Tom Wolfe developed into *The Right Stuff* in his 1979 book on test fighter pilots and the Mercury space program. Wolfe’s idea of a distinct, unifying culture shared among fighter pilots is central to this

⁷ Tom Wolfe, *Mauve Gloves & Madmen, Clutter & Vine*, (New York: Farrar, Straus, and Giroux, 1973).

work.⁸ Expanding on Wolfe's original thesis, this paper examines how an insular culture of fighter pilots affected the US Air Force in Vietnam and afterward.

This work also falls in line with a recent trend in the study of modern military history to examine the role of culture within military structures. An important work in this field is *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the US, and Israel* by Dima Adamsky, published in 2010. Adamsky argues that culture within these three military structures shaped development, thinking, and procurement of modern weaponry in the 1970s through the 1990s. The Revolution in Military Affairs (essentially the computerization of military equipment) occurred differently in each of these states, not due to mission need or resources, but because of different cultures within the military structure.⁹ Two recent histories examine similar cultural issues within these structures. Fred Kaplan's 2013 book, *The Insurgents: David Petraeus and the Plot to Change the American Way of War*, argues that a group of thinker in the US Army worked behind the scenes to develop ideas not shared by the wider army. This group shared a cultural difference in scrutinizing war, in particular counter-insurgency warfare, which separated them from many of the leading generals and overall doctrine of the US Army.¹⁰ Aaron O'Connell's 2012 work, *Underdogs: The Making of the Modern Marine Corps*, examines the role that distinct cultural identity played on shaping the proliferation of the Marine Corps as a separate

⁸ Wolfe, *The Right Stuff*.

⁹ Dima Adamsky, *The Culture of Military Revolution: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the US, and Israel*, (Palo Alto: Stanford Security Studies, 2010).

¹⁰ Fred Kaplan, *The Insurgents: David Petraeus and the Plot to Change the American Way of War*, (New York: Simon and Schuster, 2013).

branch in the post-World War II era.¹¹ This thesis works along these cultural lines to depict deeper understandings of how military structures function.

This era of US Air Force history has not been examined through this cultural lens though many of the periods in this paper have been studied extensively. A broad study of this period is the USAF-sanctioned history *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984, Volume Two*, by Frank Futrell and published in 1989. This follows a traditional, empirical view of the period examining the actions of the Air Force through mission need and budgetary constraints. It does give a detailed overview of the period, yet fails to examine agency among particular groups within the Air Force.¹² A similar study of the role of the USAF in the Vietnam War is a 1976 work by the Office of Air Force History, *Aces and Aerial Victories: The United States Air Force in Southeast Asia*. This history covers actions and results of the air war, but it does not attempt to analyze failures and problems that occurred during Vietnam.¹³

The air war in Vietnam and the experience of fighter pilots during this conflict are the subject of several works. John Sherwood's *Fast Movers: Jet Pilots and the Vietnam Experience*, published in 1999, and Robert Wilcox's *Wings of Fury: From Vietnam to the Gulf War, the Astonishing True Stories of America's Elite Fighter Pilots*, published in 1997, both give individualized accounts of missions during Vietnam by fighter pilots. Although they assist in conveying some idea of what fighter pilots were thinking and

¹¹ Aaron O'Connell, *Underdogs: The Making of the Modern Marine Corps*, (Cambridge: Harvard University Press, 2012).

¹² Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984 - Volume Two, Air Power, Tactical Air Command, Air Mobility, Space, MOL, Manned Space Flight, Strategy*, (Montgomery: Air University Press, 1989).

¹³ Office of Air Force History, Headquarters USAF, Alfred F. Simpson Historical Research Center, *Aces and Aerial Victories: The United States Air Force in Southeast Asia*. Maxwell Air Force Base, Montgomery, AL, 1976.

feeling, they are intended to narrate entertaining action stories, rather than contribute to the history of the USAF.¹⁴ Marshall Michel's *Clashes: Air Combat over North Vietnam, 1965-1972* is a good examination of the air war exploring fighter pilot adversary during the conflict.¹⁵ This thesis expands on some of those ideas presented by Michel, such as the problems of the F-105 and the F-4 in aerial combat.

Examining the strategic bombing campaign and the failures of the Rolling Thunder operation have been a common criticism of the Vietnam War. Two histories, James Thompson's *Rolling Thunder: Understanding Policy and Program Failure*, published in 1980, and Mark Clodfelter's 1989 work *The Limits of Air Power: The American Bombing of North Vietnam*, scrutinize the role of strategic bombing in the Vietnam War.¹⁶ Published in 2000, Benjamin Lambeth's *The Transformation of American Air Power* chronicles the disruption caused by the failure of Rolling Thunder on strategic thought within the Air Force.¹⁷ The failure of the strategic bombing campaign is important to this thesis for two factors: the diminishing power of bomber generals and the frustration of fighter pilots.

One of the most important works to understanding this period in the Air Force is Colonel Mike Worden's *The Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945-1982*. This was Colonel Worden's doctoral dissertation, which was

¹⁴ John Sherwood, *Fast Movers: Jet Pilots and the Vietnam Experience*, (New York: The Free Press, 1999). Robert Wilcox, *Wings of Fury: From Vietnam to the Gulf War, the Astonishing True Stories of America's Elite Fighter Pilots*, (New York: Pocket Books, 1997).

¹⁵ Marshall Michel, *Clashes: Air Combat over North Vietnam, 1965-1972*, (Annapolis: Naval Institute Press, 1997).

¹⁶ James Thompson, *Rolling Thunder: Understanding Policy and Program Failure*, (Chapel Hill: The University of North Carolina Press, 1980). Mark Clodfelter, *The Limits of Airpower: The American Bombing of North Vietnam*, (New York: The Free Press, 1989),

¹⁷ Benjamin Lambeth, *The Transformation of American Air Power*, (Ithaca: Cornell University Press, 2000).

published by the Air University Press in 1998. Worden examined Air Force leadership from the service's inception after World War II to the early 1980s. In the Air Force's early years, generals who had served as bomber commanders in World War II dominated leadership positions throughout the service. These individuals believed in the absolute nature of strategic bombing: that air power could win any conflict through a strategic bombing campaign. As a result of strategic bombing failures in Vietnam and the retirement of World War II generals, the Air Force increasingly saw the rise of generals with fighter backgrounds.¹⁸ This thesis builds on the idea that the Air Force became more accommodating to fighter pilots in the post-Vietnam era. It does address some points made by Worden. But where Worden's work deals primarily with leadership, this thesis examines technology and the role of fighter pilots outside of the generalship.

In particular, this thesis argues for the prominent role of two fighter pilot colonels who shaped new fighter jets and new strategic thinking, John Boyd and John Warden III. Two works deal with their personal contributions to the Air Force, Robert Coram's *Boyd: The Fighter Pilot Who Changed the Art of War* and John Andres Olsen's *John Warden and the Renaissance of American Air Power*.¹⁹ Coram is a biographer who has written about other prominent military figures. His book on Boyd is important for illustrating the contribution which he and the Fighter Mafia had on the development of aircraft such as the F-15 and F-16. However, since Coram's focus is Boyd, he tends to emphasize the sole agency that Boyd had on these program. Boyd is a singular fighter pilot, fighting the

¹⁸ Mike Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945-1982*, (Maxwell Air Force Base: Air University Press, 1998).

¹⁹ Robert Coram, *John Boyd: The Fighter Pilot who changed the Art of War*, (New York: Back Bay Books, 2004). John Andreas Olsen, *John Warden and the Renaissance of American Air Power*, (Washington D.C.: Potomac Books, 2007).

traditional Air Force system. Boyd and his Fighter Mafia are a crucial aspect of this thesis, yet it seeks to bring Boyd's role into a larger picture of the role of fighter pilot culture within the Air Force.

Several works have focused on the F-16. Lindsay Peacock's 1999 work, *On Falcon Wings: The F-16 Story*, is a good overall assessment of the F-16 program. Peacock does mention the role of John Boyd and the Fighter Mafia, yet this is brief and does not offer any analysis of the Air Force.²⁰ Peter Alshire's *Eye of the Viper: The Making of an F-16 Pilot* is an examination of F-16 fighter pilot training at Nellis Air Base. Through this, Alshire examines aspects of the unique culture of fighter pilots and some perspective on the role of the F-16 on this culture.²¹ However, Alshire's book is a focused narrative of the training process and does not attempt to contribute significantly to the historiography to the role of fighter pilots within the Air Force. Two Air Force studies, written in the 1980s and declassified in the 2000s contributed a great amount of background for this study. Major Deborah Gable's *Acquisition of the F-16 Fighting Falcon, 1972-1980* and Major Clarence Geiger's *Small Wonder: Development of the Fighting Falcon, 1975-1980* give insight into the development process of the F-16.²² Both of these tend to focus on the technical development of the F-16, rather than investigating the role of pilots in the development process.

²⁰ Lindsay Peacock, *On Falcon Wings: The F-16 Story*, (London: Orion, 1999).

²¹ Peter Alshire, *Eye of the Viper: The Making of an F-16 Pilot*, (Boston: Lyons Press, 2004).

²² Deborah Gable, *Acquisition of the F-16 Fighting Falcon 1972-1980*, Report No. 87-0900, United States Air Force Air Command and Staff College, Air University: Maxwell Air Base, March 1987. Clarence Geiger, *Small Wonder: Development of the F-16 Fighting Falcon 1975-1980*, Narrative Report, Aeronautical Systems Division, United States Air Force Systems Command, Washington D.C., January 1980.

John Andres Olsen is one of the most prominent airpower historians and theorists in the world today. His work on Warden is important for establishing the fighter pilot as among the most important strategic thinkers in the history of airpower. Olsen argues that Warden is responsible for the reestablishment of American air power and its dominance over Saddam Hussein's Iraq in Operation Desert Storm. This is an integral aspect of the thesis as Warden is part of fighter pilot culture, which took his Vietnam experience and changed the nature of warfare. Rick Atkinson's *Crusade: The Untold Story of the Persian Gulf War* is an excellent history of the overall operation, which this thesis uses in filling in certain areas.²³ Operation Desert Storm is important in that it has been seen as the pinnacle of American air power during a period dominated by fighter pilots. This conflict served as confirmation for many fighter pilots, who believed their influence had created a stronger institution. This thesis questions whether such a justification has been necessarily a good thing, in light of recent developments.

Methodology

This thesis relies on a wide variety of official Air Force documentation in order to achieve an inside picture of the service. In particular, Air Force interviews conducted during Vietnam and after the war are used throughout to allow of the individual voices of fighter pilots to be documented. While this is a study of the Air Force, it is also a study of fighter pilots, and these pilots tended to be individualistic. Therefore, these interviews are imperative in giving agency to fighter pilot culture in this thesis. For the Vietnam War, fighter pilots' critiques of the war are vital in understanding the frustration and

²³ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War*, (New York: Mariner Books, 1994).

disappointment felt by jocks. During the period immediately following the war, interviews with fighter pilots, generals, and developers involved in the F-111 and F-15 program are used to examine the procurement of military aircraft and the thoughts of those involved.

Where available, Air Force reports are used to examine the Vietnam War and aircraft procurement, in particular staff reports of the F-16. These staff reports have recently been declassified and made available to the public. However, Air Force interviews and most official documentation regarding the F-16 procurement remain classified at this period. This is further the case for the official documentation regarding Operation Desert Storm, and the F-22 and F-35 programs. These classified Air Force documents remain the greatest area of possible expansion for this work in the coming years. Where necessary this thesis relies on secondary sources to fill in many of these areas. For the modern fighter program, the F-22 and the F-35, news publications and government accounting data are used extensively to acquire information regarding problems of budgetary expansion and procurement difficulties. The goal throughout the thesis is to give agency to fighter pilots in order to prove how they changed the Air Force.

CHAPTER 2: THE FIGHTER FAILURE OVER VIETNAM

16 January 1967. Udorn Royal Thai Air Force Base, Thailand.

“Your mission’s been cancelled; you’ve got a hot one.” Captain Thomas Storey, or “Uncle Tom” as he was known, received these orders as he stood in the early morning heat of the planning room of the 11th Tactical Reconnaissance Squadron. Storey had been studying maps with his backseat navigator, Captain Ron Mastin, in preparation for a mission that was no longer happening. Their new mission was “hot,” Air Force slang for a mission ordered from the Joint Chiefs of Staffs making it likely that it came down from the White House.²⁴ This was year two in what became the longest aerial campaign in the history of the United States, a massive bombardment of North Vietnam known as Operation Rolling Thunder. Out of fear of provoking the Soviet Union and China into World War III, President Lyndon Johnson and Secretary of Defense Robert McNamara had placed strict controls over all military operations and decisions. To many in the Air Force, this caused serious problem in fighting the war, as Storey was about to discover first-hand.

Storey was one of the many American pilots flying the most advanced fighter jet in the world, the F-4C Phantom II. A fighter pilot by training, his assignment in Vietnam was that of a supersonic photographer. His Phantom was especially equipped with a

²⁴Thomas Storey, Interview by Dr. James Hasdorff, 9 October 1992, #K239.0512-2235, transcript, U.S Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL. 26-27.

camera designed to observe possible bombing targets. These images were then sent through the chain of command before a decision was returned as of whether to bomb or not to bomb. The target for this “hot” mission was the railroad yards and steel mills at Thai Nguyen in North Vietnam along the Chinese border. His mission was to fly in fast and low, take pictures, and then haul back to safe air outside of North Vietnam.²⁵

Although relatively simple in concept, no mission over North Vietnam was easy. In the two years since the opening of the air war, the skies over North Vietnam had become increasingly dangerous for American pilots as Soviet air defenses flooded into the country. The point of flying low was to evade detection from the massive radar blanket which covered Vietnam. With a little luck this would make him invisible to the deadly arsenal of Soviet surface-to-air missiles (SAMs), which littered the countryside and had terrorized American pilots. With further luck, he would also avoid the Soviet MiG-21 fighter jet, which was the most advanced fighter the enemy possessed and typically patrolled the skies at 20,000 feet or above. However, flying low did not ensure safety. Instead, it exposed a pilot to a whole different set of deadly problems. At low altitudes, pilots were exposed to the nimble, Soviet MiG-17 fighter jet and an array of anti-aircraft guns.²⁶ But enemy weapons were not the only danger. American politicians were making decisions that were actually aiding the enemy and caused American pilots to lose their lives.

It was already late in the morning when Captain Storey received his new orders and he and his navigator expected a mission flight time of around four hours. The two

²⁵ Storey, Interview, US Air Force Oral History Program, 28.

²⁶ Defense Clandestine Service, Headquarters Pacific Air Force. *North Vietnamese Air Force Fighter Patterns*, Osan Air Base, Republic of Korea, 28 March 1968. 5.

pilots always spent at least two hours planning a mission, studying maps to understand exactly where they would be flying and what they might encounter. However, orders had come down from the Seventh Air Force command that this mission needed to be completed that day. With little over an hour to plan for the upcoming flight, Storey broke his personal rules that had kept him alive through 34 previous missions.²⁷ To make matters worse, this flight was coming only a couple weeks after the Christmas Truce declared by President Johnson. The truce was a political maneuver that created a two-week ban on American flights over North Vietnam. In two years of operations, the Air Force had been able to create detailed maps locating of all Vietnamese air defenses. However, while American airmen had been grounded, their enemies were quickly rearranging defenses throughout the country.²⁸ Storey was aware of these factors and upon leaving for his flight he half-jokingly commented to a superior, “If we get our ass shot down on this mission, you’re going to feel mighty bad.”²⁹

“Flying in the weeds” as the pilots called staying low, the F-4 flew out of Thailand across Laos and into enemy airspace above North Vietnam. Both Storey and Mastin religiously scanned the air for enemy MiGs, as surprise was the smaller fighters’ greatest advantage over the large American jet. Approaching the target, Storey reduced speed to drop the extra fuel tanks held on the wings giving him increased speed and performance for the run home. As he started to increase speed, he saw what he described as a “waterfall in reverse” cascading into the sky in his direct flight path.³⁰ The waterfall

²⁷ Storey, Interview, US Air Force Oral History Program, 28.

²⁸ Ibid., 30-31.

²⁹ Ibid., 29.

³⁰ Ibid., 31.

he was witnessing was the fire of thousands of tracer bullets being shot from antiaircraft guns on the ground. Flying through a barrage of bullets the size of oil cans was an experience described by other unfortunate pilots as trying to fly through a rainstorm without getting wet.³¹ This flight was about to get soaked.

Within seconds, warning lights lit up, alarms rang, and Mastin was yelling they had been hit. He called over the radio to command, “we’ve been hit, and we are heading for feet wet.” “Feet wet” was code for flying to the Gulf of Tonkin and ejecting in hopes of rescue by Navy vessels patrolling the sea. This was a common goal of pilots who were seriously damaged as splashing into the sea greatly decreased chances of being captured. Moments later Mastin called out “Hey, Uncle Tom, I’m going to leave you. I’ve got fire back here in the cockpit, Sayonara!” and promptly ejected from the aircraft. Backseaters were less likely to die in crashes as they were usually quicker to eject.

The pilots of fighter jets were expected to possess certain *skills*--the ability to control their craft no matter the circumstances. To crash was to *fail*--something fighter pilots *did not* do. Therefore, many pilots stayed in the cockpit too long after taking damage. Storey wrestled with the vibrating control stick trying to stabilize the jet, a man struggling to control a dying machine. But it was too late. Warnings indicated that the hydraulics were lost, and the aircraft began spinning through the air. Fighting extreme g-forces, Storey reached over his shoulder to pull the cord, causing his seat to eject from the flaming F-4. The parachute quickly opened and Storey proceeded to float toward earth and almost certain capture. In the oddly quiet air, he watched as his three million dollar

³¹ Tom Wolfe, “Jousting with Sam and Charlie: The Truest Sport,” *Mauve Gloves & Madmen, Clutter & Vine*, (New York: Farrar, Straus, and Giroux, 1973), 37.

jet crashed into the heavy jungle. This machine had carried him in and out of danger many times, but as he watched he called out towards the blazing wreck, “You bitch, you let me down.”³² Given a dangerous political mission, Storey’s immediate reaction was a sense of betrayal not by man, but by machine. Both Storey and Mastin spent the next six years as two of a disproportionate number of pilots who became prisoners of war after crashing over North Vietnam.³³ Their experience unfortunately was not rare for fighter pilots over Vietnam.

Inside the narrative of the Captains Storey and Mastin is a microcosm of what the Vietnam experience was for fighter pilots. Storey was a trained fighter pilot; however his duty was flying reconnaissance missions. He flew what was arguably the most advanced jet in the world during the period, the F-4 Phantom. The F-4 had been designed to be a fighter-bomber, but could also be used for taking pictures. Therefore it was a multi-role platform, however one that never really worked as envisioned. The failure of the fighter pilot experience in the Vietnam War can be seen in the dangers, restraints, and frustrations experienced by these aviators.

2 March 1965. Osan Air Base, Republic of Korea. Headquarters, Seventh Air Force (Pacific Air Force)

Operation Rolling Thunder, which began on March 2, 1965, was a massive aerial bombardment meant to destroy the will to fight of the Communist North Vietnam and to secure an independent South Vietnam. The United States had been steadily building

³² Storey, Interview, US Air Force Oral History Program, 34.

³³ Of the 532 prisoners of war returned by North Vietnam at the end of the conflict in 1973, 501 were pilots who had been crashed over the North, many of them during Rolling Thunder. John Sherwood, *Fast Movers: Jet Pilots and the Vietnam Experience*, (New York: The Free Press, 1999), Xiii.

military forces in Southeast Asia; now they were going to turn to airpower to win the war. With the opening of these major military operations, the United States Seventh Air Force took the lead in bringing the battle to Communist North Vietnam. The Seventh Air Force acknowledged its mission in Vietnam was simply to “fly and fight.”³⁴ But the conflict was going to be more than anyone expected. To protect the colossal bombers leading the charge was a group of fighter pilots who followed in a long line of American success in the air. Many of the commanding officers of these fighter pilots had fought over Europe in World War II and destroyed the Luftwaffe in aerial combat. Many more pilots had experienced combat, fighting communist expansion over Korea, establishing a terrific record of success in air-to-air victories.

For the fighter pilots coming to Vietnam in the mid-1960s, there was no reason to believe that the Vietnam War was going to be any different. Some of the most advanced weaponry of the day was at their disposal, they believed they had received the best training the world, and furthermore they shared a self-assured nature that was an essential part of being a “fighter jock” (as they referred to each other). All of these ideas seemed to assure victory in the minds of these Air Force pilots, but the conflict over Vietnam was more arduous than any of them could have expected.

Although massive in scale and expense, Operation Rolling Thunder failed to achieve the goals promised by airpower absolutists. Rather it was a politically inflected mission that served to exacerbate frustration within the Air Force over the role of political oversight. Originally designed to last six weeks, the mission lasted over three years and

³⁴ United States Military Assistance Command, *Fact Sheet, US Air Force in Vietnam, The Mission of the Seventh Air Force*, Washington, D.C, 1966.

failed to achieve its primary goals. The years following this major operation only further complicated ideas of airpower due to the unexpected nature of warfare in Vietnam. The fighter jocks found themselves in a marred in a dilemma they had not anticipated. Unlike the Korean War where fighters had seen a success rate of 14:1 (14 enemy aircraft shot down for every 1 aircraft lost), the ratio during Rolling Thunder was an unimpressive and unacceptable 2:1. These combat numbers remained stagnant for the remainder of the conflict in Vietnam. Unlike the Navy, which opened a new fighter pilot training school as the result of early losses in Vietnam, the Air Force fighters blamed technological deficiencies and political limitations.³⁵ Although the F-4 Phantom and F-105 Thunderchief were superior in certain capabilities, they had not been specifically designed for aerial combat. The fighting in the skies over Southeast Asia exposed serious defects in their air-to-air capabilities. Conversely, during the war, North Vietnamese forces became equipped with more state-of-the-art Soviet weaponry causing further problems for U.S. fighters. This failure over Vietnam had lasting repercussions on the United States Air Force's doctrine and technology.

April 1966. George Air Force Base, California. 479th Tactical Fighter Wing.

The ace is kind of a magical thing created by the French in World War I. He is kind of a glamorous guy, and he lives up to it. He is the only complete weapon system himself. He is the pilot, he is the copilot, he is the navigator, he is the bombardier, he is the gunner, he does it all. As a result of it, he comes out with a uniquely proud feeling of accomplishment and not a great deal of patience for other branches in the air.³⁶

-Brigadier General Frank Gailer, USAF, World War II Ace

³⁵ Marshall Michel, *Clashes: Air Combat over North Vietnam, 1965-1972*, (Annapolis: Naval Institute Press, 1997), 85.

³⁶ Frank Gailer, Interview by John Dick, 19 January 1977. #K239.0512-1065, transcript, U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base Montgomery, AL, 6.

Although it was taboo for a fighter pilot to admit it, war was the ultimate testing ground for their skills and many looked forward to the challenge. In May of 1966, the *Los Angeles Times* interviewed three fighter pilots as they prepared for war in Southeast Asia. All expressed confidence in their ability and their equipment as they continued their laborious training. The pilots were not worried that they were going to face the Russian MiG-21 or tangle with other jets in the skies. As journalist Marvin Mills pointed out, “not only are they confident that U.S. aircraft are superior, they feel that Air Force tactics, training, and pilot experience give U.S. air power a decided edge.” Mills further stated, “The three fighter pilots didn’t deny that modern air combat with the MiG-21s could be rough, but it was clear that all three would welcome a chance to tangle with Russian-built jets, although they didn’t point out in so many words.”³⁷ These fighter jocks were not an anomaly in the Air Force, rather they were describing a prevalent sentiment throughout the service. Given the history of the Air Force and the tools that they had at their disposal, there was no reason to believe this wasn’t true.

Simply calling these pilots naïve or overconfident misses a crucial part of being a fighter jock. These men shared a common culture and personal connection as jet pilots; in what Tom Wolfe had described when asserting the idea of *the right stuff*. Fighter jocks were united by the physical and mental capability to take great personal risk while maintaining a certain bravado and skill. Wolfe argued that fighter pilots in Vietnam were a throwback to “single combat warriors,” such as medieval knights and believed that they often saw themselves as engaging in a dangerous sport against the enemy.³⁸ Fighter

³⁷ Marvin Mills, “Fighter Pilots Prepare for War,” *Los Angeles Times*, April 22, 1966. 22.

³⁸ Tom Wolfe, “Jousting with Sam and Charlie: The Truest Sport,” 38-55.

jocks widely embraced this idea and promoted it as a unifying culture amongst their fellow pilots. As the medieval knights rode into battle on the finest horses, these warriors went to battle in the most advanced jet fighters in the world. The F-4 Phantom II and the F-105 Thunderchief were third-generation jet fighters (i.e., they embodied the third significant design change since the introduction of jet engine) and were faster, bigger, and more heavily armed than any fighter the communists could put in the air. The U.S. Seventh Air Force fighter jocks believed they were the best and they were going to prove it in their fight over Vietnam. Although the experience in Vietnam was more difficult and deadly than any had expected, pilots knew that this was an opportunity to test *the right stuff*.

Colonel and former fighter jock David “Tex” Hill summed up the fighter culture in Vietnam in an interview in 1977 when he stated, “The real fighter pilots, who are good at anything, will try to think of ways to get there instead of ways to not get there.”³⁹ Fighter pilots wanted to be in the fight. No matter how much of a skilled pilot you were in training, combat was where a warrior earned his reputation. As fighter pilot John Alison asserted, “It is the most exciting game in town. There is nothing that gets your adrenalin up so fast.”⁴⁰ The ability to shot down another fighter jet was the truest way to prove you possessed *the right stuff*. Pilots kept tallies of the number of aircraft they destroyed. The more kills, the greater the pilot—it was that simple.

³⁹ David Hill, Interview by John Dick, 20 January 1977, #K239.0512-1063, transcript. U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL. 190.

⁴⁰ John Alison, Interview by John Dick, 27 January 1977, #K239.0512-1065, transcript, U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL. 60.

Since the days of the Red Baron, the mythology of the ace had permeated this culture. An ace is a pilot who scores five air-to-air kills. The Korean War produced a total of thirty-eight aces for American forces and energized the younger generation.⁴¹ This desire to shoot down planes was an all-encompassing motive for many and it cost many their lives. As World War II ace Frank Gailer pointed out, “The taste of blood makes it greater. The reason that we lost so many of the aces later on in their careers is that they wanted to come back on second and third tours and eventually they got shot down. We lost a lot of them that way.”⁴²

Coming back to war was not a problem for men such as Colonel Robin Olds, who had flown in previous conflicts. Even when faced with the prospect of death, the allure of making ace drove men back into the battle. A hard-drinking womanizer, Olds was a World War II ace who became the leading MiG killer during Operation Rolling Thunder, by scoring four confirmed kills.⁴³ Olds did not make ace in Vietnam, a war that only produced three aces. In fact, only one percent of fighter jocks ever scored an aerial kill, but that did not diminish the goal. Colonel Steve Ritchie was the first Air Force pilot to make ace after confirming his fifth kill in 1972. Upon receiving congratulations from the President and Secretary of Defense, Ritchie acknowledged the greatest message he ever received was from Colonel Robin Olds. Ritchie was now a member of an elite fraternity of flyers and there was no greater honor than to be recognized within fighter culture.⁴⁴

⁴¹ Wolfe, “Jousting with Sam and Charlie: The Truest Sport,” 39.

⁴² Gailer, Interview, U.S. Air Force Corona Ace Interview Collection, 54.

⁴³ Sherwood, *Fast Movers*, 32.

⁴⁴ *Ibid.*, 214-215.

Upon being asked about Ritchie, former ace Robin Olds replied, “He is brilliant. He is good-looking. He is dedicated. He is everything that we wanted. But he thinks he is God’s gift.”⁴⁵ Fighter pilots were often associated by these intangibles. But was it possible to spot these warriors outside of the air? Steve Ritchie believed that a background in schoolyard fighting was a surefire way to tell if someone was competitive enough to be a fighter jock.⁴⁶ Many pilots argued that there was no particular way to pick a fighter jock out of a crowd. However, pilot William Hovde believed that “one way we can spot them is in a bar; while getting drunk, they will be telling you how good they are and what they are going to do.”⁴⁷ In the bars and officer’s clubs across Asia, it was easy to spot many of the best fighter pilots in the Air Force. As Tom Wolfe explained, “In keeping with a tradition as old as the First World War, drink and drunkenness gave pilots their license to *let it out*.”⁴⁸ Robin Olds was rumored to have shown up hung-over to some of his most important missions. However, this was seen as part of the challenge. The fighters would out-drink you by night and out-fly you by day.

February 1951, MiG Alley, the 38th Parallel. Korea.

If a hard-drinking, competitive, and self-assured nature was essential to being a fighter jock, US Air Force fighter pilots had inherited something more important—winning. Air Force fighter pilots in the Korean War experienced terrific success, leaving an impression on the younger generation of fighter pilots. In Korea, Air Force jocks

⁴⁵ Robin Olds, Interview by John Dick, 17 January 1977, #K239.0512-1063, transcript, U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL. 118.

⁴⁶ Richard Ritchie, “End of Tour Report.” Interview by Lyn Officer, 11 October 1972, U.S Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL, 118.

⁴⁷ Alison, “Corona Ace Interview,” 63.

⁴⁸ Wolfe, “Jousting with Sam and Charlie,” 57.

scored impressive victories throughout the conflict. The main Air Force fighter jet was the F-86 Sabre, which was a fast jet with a long range. The F-84s were flying against smaller, slower, yet more maneuverable Soviet MiG-15s. For the Air Force, the terrific numbers in Korea seemed to confirm ideas regarding an age old-argument among fighter pilots of speed versus maneuverability.⁴⁹ Therefore, the Air Force focused on developing fighter jets that were big and fast during the post-Korea era. However, the Air Force did not concern emphasis regarding the development of new fighter jets and new programs lacked sufficient funding.

In the years after World War II, the Air Force had been dominated by General Curtis LeMay and Strategic Air Command. LeMay who had led the strategic bombing campaigns in Germany and Japan, became the head of the Air Force as it became an independent branch. The goal of a strategic bombing campaign was to take the fight to the enemy and destroy their will and capability to fight a war. With the escalation of the Cold War, the enemy was now the Soviet Union and the way to destroy their will was through nuclear weapons. Large bombers, such as the B-52 Stratofortress, and high-altitude surveillance planes such as the U-2, received priority over the development of new fighter aircraft. Many believed that the days of the fighter were over and that nuclear war with the Soviet Union would be so massive that no existed need for these smaller jets. In creating the fighter jet, the Air Force brass believed in a program of fighters, which qualified for use as light bombers in the event of nuclear war. The results of these programs can be seen in the aerial combat over Vietnam.

⁴⁹ William Momyer, "Address to the 4th Annual Fighter Symposium," Speech, Nellis Air Force Base, Las Vegas, NV, 28 April 1969, 10-13.

The Fighter Jets

A fighter without a gun is like an airplane without wings.⁵⁰

-Brigadier General Robin Olds USAF

The Republic F-105 Thunderchief was one of two primary fighters used by the Air Force in Vietnam; it earned the nickname “Thud” for its size, weight, and lack of mobility.⁵¹ The F-105 was one of the few aircraft in the Air Force arsenal designed for a single-purpose--an all-weather fighter-bomber intended to strike at high-speeds at low altitudes. In its original designs, it had been envisioned as a single-seat, single-engine jet capable of delivering a nuclear warhead to a Soviet target from airbases in Europe without being detected on radar. The main goal was speed. Its short 35-foot wingspan made the aircraft hard to turn and notoriously un-maneuverable. It was fast--capable of reaching Mach 1.1 (1.1 times the speed of sound) at sea level and Mach 2.2 at 32,000 feet and above. It was heavy--weighing almost 52,000 pounds fully loaded with missiles, bombs, and fuel.⁵² Air planners knew of the plane’s inability in a dogfight, but considered this fact irrelevant.⁵³ Its primary role in the Vietnam War was flying bombing missions over North Vietnam. It was also the workhorse fighter-bomber of the Air Force, delivering 70 percent of the bombs dropped and 75 percent of sorties flown during Rolling Thunder. Due to this high rate of missions, the F-105 inevitably had a high incidence of air-to-air engagements as it was pursued by enemy jets. F-105 pilots would engage in more air-to-air conflicts with enemy MiG fighters than any other in the U.S.

⁵⁰ Robert Shaw, *Fighter Combat: Tactics and Maneuvering*, (Annapolis: Naval Institute Press, 1985), 175.

⁵¹ United States Air Force Air Command and Staff College, *Air Superiority Tactics over North Vietnam 1964-1972*, Maxwell Air Force Base, Montgomery, AL, 9 August 1972, 12.

⁵² Michel, *Clashes*, 81-84.

⁵³ Mark Clodfelter, *The Limits of Airpower: The American Bombing of North Vietnam*, (New York: The Free Press, 1989), 31.

Air Force. It was equipped with a big gun and air-to-air missiles. The most telling statistic of the F-105's Vietnam experience was that of a total of 833 produced, 383 were lost in combat, an incredibly high rate of loss.⁵⁴

The Thud might have been the workhorse, but the McDonnell Douglas F-4 Phantom II was the most technologically advanced aircraft to fly over Vietnam. As seen in the narrative of Captain Thomas Storey's doomed flight, the F-4s designers envisioned its use in multiple duties, which meant that although high tech, it failed to dominate any particular area of operation. Designers has envisioned the F-4 for the Navy as a fast, long-range interceptor meant to launch from aircraft carriers and engage the enemy at high speeds and at distance. The Air Force adopted the twin-seater, twin-engine Phantom in the 1960s for its role as a fighter jet, but also for its bomber capabilities. The jet was large: capable of carrying up to 14,000 pounds of fuel, missiles, and bombs making its total weight around 53,000 pounds, more than the F-105. The F-4 fell in line with the dominant thinking of the time as its two jet engines produced similar speeds as the F-105, but was more maneuverable than the Thud. As Navy historian John Sherwood described it, "The Phantom in many ways embodied the American automobile culture of the late 1960s and early 1970s. It was big, loud, phallic, smoky, and loaded with gee-whiz technical features-in short, a Corvette with wings."⁵⁵

For the fighter jocks, the F-4 was an exciting and capable machine to fly, yet also extremely frustrating. As the planes grew faster and radar detection improved, military strategist believed that the days of the dogfight were over. Close air-to-air combat had

⁵⁴ Benjamin Lambeth, *The Transformation of American Air Power*, (Ithaca: Cornell University Press, 2000), 13.

⁵⁵ Sherwood, *Fast Movers*, 16.

been the proving ground of fighter jocks since the days of the Red Baron, but now technology was supposedly making it obsolete. Relying on an array of air-to-air missiles, the F-4 Phantom pilot sought engage enemy aircraft at distance. Designers has not equipped the aircraft with a gun, which went along with popular thinking. Secretary of Defense Robert McNamara reportedly stated “In the context of modern air warfare, the idea of a fighter being equipped with a gun is as archaic as warfare with a bow and arrow.”⁵⁶ Yet its missiles, which were supposed to end the close dogfight and guarantee air superiority, failed to meet expectations for several reasons.

One of the reasons was limited rules of engagement in Vietnam, which will be addressed in further detail, but had serious adverse effects on missile capability. In order to engage an enemy, American fighter pilots were first required to make visual confirmation that it was actually an enemy aircraft. This took away the advantages of the long-range radar capabilities with which the missiles had been designed. In a report of the state of the air war, Seventh Air Force commander General William Momyer acknowledged that the limitation on visually identifying enemy before missile launch was a “severe handicap.”⁵⁷ The two main missiles used in the conflict were the AIM-7 Sparrow, a long-range radar guided missile and the AIM-9 Sidewinder, a mid-range heat seeking missile. Developed by the Hughes Aviation Company, these missiles had proven very effective in tests prior to the war. However, these tests involved firing the missiles at slow-moving drones (remote-controlled unmanned aircraft). When put to test against the speedy and nimble MiGs, the missiles’ lack of accuracy created serious problems as

⁵⁶ Michel, *Clashes*, 16.

⁵⁷ Momyer, “Address to the 4th Fighter Symposium,” 16.

they often failed to hit their target. Another problem was that unlike Navy fighter pilots who fired 10 to 15 air-to-air missiles in training, most USAF fighter pilots entered combat without ever firing a missile.⁵⁸ The missile problem was a reflection of several problems with the Vietnam War. The lack of a gun was the product of bad foresight.

As the missiles failed to perform up to envisioned capabilities, F-4 fighter pilots found out first-hand why a gun was still a necessary tool. They were often victim at close range, without a weapon to fight back. In 1966, McDonnell Douglas began retrofitting F-4s with a Vulcan M-61 Gatling cannon and this proved effective in close air-to-air combat. Guns did make a difference in dogfights for the jocks. Once cannon became a mainstay on the F-4, guns accounted for a 16 percent kill rate as compared to an 11 percent kill rate for missiles.⁵⁹ Therefore, the argument can be made that the cannon was the most effective U.S. air-to-air weapon during Rolling Thunder.⁶⁰ The lack of foresight from air planners developing an F-4 without a gun no doubt cost good pilots their lives. Reflecting upon his experience, Col. Robin Olds stated, "I gnash my teeth in rage to think how much better this wing could have done had we acquired gun-carrying capability earlier."⁶¹

⁵⁸ Arthur Geesey, *Air to Air Engagements in SEA 1968-1972*, Project Checo Report, Seventh Air Force Command, Osan Air Base, Republic of Korea, 31 December 1972, 46.

⁵⁹ These are quantified by the times an F-4s weapons were engaged over the success of downing an enemy aircraft. 16 percent of the times, guns were used to engage the enemy they scored a successful skill. Compared with 11 percent shot down when engaged with missiles.

⁶⁰ Michel, *Clashes*, 159.

⁶¹ Robin Olds, Corona Harvest Interview, 12 July 1967, #K239.0512-160, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 42.

24 July 1965, 40 Miles West Of Hanoi, Republic of North Vietnam

This was a dark day for the Americans flying over the skies of Vietnam. Captain Foscoe Fobair and Captain Richard Keirn, pilots of an F-4C Phantom, flying a mission as part of the 47th Tactical Fighter Squadron, 15th Tactical Fighter Wing, were the first pilots to witness the wrath of a deadly new weapon. Flying a mission to intercept enemy aircraft, their aircraft was shot down by a Soviet SA-2 surface-to-air (SAM) missile, the first of many to experience such fate.⁶² Aviators had described the unfortunate experience of being targeted by SAMs as seeing a “flying telephone pole” or a shower of sparks, like the “sparks of a Roman candle.”⁶³ Guided by radar, these missiles wreaked havoc on American pilots. By August 1967, approximately 3500 SAMs had been launched, resulting in the destruction of 80 US aircraft.⁶⁴ Supplied by the communist states of China and the Soviet Union, these SAMs were part of the array of weaponry supplied to the North Vietnamese causing great frustration for the US forces. Along with the SAMs, anti-aircraft guns and Soviet aircraft, such as the MiG-17 fighter aircraft, had already been harassing American jocks.

The Soviet MiGs flown by the NVNAF (North Vietnamese Air Force) were drastically different than their American counterpart.⁶⁵ The MiGs, which saw action in Vietnam, were an update of a German World War II design obtained by the Soviets

⁶² Office of Air Force History, Headquarters USAF, Alfred F. Simpson Historical Research Center, *Aces and Aerial Victories: The United States Air Force in Southeast Asia*. Maxwell Air Force Base, Montgomery, AL, 1976, 5.

⁶³ Wolfe, “Jousting with Sam & Charlie,” 37.

⁶⁴ Lambeth, *The Transformation of American Air Power*, 17.

⁶⁵ The MiG designation is derived from the name of the Mikoyan-Gurevich (MiG) Design Bureau, which was responsible for designing some of the most advanced fighter aircraft in the Soviet Union. Martin Van Creveld, *The Age of Airpower*, (New York: Public Affairs, 2011), 110.

during that war.⁶⁶ A singular purpose motivated these jets' design: the ability to engage enemy fighter aircraft. The MiG-17 (code-named "Fresco") was a small, nimble fighter which was essentially subsonic.⁶⁷ It was a single engine, single pilot aircraft weighing around 12,000 pounds, almost five times less than its American counterpart. It was equipped with cannon and designed to engage the enemy at close range, where it could use its turning advantage. This small MiG proved deadly to American fighters who were willing to engage into a turn to try to gain an advantage.⁶⁸ The MiG-17 maintained airspace between 3,000 and 9,000 feet and usually patrolled the area close to its home bases. It was the primary NVNAF fighter aircraft until the introduction of the MiG-21 to combat in April 1966.⁶⁹

The Soviet MiG-21 (code-named "Fishbed"), while similar in design to the MiG-17, was a faster, more capable fighter. The MiG-21 was supersonic, able to reach speeds of Mach 2.2 and was therefore comparable to the American fighters; yet at 16,500 pounds, still significantly smaller. The small size of both MiGs made it hard for American jocks in the air. In April 1966 the NVNAF began putting their first MiG-21s into combat against American aircraft. The MiG-21 was equipped with an inboard cannon, a machine gun fitted inside the fuselage, and the "Atoll" missile.⁷⁰ A heat-

⁶⁶ "In fact, the MiG airplanes today are using the ideas that they assigned back in World War II and Heinkel 219, if you look into the cockpit of that, it looks exactly like the cockpit of the MiG-21." Lt. Col. Richard Suter, Corona Ace Interview, US Air Force Oral History Interview, January 26, 1977, 54.

⁶⁷ The MiG-17 was able to break sound barrier in a dive. However, due to its tendency to maintain low altitude this was rather obsolete.

⁶⁸ This is a common maneuver, in which enemy aircraft begin a turning motion to try and reach the tail of the opponent's aircraft.

⁶⁹ *Aces and Aerial Victories*, 8. "25 and 26 April MiG-21s entered air battle for the first time and launched a high altitude attack against EB-66."

⁷⁰ Sources are derived from American notes and therefore all names for Soviet weapons, such as Fresco, Fishbed, and Atoll, are derived from NATO's designation, rather than the country of origin, the Soviet Union.

seeking missile similar to the American AIM-9 Sidewinder, the Atoll became the most lethal weapon in air-to-air combat for the North Vietnamese. MiG-21 fighter pattern was generally to maintain altitude between 22,000 feet and 32,000 feet. They would then strike American aircraft from above, hoping to destroy or to drive them into MiG-17 territory. These tactics were standard operating procedure as the war drew on. The MiG-21 became a more offensive and aggressive weapon, while the MiG-17s usually waited for American jets to enter lower airspace.⁷¹ An important design note regarding the MiG aircraft was the use of bubble canopy, which stood out of the top of the aircraft. This gave North Vietnamese pilots a wider range of sight and greater ability to spot U.S. planes.

Soviet-made air defenses, combined with the fact that the NVNAF were flying over home territory, created a nightmare for fighter jocks. Although the Vietnamese pilots were not as well trained as their American counterparts, they quickly developed skills to be able to strike maximum damage. In the beginning of Rolling Thunder, American fighters flew missions known as MiGCAP (MiG Combat Air Control) to escort bombing raids. Vietnamese pilots quickly discovered ways to disrupt these operations. Surprise was the biggest advantage the NVNAF had over the US pilots. With their small jets and radar, they were able to sneak up out of sight on American planes and engage before the pilots knew what hit them. The MiG-17's turning ability allowed for early success as American jocks were quick to pursue only to realize the little jet could outturn them, easily reaching their six.⁷² As Robin Olds observed after early engagements with

⁷¹ *North Vietnamese Air Force Fighter Patterns*, 29.

⁷² A plane's six, refers to the six o'clock position directly behind the aircraft. To have an enemy plane reach your six was the worst possible outcome in an aerial engagement.

the MiG-17, “That little airplane can give you a tussle the likes of which you never had before in your life. It’s absolutely impossible to turn with them.”⁷³

Pilots quickly learned that it was deadly enter a turn with a MiG-17, instead using speed to often simply outrun the aircraft. As more MiG-21s flooded into Vietnam, they increased their combat effectiveness through the surprise use of their Atoll missiles. Fast enough to run with the F-4 and F-105s, the MiG-21s took away that advantage for the American jocks. Although never part of the objective during the earlier years of Rolling Thunder, air-to-air combat numbers mattered to the fighter jocks. All of these factor resulted in USAF fighter jocks achieving a kill ratio of only 2:1 against enemy MiGs.⁷⁴ This was still a positive ratio, but it was unacceptable for the community of American fighter pilots, whose leadership was accustomed to greater success in World War II and Korea. Not only had the pilots not been given the tool to fight, they felt they had been handicapped by political restrictions, as we shall see.

The Rules of Engagement

I won’t digress into a political discussion, but LBJ, if you are listening to me from down there where you are, go to hell. I’m glad you’re there. You dumb son of a bitch! We could have ended that war in six months, and we ended up screwing around for nine years.

-Lt Colonel John Alpers, F-4C pilot, 355th TFS⁷⁵

Operation Rolling Thunder took place under the precept of negative objectives, which essentially were objectives made to avoid certain outcomes. The main fear was

⁷³ Robin Olds, “Corona Harvest Interview,” 8.

⁷⁴ *Air Superiority Tactics over North Vietnam 1964-1972*, 31.

⁷⁵ John Alpers, Interview by Dr. James Hasdorff, 5 May 1992, #K239.0512-2242, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 18.

provocation of the Soviet Union and China resulting in a Third (and possibly nuclear) World War. Targets had to go through a chain of command before authorization for bombing raids. The narrative of Captains Storey and Mastin is an example of how this directly affected fighter pilots. Only definitive military targets such as supply depots and bases received approval through this chain of command. Politicians hoped to assuage negative relations, internationally and domestically, by avoiding large population centers. Although this was commendable in intent, the North Vietnamese were quick to adapt and exploit this factor. The Vietnamese hid weapons, such as SAMs and anti-aircraft guns, near heavy population centers, such as Hanoi and Haiphong. Even locations seemingly justified as logical military targets failed to gain clearance from the political controls. In the beginning of the war, there were restrictions denying permission to hit and destroy SAM sites as they were being constructed.⁷⁶ Not until 1967, did Air Force operations focus missions specifically on destruction of SAMs.⁷⁷ This allowed the enemy to continuously build up air defense, while little could be done by those pilots risking their lives.

However, what particularly hurt the ability of USAF fighter pilots in Vietnam were the rules of engagement. In order to engage an enemy aircraft, fighter jocks first had to make visual confirmation and then were only allowed to attack if that aircraft was a direct threat. This took away the advantage of the long-distance Sparrow missile and the advantage of surprise, but also created further complications for pilots. Fearing the

⁷⁶ *Air Superiority Tactics over North Vietnam 1964-1972*, 10. The Vietnamese adapted tactics quickly and developed SAM sites close to population centers or in dense jungle, where detection was difficult.

⁷⁷ *Ibid.*, 11-13. Specific F-4 squadrons known as Wild Weasels sought to explicitly target SAM sites beginning in 1967.

possibility of engaging Chinese fighter pilots flying over the North, instructions were to not fire until intention of attack confirmed. The problem was that even though they might not be attacking at the moment, making visual contact with a MiG often meant that it was lining up for an attack. Since they were only allowed to engage attacking MiGs, enemy aircraft sitting at a base or on a runway were off limits to attack. As F-105 pilot Captain Ronald Bliss explained, “we were flying right by Phuc Yen airfield, and there were two flights of four MiGs coming up to get us. It’s off limits. We can’t touch them. We could have made one pass down there, and as soon as they got their tires in the air we could have made ace in one pass. It was outrageous.”⁷⁸ This situation also created confusion for jocks who had come to Vietnam to fight the enemy in the skies. As F-4 jock Colonel James Kula remarked, “To tell the truth, I was shocked when I got there, because for the first two days, you are bombarded with briefings. You are required to get all these different briefings, and when they got to the rules of engagement, I was totally confused. I didn’t understand what I could or couldn’t do.”⁷⁹

The general assessment of the rules of engagement was overall frustration for the fighter pilots. Frustration that due to fear of retaliation, they could not properly perform their jobs. Frustration that a talented American pilot might die because of the decisions of someone behind a desk. As F-4 pilot John Alpers stated, “I have a deep abiding distrust of staff wienies who have never been up there, because I think they don’t appreciate the cost of their kinds of bureaucratic imperatives imposed upon the people

⁷⁸ Ronald Bliss, Interview by Dr. James Hasdorff, 17 October 1991, #K239.0512-2241, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 48.

⁷⁹ James Kula, Interview by Dr. James Hasdorff, 30 August 1991, #K239.0512-2236, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 12.

doing the job.”⁸⁰ F-4 pilot Captain Charles Jackson expressed “frustration, I held a lot of frustration. We weren’t there to win a war, we were there to spend our time in a war. That’s really the way I looked at it. Hell, what I did wasn’t going to make any difference other than hopefully save a few American lives, a few allied lives while I was there.”⁸¹ Captain Bliss summed up the frustration over the rules of engagement when asked about them, stating “It was outrageous. To spend a lot of time talking about how bad the rules of engagement were would somehow almost make them legitimate by arguing what they were. They were so bad that they showed a complete lack of understanding of what was going on, and who von Clausewitz was, and a complete disregard for the troops in the field.”⁸²

2 January 1967. Udorn Royal Thai Air Force Base, Thailand. 8th TFW.

In the narrative which opens this chapter, the negative effects of the Christmas Truce exposed those unfortunate pilots to new dangers by hindering their previous information on air defenses obsolete. However, the Air Force was able to use this break in fighting as an advantage in the war against MiG incursions. In December 1966, after almost two years of frustration, commanders in the 8th Tactical Fighter Wing began planning a deceptive mission with the goal of directly attacking MiG aircraft. The mission, known as Operation Bolo, was a colossal effort involving fighter jets and radar reconnaissance aircraft with the sole purpose of destroying MiGs. Due to restrictions on destroying planes on the ground, Air Force planners designed the operation to lure MiGs

⁸⁰ Alpers, Interview, USAF Oral History Program, 22.

⁸¹ Charles Jackson, Interview by Dr. James Hasdorff, 6 June 1991, #K239.0512-2231, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 19.

⁸² Ronald Bliss, Interview, USAF Oral History Program, 46.

into air battle. The objective was to make it appear as if it was a bombing raid by 6 flights of F-105s, prime target for MiG attack. However, escorting at low altitude would be 14 flights of F-4Cs waiting to attack MiGs who engaged the Thuds.⁸³ This was the mission the fighter jocks had come to Vietnam to fight. The restrictions were off. No ground attacks, no reconnaissance, just good old fashioned air-to-air combat. Launched on January 2, 1967, this mission became the most successful day for Air Force fighter pilots in the war.

As the F-105s approached Vietnamese airfields, MiG-21 aircraft took off in order to engage. The Thuds quickly reversed course and used their superior speed to fly back towards friendly airspace. A killer pack of Phantoms piloted by jocks foaming at the mouth for aerial kills met the unsuspecting MiG pilots. In a span of 12 minutes, seven MiG-21s were shot out of the sky. Not a single USAF aircraft was damaged.⁸⁴

Operation Bolo was a complete victory and justified the beliefs held by many in the fighter community. Without restrictive rules of engagement, their flying and fighting skills were far superior to their enemy's. Robin Olds, who earned his fourth and final victory in this flight, told reporters afterward, "We outflew, outshot, and outfought them."⁸⁵ Bolo had been the first operation which had directly targeted MiGs, and it had been successful. Leaders saw the advantages of targeting MiGs and in April 1967 lifted the restrictions of attacks on North Vietnamese jet bases. In May, American pilots destroyed 26 MiGs in the air and on the ground, mainly as a result of allowing the fighter

⁸³ A flight refers to a formation of aircraft. The Air Force used a four-plane formation, which will be detailed later in this chapter. *Air Superiority Tactics over North Vietnam 1964-1972*, 57.

⁸⁴ *Aerial Aces and Victories*, 11.

⁸⁵ *Ibid.*, 37-41.

jocks greater freedom of engagement.⁸⁶ The first six months of 1967 saw U.S. aircrews score 54 confirmed MiG kills at a cost to 11 U.S. aircraft.⁸⁷

For many of the pilots this only confirmed that despite technological advances, the basic tenets of air combat had not changed since the First World War. The skills the aces needed over the trenches of the Western Front were still the same that won victory over the jungles of Southeast Asia. With 50 years of experience in these tactics, American jocks were finally proving that their experience still ruled the skies.

Following Operation Bolo, Robin Olds summed up his ideas on aerial warfare:

The cardinal rules of air tactics haven't changed one bit since World War I, when the airplane was first used as a military vehicle. Some people's ideas of these rules have changed- changed violently. When it gets right down to cases you always have to get back to the basic precepts of formation integrity; good eyesight; aggressiveness; training; of course, a plan of action helps; integrity of flight; the inviolate requirements for a pair of fighters—one covering the tail and the other doing the firing. All of these things are well known to the fighter pilots. Unfortunately, they are not so well understood by other members of the Air Force or by people who sometimes design airplanes and buy them.⁸⁸

This was not an uncommon sentiment amongst the fighter pilots, especially following a mission like Bolo. U.S. Air Force fighter jocks ruled the sky when given the opportunity to engage in true air-to-air warfare. This success against MiG incursions permeated from the jocks through the Air Force hierarchy. On August 16, 1967, before a Senate subcommittee Lt. General William Momyer, commander of the Seventh Air Force, proudly reported that “We have driven the MiGs out of the sky for all practical purposes.”⁸⁹ He was terribly wrong.

⁸⁶ *North Vietnamese Air Force Fighter Patterns*, 27.

⁸⁷ *Ibid.*, 12. Storey and Mastin's flight was one of this unfortunate eleven shot down.

⁸⁸ Robin Olds, “Corona Harvest Interview,” 1.

⁸⁹ *Aerial Aces and Victories*, 64.

The MiGs had been driven out of the sky, but only temporally as the North Vietnamese quickly reorganized and made tactical adjustments. Relying more on the expansive Soviet ground radar system, Vietnamese pilots reestablish their prime advantage, surprise. As the air campaign dragged on through 1967, the Air Force fighter pilots continued experiencing an all-too familiar problem, heavy losses of American aircraft. From August 1967 through the end of February 1968, American fighters shot down a total of 5 MiG-21s while losing 18 U.S. aircraft to the MiG-21.⁹⁰ Despite some success, these heavy losses resulted from the same problems, which had plagued American flyers. Able to surprise and outmaneuver American fighters, these smaller, more nimble MiG jets often held a lethal advantage. The capabilities of Vietnamese anti-aircraft defense, especially SAMs, received continuous expansion and improvement. SAMs alone had accounted for the destruction of 80 U.S. aircraft by the end of 1967.⁹¹ MiG attacks accounted for another 41 losses of American planes; almost half were F-105s, showing how vulnerable this jet was in air-to-air conflict.⁹² The hope of the air war turning in advantage to the U.S. Air Force had proven false; the same was about to happen on the ground.

On January 30, 1968, during the ceasefire in observance of the Tet Lunar New Year, the North Vietnamese Army launched a substantial offensive assault on South Vietnam. American forces repelled the surge, yet it proved to American leadership that

⁹⁰ *Aces and Aerial Victories*, 12.

⁹¹ Not of all of these were fighter aircraft, but this statistic shows the amount of firepower and damage the Vietnamese were able to inflict just from the ground. Lambeth, *The Transformation of American Air Power*, 17.

⁹² 9 different aircraft were shot down by MiGs over Vietnam from 1965-1967, 18 were F-105s. *North Vietnamese Air Force Fighter Patterns*, 29.

Operation Rolling Thunder was not crippling the North Vietnamese will to fight. On March 31, 1968, Lyndon Johnson announced he would not be running for president again and that bombing would end above the 20th parallel, effectively ending the Air Force's involvement in Rolling Thunder.⁹³ In three and a half years of aerial bombardment, the United States dropped over 643,000 tons of bombs on North Vietnam, but failed to accomplish their primary goal of an independent, non-communist South Vietnamese state.⁹⁴ Air Force leaders and pilots believed their ability to complete their mission had been seriously obstructed by extensive political restrictions. While others have argued that it was not possible to destroy the industrial capabilities and will to fight through aerial bombardment in a country, such as North Vietnam.⁹⁵ The operation had been a failure for the fighter jocks, producing no aces and ending with an unsatisfactory 2:1 kill ratio. As the land war raged on, the next four years was a break in the air war, as there were no major engagements.

3 March 1969. Miramar Naval Station, California. Naval Fighter Weapons School

In the years between the end of Rolling Thunder and the bombing campaigns of Linebacker I and II in 1972, the air war was at a virtual standstill. Sitting ideally by, frustration grew for those jocks who had gone to Vietnam to get into the fight. But it was

⁹³ The Navy would continue raids on southern targets, but these were met with virtually no resistance and no loss of aircraft. In November 1968, Johnson ended all bombing as combatants entered peace talks in Paris. James Thompson, *Rolling Thunder: Understanding Policy and Program Failure*, (Chapel Hill: The University of North Carolina Press, 1980). 1-9.

⁹⁴ Sherwood, *Fast Movers*, 39.

⁹⁵ In the release of the Pentagon Papers, it was revealed that a study of the strategic bombing campaign by 47 top scientists in August 1968, known as the Jason Summers Study, had been issued to Robert McNamara shaking his conviction. The report's conclusion was, "North Vietnam has basically a subsistence agricultural economy that presents a difficult and unrewarding target system for air attack." Clodfelter, *The Limits of Air Power*, 99.

also a period of adjustment, as the failures of Rolling Thunder were analyzed and attempts made to ensure future success. Though this is a study of the Air Force fighter culture, important observations can be made in comparing alterations made by the Air Force and Navy to improve aerial combat. Although the two branches were fighting a similar war and both flying the F-4 Phantom, they approached many aspects of the Vietnam War quite differently. The Air Force continued to examine technological improvements and did not appear concerned with tactics and training. Air Force leadership appeared not overly concerned with air-to-air combat and no fighter jock was going to ask for or admit he might need more training. On the other hand, the Navy leadership emphasized the need to facilitate better combat skills and proved willing to adjust tactics during the conflict.

Throughout the Air Force, officers neglected the need for improved training in air-to-air combat, despite the losses experienced in Vietnam. Rather than training in the United States, the Air Force enforced policies in Vietnam which would introduce more pilots to combat and give them first-hand experience. Newly trained F-4 pilots began their combat tours in the backseat of the jet. While the backseater had control over radar and weapons, new fighter pilots had little opportunity to gain flying experience when they came to Vietnam. Intended to expose them to combat without control of the aircraft, backseaters often lacked proper training. The Navy used the backseat of the F-4 for a navigator who was specifically trained for those challenges.⁹⁶

The Air Force also believed that pushing through a large number of pilots would help them gain experience. It was procedure that every new pilot had to fly a year-long

⁹⁶ Michel, *Clashes*, 166-167.

tour before those with previous Vietnam combat experience were eligible to fly a second tour. Fighter jocks wanting back in fight after sharpening their skills in the air were grounded until fresh trainees had flown. In 1967, 200 USAF pilots each month were entering tactical fighter training, with many being sent to combat in Vietnam.⁹⁷ The inexperience of first-tour pilots cost many lives. Although inexperienced, these new jocks quickly became part of the fighter pilot culture resulting in a proliferation of *the right stuff* mentality. It also opened the door for great opportunity within the Air Force. As USAF colonel and historian Mike Worden points out in his study of Air Force leadership, “Combat experience provided fighter pilots with a significant advantage over bomber cohort in competing for future leadership position in a military that prized combat and command experience.”⁹⁸ The significance of this rise in number of fighter pilot affected leadership and ideas in the post-war Air Force.

The Navy and Air Force also adopted different tactics in F-4 air-to-air formations. The Air Force flight group relied on a four plane formation known as a “fluid four.” First introduced during the Spanish Civil War, this formation had served as a standard of fighter operations over 30 years. In the “fluid four,” the lead pilot was the shooter while the other three jets protected the lead aircraft. This formation was very successful in World War II and Korea. Rules of engagement and speed of the jet fighter exposed problems with the “fluid four” in Vietnam. MiG pilots figured out that a single aircraft could take four American fighters out of MiGCAP operations by engaging the lead F-4. This MiG would then make a run towards safe territory in China, while other MiGs

⁹⁷ Michel, *Clashes*, 165.

⁹⁸ Mike Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945-1982*, (Maxwell Air Force Base: Air University Press, 1998), 190.

engaged aircraft the four F-4s were supposed to be protecting. In Vietnam, the Navy adopted a two-plane formation solving some of these problems. However, the Air Force was unwilling to change because no Air Force officer was willing to admit that a Navy formation was better.⁹⁹ This rejection of the two plane formation shows how pride was still a deciding factor in the mind of the fighter jock.

The Air Force was also reluctant or unwilling to examine problems with air-to-air combat and training, often appearing simply to ignore the problem. The Air Force Fighter Weapon School continued to train pilots in both air-to-air and air-to-ground operations. By examining the school's quarterly magazine, *Fighter Weapons Review*, it becomes apparent that thinking at the school had little to do with the need for more air-to-air training. Between 1968 and 1971, the publication published 112 articles, but only 7 were on the subject of air-to-air combat.¹⁰⁰ The Air Force focused on technological upgrades, such as the F-4D and F-4E, rather than adjusting tactics or improving training. These newer models of Phantoms had inboard guns, improved radar, and better targeting displays. Designed to compensate against the enemy's use of surprise and problems with targeting, the Air Force believed these updates could fix combat problems.¹⁰¹ Missiles received some modifications, but overall the missile problem remained mostly ignored.

The Navy had a completely different approach to the problem of air-to-air combat. In March of 1969, the Navy sent several F-4 fighter crews to Miramar Naval Station in California as the first class of the Navy Fighter Weapons School. The sole focus of the school was F-4 air-to-air combat and the fighter jocks quickly nicknamed the

⁹⁹ Michel, *Clashes*, 169-172.

¹⁰⁰ *Ibid.*, 184.

¹⁰¹ *Air Superiority Tactics over North Vietnam 1964-1972*, 90-93.

school, Top Gun. Since its inception, Top Gun has been the top training ground for Navy fighter pilots and has entered into lore in the military and pop culture.¹⁰² Pilots were pitted in competition as they flew missions against each other. This experience gained at Top Gun produced significant results. Inside the Navy, the air war in Vietnam is often referred to in two phases, “before Top Gun” and “after Top Gun.”¹⁰³ In the reopening of the air war with the bombing campaigns of Linebacker I and II, the Navy’s training paid off in a significant improvement in air-to-air success. While the Navy sought to fix the problems, the Air Force jocks remained self-assured and failed to examine aspects which could have made a difference in the war.

9 May 1972. Osan Air Base, Republic of Korea. Headquarters, Seventh Air Force

In May 1972, the Vietnam War had dragged on for seven long years, and President Richard Nixon was desperate to find a solution. Under the advisement of military leadership and his National Security Advisor, Henry Kissinger, the president turned to an old tool, airpower. Unlike Johnson, who had wanted to assure an independent South Vietnam, Nixon’s goals were simply to coerce the North Vietnamese into a peace agreement, thereby assuring the withdrawal of American troops would not lead to an immediate invasion by North Vietnamese forces. Nixon and Kissinger lifted many of the restrictions that had hindered Rolling Thunder and allowed for greater amounts of targets. The operation, known as Linebacker, lasted for six months and in

¹⁰² The 1986 Hollywood movie *Top Gun*, which was a huge commercial success, depicts combat training and competition at the school. This is a prime example of a popular culture reference to fighter pilot culture.

¹⁰³ Lambeth, *The Transformation of American Air Power*, 48.

that period 155,548 tons of bombs fell on North Vietnamese targets. This was over one-fourth of the tonnage dropped during Rolling Thunder.¹⁰⁴ However, this failed to bring any settlement and Nixon authorized another bombing campaign in December 1972, Linebacker II. From December 18 through December 29, American aircraft dropped an enormous amount of bombs, which impressed the North Vietnamese with its magnitude. In eleven days, aircraft dropped 13 percent of the tonnage delivered during the five months of Linebacker I.¹⁰⁵ Following this display, North Vietnamese leaders returned to negotiations and signed the Paris Peace Accords effectively ending the Vietnam War.

For advocates of strategic bombing, Linebacker I and II was a vindication of the effectiveness of airpower when political limitations are loosened. Many air commanders likened Linebacker II to the opening of Rolling Thunder and argued that the war could have been ended in the spring of 1965.¹⁰⁶ The problem with this view is that many commanders failed to change any ideas regarding strategic bombing. Rather than examining problems with strategic bombing, air power advocates considered Linebacker I and II an utter success.¹⁰⁷ They failed to see how technology had seriously aided these later efforts. Laser-guided smart bombs allowed planners to hit targets closer to populated areas with lesser risk of civilian casualties. Rather than dropping them from large bombers, such as the B-52, these bombs were best deployed by smaller and faster aircraft, in particular the F-4 and F-105. This meant a proliferation and justification of the fighter bomber aircraft in Vietnam. Although some in the Air Force felt vindicated

¹⁰⁴ Clodfelter, *The Limits of Air Power*, 166.

¹⁰⁵ *Ibid.*, 196.

¹⁰⁶ *Ibid.*, 201.

¹⁰⁷ *Air Superiority Tactics over North Vietnam 1964-1972*, 112.

by the bombing campaigns in 1972, the fighter jocks experienced familiar setbacks and failures.

During the four-year break in the air war, the North Vietnamese had built up the greatest air defense system in the world. As the Phantoms and Thuds reentered the fight, the same antagonists of Soviet weaponry greeted them: country-wide radar integration, anti-aircraft guns, SAMs, and MiG 17s and 21s.¹⁰⁸ The technological improvements did little to assist the fighter jocks whose deficiencies in Linebacker I were even worse than Rolling Thunder. By the end of June 1972, the Air Force had lost 25 aircraft while only shooting down 20 MiGs for a negative ratio.¹⁰⁹ In response, the Air Force assigned the 555th Tactical Fighter Squadron, known as the “Triple Nickel,” to the sole pursuit of shooting down MiGs. The Triple Nickel produced the war’s first ace, as Captain Steve Ritchie shot down his fifth MiG on August 28, 1972. In the months following, the Air Force produced two more aces, Captains Chuck DeBellevue and Jeff Feinstein.¹¹⁰ These aces and the targeting of MiGs did improve the air war, but not by much. Linebacker I ended with a paltry ratio of 2 MiG shot down for every 1 American jet lost. Despite new fighter updates, fighter jocks experienced no improvement over the frustrating results of Operation Rolling Thunder.

During the eleven days of fighting during Linebacker II, inactivity of MiG aggression resulted in fighter jocks not get many chances for kills. While the Air Force

¹⁰⁸ *Aerial Aces and Victories*, 85.

¹⁰⁹ Although these majority of these aircraft shot down were F-4s and F-105s, it includes American aircraft. However, these numbers help to illustrate the inability of the Air Force to protect against MiG engagements. Michel, *Clashes*, 239.

¹¹⁰ The Navy produced two more aces, while it is estimated that the North Vietnamese Air Force produced a total of 16. *Aerial Aces and Victories*, 102-109.

struggled during the Linebacker operations, the Navy experienced a much higher rate of success. During the two operations, the Air Force shot down 48 MiGs and lost 24 aircraft to MiGs (2:1). The Navy only lost 4 aircraft to MiGs while shooting down a total of 24, a kill ratio of 6:1. A reason for this success was that the Navy was much better at evading MiGs. The North Vietnamese scored a kill about every 3 times they engaged the Air Force and about one kill every six and a half times they engaged the Navy.¹¹¹ Most of this can be attributed to skills learned and sharpened at Top Gun for Navy fighter jocks. For Air Force fighter jocks, these statistics particular stung. As bad as it was to be beaten in the air by the enemy was one thing, morale sank with the realization that they had outflown by sailors.

29 March, 1973. Gia Lam Airport. Hanoi, Democratic Republic of Vietnam.

I think you will find a lot of people, including myself, very bitter about the fact that it cost so many good, young men and women their lives and the loss and cost and money and equipment for some bumbling politician to do whatever he thinks he is trying to do.¹¹²

-Major Timothy Ayres, F-4 pilot and POW

In February 1973, as part of the Paris Peace Accords, the North Vietnamese began releasing prisoners of war to the United States. By late March, 532 prisoners of war had been released and flown back to the United States from Hanoi. Of these prisoners, 501 had been pilots captured when they had been shot down over the North.¹¹³ Many of these pilots spent years locked up in Vietnamese prison camps as the result of failures in the air

¹¹¹ Michel, *Clashes*, 277.

¹¹² Timothy Ayres, Interview by Dr. James Hasdorff, 17 October 1991, #K239.0512-2237, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 12.

¹¹³ Sherwood, *Fast Movers*, xiii.

war. These men gave years, while many of their fellow warriors gave their lives. Over 2,700 Air Force airmen lost their lives in combat and the Air Force lost a total of 2,257 aircraft over the skies of Southeast Asia. The U.S. Air Force would spend more time fighting and more money there than any of the other services.¹¹⁴ This money was used to unleash the bombing campaigns of Rolling Thunder and Linebacker I and II, which combined were the greatest display of firepower in the history of man. In the eight years of fighting, the United States dropped over 8 million tons of bombs on the Southeast Asian countryside.¹¹⁵ This equaled over 500 pounds of bombs for every person in the North Vietnam or 70 tons per square mile.¹¹⁶ For all of this money and effort, the final outlook for the Air Force was mixed. Many believed money and resources had been greatly wasted on a strategic campaign destined to fail.¹¹⁷ Some felt vindication for the success of the Linebacker operations. For the community of fighter jocks, this air war had been a failure.

Fighter pilot culture existed in an Air Force built on great accomplishment and success. The war in Vietnam opened an opportunity for a new generation of fighter jocks to join the ranks alongside the aces and heroes of World War II and Korea. However, this was not the case. In an Air Force devaluing the role of air-to-air combat, the fighter pilots lacked the proper tools to fight a successful war. Flying multi-role aircraft, such as the F-4 and F-105, aviators found themselves being beaten by smaller MiG aircraft and

¹¹⁴ Worden, *Rise of the Fighter Generals*, 160.

¹¹⁵ Sherwood, *Fast Movers*, xii.

¹¹⁶ Worden, *Rise of the Fighter Generals*, 160.

¹¹⁷ As noted earlier, with the release of the Pentagon Papers, it became apparent that many prominent thinkers in the DoD did not believe a strategic bombing campaign could work against North Vietnam. Due to it being an agricultural society, it lacked proper industrial targets to attack.

the array of anti-aircraft defenses. To exacerbate failures, fighter jocks had their wings clipped through political restrictions and rules of engagement. These factors resulted with a drastic drop in success as compared to those previous wars. For many, fighting a long war that ended in failure would have destroyed their foundations. But, as argued, fighter pilots were not the type to give up on a fight.

The war had produced a whole new generation of fighter pilots who were hungry for future competition, whether on the battlefield or home front. Many of the fighter pilots who flew over Vietnam returned to successful careers in civilian life. However, many of these pilots returned home and began a new battle, this one within the Air Force. With the experience gained in Vietnam, fighter pilots began gaining more prominent leadership positions. This was a struggle against the bomber pilots and Strategic Air Command, which had controlled the Air Force since inception. But, fighter pilot culture would prevail and become more dominant in the 1970s. Closely studying the lessons of Vietnam, former fighter pilots molded new ideas regarding aerial combat. These former pilots would push through new fighter jets, such as the F-16, which were designed to assure air superiority. Fighter pilots challenged traditional ideas of strategic bombing and began examining new technological capabilities, such smart bombs. The fighter jocks sought to guarantee that a conflict like Vietnam was never going to happen again.

CHAPTER 3: THE RISE OF THE FIGHTER MAFIA

June 1965. The Pentagon. Washington, DC.

The fighter jock approached the suit and extended his right hand, “My name is John Boyd and I’m a fighter pilot and I understand you work on the F-111 and what I want to know is why you guys built a goddamn eighty-five-thousand-pound airplane and called it a fighter.”¹¹⁸ Henry Hillaker, chief project engineer at General Dynamics, a leading military aviation contractor, had dealt with military brass his entire career, but this Air Force major was particularly abrasive. “It’s too goddamn big, too goddamn expensive, too goddamn underpowered. It’s just not worth a good goddamn.”¹¹⁹ But what Hillaker and the rest of the military aviation establishment would soon discover was that this was no ordinary fighter jock. Major John Boyd had earned the nickname “Forty-Second Boyd” from his quick skill in outmaneuvering enemy aircraft as a flash fighter instructor in the late 1950s. However, Boyd’s legacy would not be made in the skies, but rather through fighting arguably a more difficult and important battle, the pursuit of the ideal Air Force fighter jet. Little did he know it at the time, but Henry Hillaker would become a partner with John Boyd and his allies, a group that became known as “The Fighter Mafia,” as they set out on one of the most audacious and challenging missions in Air Force history. The fighter pilots were fighting back.

¹¹⁸ Robert Coram, *John Boyd: The Fighter Pilot who Changed the Art of War*, (New York: Back Bay Books, 2004), 155.

¹¹⁹ *Ibid.*, 155.

The Vietnam experience had caught many in the Air Force completely off guard. How could third-world pilots flying technologically inferior Soviet aircraft shoot down American fighter jocks flying the pinnacle of jet aircraft? John Boyd knew the answer. In fact, in 1964, before shots were fired, he had predicted that the F-4 and F-105 could be easily outmaneuvered and defeated by the smaller Soviet MiGs. In a brief at the Pentagon to top Air Force generals, Boyd caused a stir as he demonstrated to the Air Force how “they thought we were a lot better off than we were.”¹²⁰ Boyd’s theory, which he coined Energy-Maneuverability or E-M, was a mathematical formula equating the potential of fighter aircraft performance. As Boyd biographer put it, “The E-M theory, at its simplest, is a method to determine the specific energy rate of an aircraft. This is what every fighter pilot wants to know.”¹²¹ This was a radical new way of looking at aircraft potential and it would shape the new generation of fighter jets.

“Forty-Second” Boyd

He was first, last, and always a fighter pilot- a loud-talking, cigar-smoking, bigger-than-life fighter pilot. There is no such thing as an ex-fighter pilot.¹²²

-Robert Coram, John Boyd’s Biographer

John Boyd entered the U.S. Air Force following the triumph of fighter pilots that had been the Korean War. Boyd earned his wings and began his career flying the F-86 Supersabre, the last great Air Force fighter jet, which had ravaged enemy aircraft over MiG Alley. Proving his worth behind the stick of a fighter jet, Boyd received promotion and became an instructor at the Fighter Weapons School (FWS) located at Nellis Air

¹²⁰ John Boyd, Interviewed by Jack Neufeld, 23 May 1973. #K239.0512-859, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL. 7.

¹²¹ Coram, *Boyd*, 147.

¹²² *Ibid.*, 4.

Base. FWS formed in 1949 and throughout the 1950s was the home to those select fighter brethren who sought to improve the art of aerial warfare. Boyd quickly became a legend at the school earning the nickname, “Forty-Second” for his ability to outmaneuver an opponent and reach his tail in that short period of time. But more than simply a reactionary art, Boyd taught his fellow pilots that the key to aerial combat was to think. The use your mind to anticipate, to judge enemy movement, how to keep enough airspeed to counter-move; he was attempting to turn air combat into a science.¹²³ Even as fighter pilots spent most of their time training for air-to-ground missions and the Air Force stressed the omnipotence of missiles in air-to-air combat, Boyd continued to teach maneuverability and the science of aerial combat.¹²⁴ Advanced studies and a desk job led him to establish and refine ideas he had suspected all along and set him on his most important mission.

Major John Boyd entered graduate studies at Georgia Tech in 1960 in pursuit of a master’s degree in mechanical engineering. During his studies, he became enamored with the laws of thermodynamics about the conservation and dissipation of energy. Since the inception of the jet engine, the Air Force had regarded performance in terms of engine thrust and airspeed capability. Boyd began to think of performance in terms of energy lost and gained. In a dogfight, it is not the power or airspeed that enables a pilot to outmaneuver an enemy. It was energy.¹²⁵ Boyd began to work out his ideas mathematically and created a new theory for air performance, the aforementioned E-M theory. As Boyd explained in simplified terms, E-M is “using energy and energy changes

¹²³ Coram, *Boyd*, 60-76.

¹²⁴ *Ibid.*, 115.

¹²⁵ *Ibid.*, 130-132.

to actually measure maneuverability. It allows you to define maneuverability. The ability to change altitude, air speed and direction.”¹²⁶ Following his graduation, Major Boyd received a desk job in the Pentagon working on aircraft design. Here he met a like-minded mathematician working under a government contract, Tom Christie. Christie became Boyd’s first disciple and helped Boyd calculate E-M equations further. Boyd and Christie’s first mission in the Pentagon was to take on the greatest innovation of the time, the “too-goddamn” F-111, which had been created in the typical Air Force fashion of big multi-capable aircraft.

The F-111 and a Change of Perception

A big aerial barge is too clumsy for fighting. Agility is needed.

-Baron Manfred von Richthofen, “The Red Baron”¹²⁷

Although tactical aircraft tended to be ignored due the dominance of SAC and the bombers, the Air Force had searched for a fighter aircraft that would assure air superiority in the late 1950s and 1960s. Air Force developers thought in terms of Higher-Faster-Bigger-More Expensive aircraft and new designs reflected this thinking. The dominant generals in the Air Force tended to believe that these attributes made aircraft superior. The YF-12A supersonic interceptor introduced in the early 1960s was the ultimate design along these lines. This was a monstrosity of an aircraft. At 100 foot-long, 50-foot wingspan, and weighing between 150,000 to 200,000 pounds, designers had envisioned the YF-12A for tremendous range and speed without any regard for maneuverability.¹²⁸ Although this program was popular with many in the Air Force, the

¹²⁶ Boyd, “Interview,” USAF Oral History Program, 1.

¹²⁷ Robert Shaw, *Fighter Combat: Tactics and Maneuvering*, (Annapolis: Naval Institute Press, 1985), 412.

¹²⁸ Robert Lyons, *The Search for the Advanced Fighter: A History from the XF-108 to the Advanced Tactical Fighter*, Report No. 86-1575, United States Air Force Air Command and Staff College, Air University: Maxwell Air Base, August 1986, 1-9.

Department of Defense failed to see the need for a five billion dollar interceptor program. Secretary of Defense Robert McNamara favored multi-use aircraft in supplementing such expensive pieces of machinery. Like the F-4, the new fighter was going to be an interceptor with bombing capability designed in cooperation with the Navy. In 1961, the DoD accepted the General Dynamics/Grumman F-111 fighter bomber as the future jet fighter for the United States military.¹²⁹

The F-111 fighter-bomber was a two-engine, large bodied aircraft intended to reach high-speeds and carry heavy ordinance. It featured a revolutionary design, which was supposed to offer high-speed without sacrificing too much maneuverability: the variable swept-wing. This meant that the angle of the wings could be manually adjusted in order to complete different missions. When at close range, in bombing or fighting situations, the wings could be moved to a position perpendicular position to the fuselage. At supersonic speeds, the wings moved back to a position flush with the plane's fuselage representing a V-pattern. This design was supposed to solve many problems, but instead ended up complicating them and causing project costs to skyrocket. As with John Boyd, many in the Air Force and Navy were not happy with the design. Former fighter pilot and a leading aerospace consultant, Charles "Chuck" Myers, summed it up as "the basic problem I found in Washington, in the aerospace community, the DoD community, in Congress and within the Air Force and Navy itself, was that people had forgotten about the mission of air fighting."¹³⁰ In fact, the leading proponent of the F-111 program in the

¹²⁹ This decision involved a great amount of controversy within the branches and the Department of Defense.

¹³⁰ Charles Myers, Interviewed by Jack Neufeld, 18 July 1973, #K239.0512-971, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 5.

Air Force was SAC, which in 1965 began moving funding from TAC as they envisioned the aircraft as a possible replacement to the B-52.¹³¹ Many fighter pilots were not happy with what was becoming a familiar pattern.

As the program grew in the mid-1960s, fighter pilots began to worry that they were getting simply more of the same as with the F-4. Chuck Myers believed that even calling it by the F (fighter) designation was incorrect and misleading. He stated in a later interview that “the greatest example of misdesignation was the Air Force’s nuclear low altitude, deep strike, all-weather attack airplane-the F-111. If there’s anything the F-111 never intended to be and never could be, it was a fighter airplane.”¹³² General Robert Marsh, deputy chief of staff for Research and Development, believed that “it was an unholy marriage, a dumb thing to do, and people saying one system is good for all purposes and all services and so on. That did not make sense from day one. It is a good example of a program managed by people who were not well-equipped to address the performance requirements and make good judgments, and instead, said we are going to have a common airplane for everybody and to hell with it.”¹³³ After an F-111 crash in the early 1960s (one in a series of accidents), General Otto Glasser, former bomber pilot, stated that “we have learned through our F-111 experience...that aircraft built for too many purposes that is too much of a multipurpose airplane is not a good thing. In many cases single purpose airplanes are best, and if an aircraft is to be built for more than one

¹³¹ Strategic Aircraft Study Group Briefing, Headquarters USAF, Briefing to the Chief of Staff, USAF, 13 April 1965.

¹³² Myers, “Interview,” USAF Oral History Program, 10.

¹³³ Robert Marsh, Interviewed by Charles Gross and Walter Kraus, 26 July 1984, #K168.03, transcript. U.S. Air Force Systems Command Oral History Interview, Andrews Air Force Base, Alexandria, VA, 140.

purpose, that purpose should be closely related.”¹³⁴ John Boyd of course was not without his opinion, stating that “you know the F-111 is not going to be a very good air superiority airplane. And I’m talking about where it can shoot down airplanes in air-to-air combat.”¹³⁵ Due to rising costs the Navy pulled out of the program and began to pursue its own fighter program. The Air Force would continue to develop and proliferate the F-111, but it would never reach the numbers or complete the mission for which it was originally proposed.¹³⁶

The F-111 program began to dissipate due to budgetary constraints right as the fighter problem over Vietnam exploded. This caused many in the Air Force to question ideas regarding multi-use aircraft, which had been promoted by McNamara and the DoD. In March of 1966, Secretary of the Air Force Harold Brown stated “We must build for the future a balanced fighter force. This should include a family of aircraft, each designed to do one mission extremely well—counter air, close support, interdiction, or reconnaissance- and on or more others creditably well. A most important member of this family should be a fighter which will defeat the best enemy aircraft in air-to-air combat.”¹³⁷ The Air Force would now pursue the first air superiority fighter since the F-86 Sabre, which had ruled the skies over Korea, almost twenty years earlier.¹³⁸ However,

¹³⁴ Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984 - Volume Two, Air Power, Tactical Air Command, Air Mobility, Space, MOL, Manned Space Flight, Strategy*, (Montgomery: Air University Press, 1989), 481.

¹³⁵ Boyd, “Interview,” USAF Oral History Program, 12.

¹³⁶ General Dynamics built a total of 566 F-111 jet fighters. This aircraft served in the USAF and the Royal Australian Air Force in a several conflicts, including Vietnam and Operation Desert Storm. United States Air Force, *Fact Sheet, F-111A Aardvark*, Washington, D.C., April 24, 2014, retrieved from USAF Fact Sheets via National Museum of US Air Force: nationalmuseum.af.mil/factsheets/factsheet.asp, accessed December 1, 2014.

¹³⁷ Lyons, *The Search for an Advanced Fighter*, 15.

¹³⁸ *Ibid.*, 18

the new program, designed F-X, was to be an experiment following traditional thinking in the Air Force. It was up to the fighter pilots in the Pentagon to save the next fighter, while their brothers lost their lives in Vietnam.

The Need for Air Superiority and the F-X Program

In October of 1966, Major John Boyd was preparing to head to Vietnam for a tour flying the F-4 Phantom in combat. Days before departure, Boyd received orders to return to the Pentagon to help work on the F-X, which was now facing problems. His E-M theory had been gaining momentum in the Air Force, and Boyd was chosen by General Walter Sweeney, head of TAC, to oversee the program. The program Boyd returned to was in a state of chaotic mess. In the late 1950s the Soviets had developed an aircraft, capable of reaching speeds upward of Mach 3, the MiG-25. This was a long-range, high-speed interceptor, which the Air Force dubbed “Foxbat” and which sent shockwaves through the service as it appeared the Soviets were progressing far beyond them.¹³⁹ Due to the threat of the MiG-25 Foxbat, the Air Force remained convinced that the new air superiority fighter needed to be a supersonic jet armed solely with missiles. Boyd’s first reaction upon reviewing the design was that “it looks like we are building another F-111.”¹⁴⁰ Boyd knew what they needed and began to hold clandestine meetings in the Pentagon with the goal of creating the F-X with a maximum weight of 40,000 pounds. Around this same time signs began showing up on the walls of the Pentagon: “IT TAKES A FIGHTER WITH A GUN TO KILL THE MIG-21.”¹⁴¹

¹³⁹ R.A. Belyakov and J. Marmain, *MiG: Fifty Years of Secret Aircraft Design*, (Annapolis: Naval Institute Press, 1994), 383.

¹⁴⁰ Boyd, “Interview,” USAF Oral History Program, 15.

¹⁴¹ Coram, *Boyd*, 219-225.

Despite some objections to the F-X original design, Navy developments sent more shockwaves through the Air Force generalship than the ideas of their own thinkers. The Navy was developing the F-14 and rumors began floating around that the DoD simply planned to buy it for the Air Force, a repeat of the F-4.¹⁴² Roger Rhodarmer, one of the fighter pilots working on the F-X, stated that “I became concerned because of the very unified voice the Navy had on the F-14 program and the kind of diffused voice of the Air Force. As a matter of fact we still had people who were talking of using the aircraft as a fighter-bomber.”¹⁴³ Soon, brochures promulgated by the Navy began floating around advertising their F-14 as the greatest fighter in the world.¹⁴⁴ This spooked the brass and made them realize that they were working with something the Navy was not, E-M theory. The Navy had adopted the variable swept-wing design developed for the F-111 as they were still believers in that concept. However, Boyd and Christie prepared for battle to prove them wrong and to design an airplane that could blow the F-14 out of the water.

During this return to the Pentagon, Boyd met a young defense contractor and aircraft engineer who shared a similar mindset, Pierre Sprey. Sprey argued at the time that requirements set by the Air Force were ruining the F-X design. As Sprey stated in a 1973 interview, “TAC headquarters, as is true on almost every program they’ve ever been involved in, had some disastrous requirements that were really going to ruin the airplane. The requirements were for vastly too much range. There’s no faster way to kill

¹⁴² Coram, *Boyd*, 229.

¹⁴³ Roger Rhodarmer, Interviewed by Jack Neufeld, 23 March 1973, #K239.0512-972, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 19.

¹⁴⁴ Arthur Agan, Interviewed by Jack Neufeld, 2 October 1973, #K239.0512-857, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 11.

off a fighter than to ask for too much range.”¹⁴⁵ Sprey agreed with Boyd’s ideas of E-M and their main concern became keeping the weight of the aircraft down. Thrust and powerful engine did not matter; what was important was the jets ability to transfer energy. They set the weight limit at 40,000 pounds, but pushed for an even smaller craft. Boyd wanted a small high-performance hot rod with a high thrust to weight ratio, able to dump and regain energy faster than anything in the sky. This would be the purest air-to-air machine ever developed that could outmaneuver any plane and guarantee that USAF fighter jocks would dominate the skies for decades to come.¹⁴⁶

Using data compiled by NASA studies and relying on their own calculations, Boyd, Sprey, and Christie decided in 1968 that a fixed swept-wing was superior. The variable swept wing design of the F-111 and the F-14 added weight to the craft and did not offer any advantages according to E-M theory. Following this establishment of the fixed wing F-X design, Sprey took his expertise and experience to help with the development of Attack Experimental (A-X) program. The A-X program intended to create a tactical aircraft specifically designed for close air support. Using E-M and ideas developed by Boyd, Sprey was able to influence the program through establishing a fixed-wing design and reducing weight.¹⁴⁷ The resulting aircraft, the A-10 Thunderbolt II, has been one of the most successful planes in Air Force history serving in combat through the modern day.

¹⁴⁵ Pierre Sprey, Interviewed by Jack Neufeld, 12 July 1973, #K239.0512-969, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 13.

¹⁴⁶ Coram, *Boyd*, 194.

¹⁴⁷ Sprey, “Interview,” USAF Oral History Program, 15-18.

Through he faced opposition, Boyd's preaching coincided with Vietnam spiraling into a quagmire just as he had predicted, giving his theory even more authority.¹⁴⁸ Sacrificing extreme speed for subsonic maneuverability was a primary objective. This was not only based on Boyd's theory, but as the Vietnam pilots discovered, this is where you fought. But this idea was still not accepted in the Air Force. General Felix Rogers, commander of Air Force Logistics Command, stated that "I, and lots of other fighter pilots, had an intuitive and a visceral feeling that that's where you fought. But that was based on experience. Many times, particularly when you wanted to turn you around and go the other way, experiences were not acceptable to people who had calculations."¹⁴⁹ The F-X program was a "paper" airplane, designed using models, equations, and data set according to Air Force specifications before accepting proposals from defense contractors. Because of this, the competition in the Pentagon was fierce, and Boyd gained a reputation for being an abrasive, foul-mouthed fighter pilot. During a particular argument with a superior, Boyd burnt a hole in a general's tie with his cigar as he was animatedly speaking with his hands.¹⁵⁰ Through his fighter pilot character, Boyd tended to alienate and offend rather than persuade, even though his theories were sound.

After years of work, on December 23, 1969 McDonnell Douglas won the F-X development and production competition. Since the F-14 was the Navy's newest fighter, the F-X became the F-15.¹⁵¹ The accepted design, nicknamed "Eagle," was a two-seat, twin-engine fixed wing fighter with a length of 63 feet, a wingspan of 42 feet, and

¹⁴⁸ Boyd, "Interview," USAF Oral History Program, 22.

¹⁴⁹ Felix M. Rogers, Interviewed by Jack Neufeld, 17-18 July 1974, #K239.0512-943, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 30.

¹⁵⁰ Coram, *Boyd*, 204.

¹⁵¹ Lyons, *The Search for an Advanced Fighter*, 17.

weighing over 60,000 pounds.¹⁵² The extra weight was the result of a large radar system in order to control missile launches targeting enemies at distance. This was similar to weapons system causing problems for Vietnam pilots. Although they had saved the wing design and reduced the weight substantially from early designs, Boyd pessimistically thought bigger, faster, higher would continue to rule the Air Force. Boyd submitted retirement papers which would become effective the following year.¹⁵³ However, fighter pilots and like-minded designers convinced Boyd to stay. They were about to take on their toughest job yet. As Pierre Sprey recalled of Boyd, “the F-15 was a learning experience that prepared him for an even more difficult task. He was about to use his considerable talents on developing another airplane, *an airplane the Air Force did not want.*”¹⁵⁴

The Lightweight Fighter and the Rise of the Fighter Mafia

The name started as a way to mock the bombers who had controlled the Air Force since its inception, known as the Bomber Mafia. Major Everest Riccioni, a test pilot and proponent of the right stuff, decided they would be the “Fighter Mafia.” Along with John Boyd and Tom Christie, Pierre Sprey, and Henry Hillaker, a member of the F-111 design team from General Dynamics, were going to build the true fighter jet, the lightweight fighter. The idea was to work behind the backs of the Air Force and develop an aircraft that was too good to turn down. The Air Force had just developed its first aircraft in over 20 years designed for air-to-air combat. A jet which the Fighter Mafia

¹⁵² Air Combat Command, *A Concise History of Nellis Air Force Base*, Office of Air Force History, Air Warfare Center, Las Vegas, NV, 15 March 1997.

¹⁵³ Coram, *Boyd*, 231.

¹⁵⁴ *Ibid.*, 232. Italics emphasis from source material.

viewed as merely a transition aircraft. They envisioned designing and constructing the greatest fighter in the world. This was horror to those who ran the Air Force as they had just created the “greatest” fighter jet in the world, the F-15. The Mafia was convinced they could create a better aircraft and it was going to be significantly cheaper.

The Fighter Mafia’s scheme involved convincing the DoD to reissue the process of prototyping, which had been a standard practice in the US Army Air Force. Unlike the “paper” airplanes such as the F-111 and the F-15, The Mafia proposed that the lightweight fighter be a prototype. In this process, competing firms built aircraft according to Air Force desired capabilities and the planes were tested against each other. This process had been used by the US Army Air Forces in World War II, but had been scrapped as jet technology became more complicated. However, the Mafia’s influence had grown and they found a partner in Deputy Secretary of Defense David Packard. Packard believed that prototyping offered some unique benefits and decided to reestablish the program. This new process became known as “Packard Prototyping.” While more expensive in the beginning, prototyping allowed for more innovation by the defense firms. On August 25, 1971, Secretary of Defense Melvin Laird issued a program memorandum directing the Air Force to establish two competitive lightweight fighter programs.¹⁵⁵

The Air Force sent out a 21 page request for proposals to nine companies for which they would choose two prototype advanced fighters.¹⁵⁶ Unlike the F-111 and F-15, these would not have Required Operational Capability (ROC) allowing the firms

¹⁵⁵ Deborah Gable, *Acquisition of the F-16 Fighting Falcon 1972-1980*, Report No. 87-0900, United States Air Force Air Command and Staff College, Air University: Maxwell Air Base, March 1987, 8-9.

¹⁵⁶ Lyons, *The Search for an Advanced Fighter*, 26.

more options to demonstrate technology.¹⁵⁷ It also helped to ease the mind of those who opposed the lightweight fighter program. Bomber General Otto Glasser insisted that the lightweight fighter was a technological endeavor stating, “We have no intention in the Air Force of going into production for this airplane, of asking for a force structure for this airplane.”¹⁵⁸ General John Dale Ryan, SAC general and former Chief of Staff, agreed, stating that “the lightweight fighter, as it is presently conceived, is not a weapon system. Instead, it is more of a technological effort so that you can try out these thing to see if they do give you that increased performance.”¹⁵⁹ General Marsh summed it up best, stating, “I do not believe, it is fair to say that anybody in the United States Air Force, in a senior position, planned to inventory the F-16. I think it was thrust upon us.”¹⁶⁰

Having just funded procurement of the F-15, there was serious doubt that Congress would approve another fighter. Many in the Air Force held great hostility towards the lightweight fighter program as it was seen as a challenge to the F-15 right as it was entering service.¹⁶¹ However, Boyd and the Mafia knew that this was chance to create the greatest air-to-air fighter in the world. Behind the scenes, the Mafia worked directly with individuals in companies, such as Lockheed, Northrup, and Vought. In particular, they worked closely with Henry Hillaker and Pierre Sprey of General Dynamics who were both firm believers in Boyd’s E-M principles.¹⁶² Of the submitted proposals, the Air Force chose the Northrup YF-17 and the General Dynamics YF-16.

¹⁵⁷ Gable, *Acquisition of the F-16 Fighting Falcon*, 9.

¹⁵⁸ Futrell, *Ideas, Concepts, Doctrine*, 501.

¹⁵⁹ *Ibid.*, 502.

¹⁶⁰ Marsh, “Interview,” USAF Oral History Program, 251.

¹⁶¹ Coram, *Boyd*, 239-242.

¹⁶² Lindsay Peacock, *On Falcon Wings: The F-16 Story*, (London: Orion, 1999), 10.

The competition between the two jets would take place in independent flight test during a 300-hour, 12-month schedule.¹⁶³

Flight tests took place at Edwards Air Force base, where Chuck Yeager and the test pilots of the 1940s and 50s had shaped fighter pilot culture and Wolfe's idea of *the right stuff*. Fighter pilots would conduct the flight testing, but they were not only used for their skills with airplane controls. While they were not tested directly against each other, the prototypes would go up against the F-4 Phantom. Also, Pierre Sprey insisted that it was not only career test pilots who would fly the YF-16 and YF-17, but real fighter pilots with combat experience.¹⁶⁴ This aspect made the prototyping a significant opportunity for fighter pilots. Unlike the "paper" airplanes, such as the F-15, where engineers and pilots on the ground developed designs, fighter pilots in the sky would share in the decision of choosing the lightweight fighter. Pilots gathered data on drag, stability and control, and maneuverability.¹⁶⁵

The early flight tests proved extremely successful as both light fighters easily outmaneuvered the F-4, exactly as the MiGs had done in Vietnam. As Major Deborah Gable declared in her study, "The success of the F-16 program can be traced to this initial prototype phase that involved competition between two defense contractors that built a lightweight fighter and demonstrated technical capabilities. The 'fly-before-you-buy' approach to weapon systems acquisition allowed the Air Force to choose the best fighter aircraft to meet mission needs, and it assured a relatively smooth transition from

¹⁶³ Lyons, *The Search for an Advanced Fighter*, 27.

¹⁶⁴ Coram, *Boyd*, 259.

¹⁶⁵ Gable, *Acquisition of the F-16 Fighting Falcon*, 18.

prototype to air combat fighter.”¹⁶⁶ These positive results led to the Air Force announcing the Air Combat Transition Program in July of 1974, resulting in the eventual procurement of a lightweight air superiority fighter.¹⁶⁷

Budgetary constraints and ideas regarding a balanced force can be partially attributed to the decision to advance with procurement. The planned cost of the lightweight fighter was \$3 million a unit, compared the \$10 million a unit for the F-15. While rejections existed for the need for another fighter, some proponents believed in a high-low mix of fighter jets. The F-15 was the air superiority, all-weather fighter equipped with a large radar and advanced missiles in order to engage the enemy at distance. However, the Vietnam experience had proved that this did not guarantee victory. As with all military planning during the Cold War, the threat of World War III and the European theatre dominated thinking. In a war with the Soviet Union, some argued that in order to gain air superiority, any air force must consist of a large contingent of aircraft. A smaller number of F-15s would use missiles to engage long-range MiG interceptors, such as the MiG-25 and MiG-29, while larger numbers of lightweight fighters would meet the smaller, more maneuverable MiGs. General Robert Marsh stated “obviously it is a lower cost profile. That was appealing. Where you could envision that you might get one and a half of these for every one of the F-15’s outlay. That had a strong appeal. I think the fact that it ended up having so much more range and payload capability than most of us though that you could build into a light-weight fighter.”¹⁶⁸ Marsh further detailed, “that F-16 started to look so good that we, and there

¹⁶⁶ Gable, *Acquisition of the F-16 Fighting Falcon*, 53.

¹⁶⁷ *Ibid.*, 13-14.

¹⁶⁸ Marsh, “Interview,” USAF Oral History Program, 187.

was major pressure down in OSD (Office of the Secretary of Defense) for a high-low mix. You know, an F-15 was used as the high end of the fighter spectrum and the F-16 started to have a lot of appeal with people like Pierre Sprey, the very good salesmanship of General Dynamics at the time.”¹⁶⁹

Another important factor in meeting budgetary constraints was that the lightweight fighter was going to be an international endeavor. Many NATO countries, facing the same fears of war with the Soviet Union, had not updated their fighter force in 20 years, still flying the Century-Series F-104 developed in the mid-1950s. In May 1974, officials from Denmark, the Netherlands, and Norway had decided to purchase a U.S. aircraft, the winner of the lightweight fighter competition, while some other NATO countries remained uncommitted.¹⁷⁰ However, the possibility of expanding international cooperation existed as many countries remained interested in competing designs from European developers, such as the French Dassault Mirage F1 fighter jet. This cooperation would make the program cheaper by spreading the production costs across several different countries. It also assured that NATO countries were equipped with the best fighter equipment as they stood on the frontline against Soviet aggression.

While the YF-17 proved a capable fighter jet, it was clear to the pilots and others involved that the YF-16 was the jet which the jocks desired. The two-engine, two-seated YF-17 was capable of carrying 25 percent greater payload, but the single-engine, single-seated YF-16 outperformed it in every other aspect. The YF-16 was superior in subsonic and supersonic combat exercises. It was more maneuverable, had greater excess thrust,

¹⁶⁹ Marsh, “Interview,” USAF Oral History Program, 250.

¹⁷⁰ Gable, *Acquisition of the F-16 Fighting Falcon*, 37.

and greater range. This was a testament to the work of John Boyd's E-M theory, which had been the catalyst behind General Dynamics' design. The design team at General Dynamics had worked closely with the Fighter Mafia in developing their aircraft. The YF-17 adaptable design was eventually adopted by the Navy as a model for their next-generation fighter, the F/A-18. However, the YF-16 had proved its worth to the fighter pilots who were flying it. On January 13, 1975 Secretary of the Air Force McLucas announced his selection of the F-16 as the Air Force's new Air Combat Fighter.¹⁷¹

The F-16 is a single seat aircraft, powered by a single Pratt and Whitney F100 engine. This engine developed as part of a joint Air Force/Navy program to build a high performance, after-burning, turbofan engine which would produce 10 percent more thrust, yet weigh 25 percent less than the F-111's TF30 engine. The F100 was selected in August 1968 and used side-by-side in the twin-engine F-15.¹⁷² This engine offered 25,000 pounds of thrust and kept development costs down as it was already incorporated into an operational aircraft.¹⁷³ The aircraft had a takeoff weight of 27,000 pounds, and therefore a thrust to weight ratio of nearly one-to-one. The aircraft was 49 feet long with a 30-foot wingspan, and 280 square feet of wing surface.¹⁷⁴ It incorporated a fixed-swept wing design, in which the fuselage and wing were blended allowing for a large internal fuel and equipment storage. The air intake for the jet engine was directly under the fuselage and gave the F-16 a menacing look. Though this may not be an operational characteristic, it was an important aspect for the fighter jocks. The F-16 looked cool. It

¹⁷¹ Gable, *Acquisition of the F-16 Fighting Falcon*, 18.

¹⁷² *Ibid.*, 9.

¹⁷³ *Ibid.*, 21.

¹⁷⁴ *Ibid.*, 22.

was given the designation Fighting Falcon by the Air Force, but jocks soon started calling them Vipers after the fighters in the TV show *Battlestar Galactica*.¹⁷⁵ As Peter Alshire states in his examination of F-16 fighter training, *Eye of the Viper*, “the Viper looks so cool it could make a young man-or woman-warp his or her whole life for a chance to climb in, lift off, jam on the afterburner, and spin it like a pinwheel.”¹⁷⁶

The principles promoted through applying Energy-Maneuverability had proven that the F-16 was superior in air-to-air combat. In fact, the F-16 was too good, capable of reaching G-forces that could kill a pilot. In order to prevent this, General Dynamics created an “electronic” aircraft, using a revolutionary technology known as fly-by-wire. Rather than the control stick being connected directly to hydraulics and heavy mechanical pushrods, electronic wires sent commands directly into the servos for instantaneous response. While used in earlier experimental craft, this was the first operational aircraft to incorporate such a design, which became standard for future military aircraft.¹⁷⁷ Due to the fly-by-wire system, the F-16 was able to achieve negative stability meaning that the plane became unstable during certain maneuvers, but the electronic controls were able to correct it without the pilot knowing. This was not possible in earlier jets and allowed the F-16 greater maneuverability and mobility. More importantly, the fly-by-wire system kept the pilot from performing maneuvers which would have killed him. The system regulated maneuverability to allow it to only pull g-forces up to 9, the upper limits of

¹⁷⁵ Peter Alshire, *Eye of the Viper: The Making of an F-16 Pilot*, (Boston: Lyons Press, 2004), xxii.

¹⁷⁶ *Ibid.*, 49.

¹⁷⁷ Gable, *Acquisition of the F-16 Fighting Falcon*, 22.

human capacity.¹⁷⁸ This was an unprecedented capability and it left the test pilots extremely impressed. Lt. General Thomas Stafford was one of the first test pilots to fly the F-16 and stated of his experience, “It is amazing, this little airplane that weighs half of an F-4 can carry the same bomb load as the F-4 twice as far using less fuel. It is the only airplane we have ever designed to pull nine G’s. That is a lot of G’s to pull.”¹⁷⁹

Fly-by-wire was not the only revolutionary design in the F-16 as almost every aspect of the plane had been designed ergonomically with the pilot in mind. The cockpit itself was the result of a “great deal of innovation” according to official Air Force documentation.¹⁸⁰ The ejection seat was tilted backwards at a 30-degree angle as this alleviated pressure from the high-amount of g’s the jet was capable of performing. The control stick was placed to the right side of the cockpit and required very little movement. This was a departure was the traditional location, between the pilots legs, and although slightly controversial, was an important improvement.¹⁸¹ Not only did this mean that the pilot could maintain control of the craft as he was pushed strongly back in his seat from the g-forces, but allowed for more controls in front of the pilot. The F-16 featured a Heads-Up-Display or HUD, which displayed targeting and crucial flight information, such as airspeed and altitude, on a clear display in front of the pilot. The cockpit featured a one-piece “bubble” canopy offering pilots 360-degrees visibility above the airframe.

¹⁷⁸ A g-force is a quantitative measurement to express the amount of gravity which is being forced on a person or object. It is an exponential measurement in that 2 g-force (g’s) is equal to twice as much as Earth’s normal gravitational force. 3 g’s is equal to 3x, etc.

¹⁷⁹ Futrell, *Ideas, Concepts, Doctrine*, 562.

¹⁸⁰ Gable, *Acquisition of the Fighting Falcon*, 22.

¹⁸¹ There were worries within the Air Force of the possibility of the right arm being wounded and the problem of left-handed pilots. Both of these worries were alleviated as the usefulness of the right-sided stick was proven.

The cockpit and the HUD were not only technological breakthroughs, but they were the results of the failure of the fighter war over Vietnam. The F-4s cockpit was built into the jet and did not allow for great visibility behind the aircraft. Since World War I, fighter pilots knew that regardless of skill or weaponry, surprise proved the most lethal tactic. As discussed in the previous chapter, F-4 and F-105 pilots experienced the most danger when caught in surprise attacks from smaller MiG-17s and MiG-21s. This bubble canopy and the HUD allowed pilots to maintain their eyes on the skies, constantly searching for enemy craft. Applying the lessons of Vietnam, the Fighter Mafia was assuring such a predicament would never happen again for USAF fighter jocks. As Pierre Sprey described it, “my airplane was exclusively structured to shoot down a MiG-21. Anything that didn’t add to that purpose, outside of things that made the airplane unsafe, simply wasn’t put on the plane.”¹⁸²

7 June 1975. Le Bourget Airfield, Paris, France.

You know this is no toy, this is a very, very capable machine, air-to-ground as well as air-to-air. And, so with that, it really caught, it caught everybody’s imagination.¹⁸³

-USAF Lt. General Robert Marsh, Systems Command

One of the key aspects that made the lightweight fighter program able to flourish into the F-16 was the concept of international cooperation and sales opportunities. These sales could assure that costs stayed relatively low during procurement and allow for a return on investment. On June 7, 1975, the first great sales exposition of the YF-16 was held at the Paris Air Show at Le Bourget Airport. Flown by fighter pilot Neil Anderson,

¹⁸² Sprey, “Interview,” USAF Oral History Program, 44.

¹⁸³ Marsh, “Interview,” USAF Oral History Program, 187.

the YF-16 easily outperformed other fighter aircraft, such as the French Mirage F1.¹⁸⁴ This was important as several NATO countries were currently seeking to upgrade their fighting forces with the new fourth-generation fighter jets. A few days later on June 10, 1975, the United States, Belgium, Denmark, The Netherlands, and Norway signed a Memorandum of Understanding: a series of preliminary bilateral contracts which outlined each country's aircraft requirements, financial agreements, and schedules.¹⁸⁵ As Clarence Geiger states in his Air Force report on the program, "This was a multinational agreement which superseded the usual American foreign military sales practice. The F-16 program encompassed a multinational coproduction arrangement, not a sales transaction."¹⁸⁶

This program meant that these European countries would produce machinery for the F-16 in their own factories and work with General Dynamics in creating their fighter jets. The official launch of co-production came in July 1977, when workers at Fokker began the process of machining the first bulkhead plates. By the start of the 1980s, the F-16 production was firmly secure at Fort Worth, Texas; Gosselies, Belgium; and Schiphol, Netherlands; turning out aircraft for the original five customers.¹⁸⁷ This multi-national cooperation was unprecedented and managed to stay ahead regulatory setbacks. General Marsh, who oversaw production, stated that "there weren't any SOPs (standard-operating procedures), there were no ground rules about how to conduct a major multi-national

¹⁸⁴ Peacock, *On Falcon Wings*, 16.

¹⁸⁵ Gable, *Acquisition of the F-16 Fighting Falcon*, 26-27.

¹⁸⁶ Clarence Geiger, *Small Wonder: Development of the F-16 Fighting Falcon 1975-1980*, Narrative Report, Aeronautical Systems Division, United States Air Force Systems Command, Washington D.C., January 1980, 6.

¹⁸⁷ Peacock, *On Falcon Wings*, 21-23

program, and the old F-16 program just went steaming down the road.”¹⁸⁸ Despite this lack of oversight and precedent, the program worked seamlessly without a major setback. The program achieved the goals of keeping production costs down in the United States, while also selling American weaponry internationally, and equipping NATO allies with top-of-the-line fighter jets. Former fighter pilot and director of budget for the Office of the Comptroller of the Air Force, Lt. General Hans H. Driessnack, stated in an interview of the F-16, “Well, it turns out that was a good investment because it did keep the cost of the weapon system down, and better than that, it insured the quality of the product, which was really what we were after. It has made them competitive. The F-16 is sold all around the world.”¹⁸⁹

As Driessnack inferred, the F-16 really did sell all around the world, not only to NATO allies involved in the multi-national procurement. As of the mid-1990s, the F-16 served with close to 20 overseas operators with many more on order and still more countries wanting it.¹⁹⁰ As of 2014, that number has risen to 26 countries purchasing with 53 follow-on buys by 14 of those countries. There have been a total of 4,400 aircraft produced to date and Lockheed Martin markets the aircraft as “the world-standard for multirole fighter jets.”¹⁹¹ Through sales, the F-16 became a symbol of the United States Air Force’s power throughout the world. This was a symbol the Air Force embraced by making the jet the successor to the F-4 Phantom in the aerial show team, the

¹⁸⁸ Marsh, “Interview,” USAF Oral History Program, 189.

¹⁸⁹ Hans H. Driessnack, Interviewed by Hugh Ahmann, 18-19 October 1987, #K239.0512-1769, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 239.

¹⁹⁰ Peacock, *On Falcon Wings*, 84.

¹⁹¹ *F-16 Fighting Falcon: The Most Technologically Advanced 4th Generation Fighter in the World*, Sales Brochure, Lockheed Martin Aeronautics Company, Fort Worth, TX, 2014, retrieved at lockheedmartin.com/content/dam/lockheed/data/aero/documents/f16/f16_brochure_a11-34324h001.pdf, accessed on July 22, 2014.

Thunderbirds. In 1982, the F-16 represented the Air Force continuing a line which included the F-86, F-105, and the F-4. As of 2014, the aircraft is still serving in this role, over three times as long as any of the other served in the *Thunderbirds*. The team has given over 1,000 shows before hundreds of millions of spectators in countries all over the world.

The lightweight fighter program's success had been born out of the role of fighter pilots and the experience of Vietnam. It had been created to be the best, most maneuverable fighter jet the world had ever seen. As Peter Alshire summed it up, "It is—after all—the best frigging plane in the whole history of the world. A miracle of technology. The tip of the spear. A reason for living. An addiction. A lover. One of the most maneuverable, beautiful, heart-stopping fighter jets ever built. A jet dreamed up by a fighter pilot and slipped past the grumbling, quarreling, quivering generals."¹⁹² The Fighter Mafia had aided General Dynamics to design an airplane capable of outmaneuvering any jet in the world in aerial combat. Pierre Sprey stated during development, "It would literally fly circles around the F-15 in a dogfight."¹⁹³ However, despite the proliferation of fighter generals, too many leaders still saw the F-15 as the air superiority jet, with the F-16 on the low-end or ground support spectrum. The F-16, due to its immense capabilities, became increasingly incorporated in the role of air-to-ground.

In 1977, the Air Force had been so impressed that it announced plans to buy additional F-16As and F-16Bs (B series is a two-seated version) over the original intended procurement amount. However, it also announced plans to classify and use the

¹⁹² Alshire, *Eye of the Viper*, 38.

¹⁹³ Sprey, "Interview," USAF Oral History Program, 41.

F-16 as a fighter-bomber, rather than as a lightweight fighter. The F-16 had proved more than capable in air-to-ground flight testing and the Air Force brass saw this as a more appropriate use. As Lt. General F.M. Rogers of Systems Command stated, “TAC was – I don’t care what they say now- pressing for air-to-ground capability.”¹⁹⁴ Many in the Air Force never stopped seeing the F-16 as Boyd and the Fighter Mafia’s jet and set about turning it into a bomber. It had new targeting radar as well as greater ability to communicate ground targets with Boeing E-3 Sentry aircraft, better known as AWACS (Aerial Warning and Command Systems), which is a large flying radar system. The new equipment added weight to the F-16 and sacrificed some of its aerial capabilities in exchange for a multi-use format. Although the Air Force had changed in many ways, certain aspects remained eerily similar. This was a blow to the Fighter Mafia and to John Boyd personally.

The final battle of John Boyd’s Air Force career, to maintain the F-16 as a pure air-to-air fighter, had been lost. As Robert Coram states, “Boyd’s anger at what the Air Force did to the F-16 never abated. He had lost the last great battle of his Air Force career. And perhaps his bitterness at the defeat was the final catalyst in the shifting his attention from hardware towards more cerebral pursuits.”¹⁹⁵ Boyd retired from the Air Force in 1975, yet continued to advance intellectual ideas regarding aerial warfare, including the Observe-Orient-Decide-Act cycle or O-O-D-A loop. Boyd developed this technique as a process for fighter pilots in judging a situation, but gained wide-scale popularity being used in business, military, and organizational strategy.¹⁹⁶

¹⁹⁴ Rogers, “Interview,” USAF Oral History Program, 31.

¹⁹⁵ Coram, *Boyd*, 308.

¹⁹⁶ *Ibid.*, 326-335.

As for the fighter Boyd had helped design, the F-16 entered service in January 1979 when the first operational F-16A was delivered to the 388th Tactical Fighter Wing at Hill Air Force Base, Utah.¹⁹⁷ The Israeli Air Force was the first to use the F-16 in combat, destroying an Iraqi nuclear reactor in 1981.¹⁹⁸ Israeli fighters proved the worth of the American fourth-generation fighters further when in 1982 flying F-15s and F-16s, they shot down eighty-five Syrian MiG-21s and MiG-23s without losing a single airplane themselves.¹⁹⁹ Despite the introduction of new fifth-generation fighters, the F-16 still makes up fifty-seven percent of the USAF's 20-wing general purpose fighter force.²⁰⁰ There are currently 1,018 F-16C and F-16D aircraft in USAF service, costing around \$18 million per aircraft. These updated C and D models feature built-in structural and wiring provisions, which allow for improvements and flexibility in precision strikes, night attack, and beyond-visual range interception. According to Lockheed Martin, the airplane has flown over 400,000 sorties worldwide in its history.²⁰¹ The F-16 has served a major role since September 11, 2001 flying thousands of sorties in Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in Iraq.²⁰² Although still integral to the Air Force, current plans regarding the F-16 is to be phased out with the introduction of the next generation of fighter aircraft, the F-35 Joint Strike Fighter.

¹⁹⁷ United States Air Force, *Fact Sheet, F-16 Fighting Falcon*, Washington, D.C., October 8, 2007, Retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx.

¹⁹⁸ Peacock, *On Falcon Wings*, 65-66.

¹⁹⁹ George Friedman and Meredith Friedman, *The Future of War: Power, Technology and American World Dominance in the Twenty-first Century*, (New York: St. Martin's Griffin, 1998), 250.

²⁰⁰ A fighter wing usually consists of around three squadrons, with a squadron typically consisting of around 20 aircraft. Peacock, *On Falcon Wings*, 63.

²⁰¹ *F-16: Fighting Falcon*, Lockheed Martin Sales Brochure.

²⁰² USAF, *Fact Sheet, F-16 Fighter Falcon*.

The Rise of Tactical Air Command

Although Boyd and the Fighter Mafia had faced significant resistance during their pursuit for the lightweight fighter, a major change in leadership occurred allowing for more fighter influence. A fundamental shift in the number of high ranking officials with fighter pilot backgrounds grew tremendously during the post-Vietnam 1970s and early 1980s. Curtis LeMay and many of the World War II bomber generals retired in the mid-1960s, leaving a gap in the avid absolutists of Strategic Air Command who had dominated the Air Force. The failure of the Vietnam strategic bombing campaign during most of the war shifted the focus toward ideas of limited warfare and the role of Tactical Air Command. Fighter pilots also outnumbered bomber pilots heavily during Vietnam and the Air Force favored experience when promoting through the ranks. Several other factors contributed greatly to the decline of the bomber community.

The 1970s saw the introduction of three successful tactical aircraft, the F-15, F-16, and A-10. While successful testing and procurement of these aircraft took place, SAC still struggled to find a replacement for the enormous, long-range bomber, the B-52 Stratofortress. The B-70 high-altitude bomber had been cancelled in 1962 due to budgetary problems and the newest bomber, the B-1, faced similar set-backs.²⁰³ Developed in 1970, the B-1 ran into a series of problems over the decade causing costs to grow astronomically. For the fiscal year of 1977, the B-1 allocated budget was around \$500 million for R&D and over \$1 billion for the production of the first three prototype aircraft. This compared to the production of 16 F-16 prototype fighters for \$300 million

²⁰³ Worden, *Rise of the Fighter Generals*, 124-125.

making even the prototype almost 20 times cheaper.²⁰⁴ Given such numbers and facing pressure from Congress to reduce budget, President Jimmy Carter canceled the B-1 program. Carter also hoped to gain a bargaining chip with the Soviets in the Strategic Arms Limitation Treaty II (SALT II), by moving away from the heavy bomber.²⁰⁵ SAC commanders found their role dwindling without a new plane and with the increased cooperation with the Soviets over nuclear weapons.

Throughout the 1970s, more prominent roles were being filled by former fighter pilots. Generals quoted throughout this chapter are part of this generation of fighter pilots who moved up through the ranks. The idea of cooperation with the Army in the event of a land war in Europe proliferated the need for greater tactical forces. NATO strategy in Europe began to deviate from ideas of nuclear war towards the increasing role of tactical air support. The Army admitted that it could not win a major land war without tactical air support. It would need the assistance of F-15s for air superiority, F-16s for air-to-air and air-to-ground missions, and A-10s for close air support. Because of this, TAC increasingly received more funding for greater mission support in the crucial conventional buildup in Europe. By 1982, no key Air Staff positions were held by bombers and fighter generals outnumbered bomber generals by a ratio of five to four.²⁰⁶

The proliferation of TAC and the decline of SAC is no doubt the result of a variety of factors. However, it is crucial in the increasing power of fighter pilot culture throughout the Air Force and the new fighter jets which developed. Although the Fighter

²⁰⁴ Frank Scheid, *History of the Directorate of Budget 1 July 1975-31 December 1975*, Headquarters USAF, Washington D.C., Declassified February 10, 1984, 43-44.

²⁰⁵ Worden, *Rise of the Fighter Generals*, 218

²⁰⁶ Worden, *Rise of the Fighter Generals*, 222-228.

Mafia met opposition throughout the development of the F-16, they did find several allies in the new fighter generals. There can be little doubt that such an audacious plan would not have worked under the Air Force under the strong dominance of Curtis LeMay and Strategic Air Command. SAC and the bomber pilots' downfall can be attributed in many ways to the rise of new technology. ICBMs, cruise missiles, and aerial refueling all meant that large, long distance bombers had lost their monopoly on the delivery of bombing enemy territory. A similar situation could be playing out in modern times for fighter pilot culture as new technology is threatening the existence of the manned fighter.

The Unmanned Aircraft

Drone, Remotely piloted vehicle (RPV), or Unmanned Aerial Vehicle (UAV) are terms which would not have been familiar to 1970s America. However, almost anyone aware of the news is clearly acquainted with the vehicle for which these terms apply. This aircraft is flown by remote controls by a pilot miles away, safe from danger on the ground. As the Fighter Mafia fought for a lightweight, nimble fighter, robotic flying machines weighing a fraction of the F-16, performing more maneuverable turns, and costing significantly less were already in the skies. There were people within the Air Force who believed that these machines represented the future of the Air Force as drones could serve alongside manned aircraft. These predictions proved partially correct.

The modern-day drone development began in the United States in 1959 when the Ryan Aeronautical Company put into production its Firebee, a target drone. The Firebee was a subsonic, jet-propelled unmanned aircraft, remotely controlled from either another

aircraft or a ground station.²⁰⁷ The Air Force embraced the role of target drones using them in training for air-to-air combat in the 1960s and 1970s with the technology advancing rapidly from there. During the Vietnam War, over 3,000 drone sorties flew over the heavily-defended North, automatically photographing targets and recording damage from manned bombing missions.²⁰⁸ The Air Force even expanded the drone's mission to include aspect aerial tasks reserved for TAC. In 1968, Tactical Air Command created a COMBAT ANGEL Task Force (CATF) in Vietnam to perform a chaff-dispensing mission, but the force was not deployed.²⁰⁹ Coming out of Vietnam, unmanned aircraft had shown that it was an area ripe for future opportunities for expansion.

In the early 1970s former Secretary of the Air Force John L. McLucas wrote “I believe we are entering an era when RPVs will play an increasingly important role in helping airpower to serve the nation. However, we need to check out our mission to make sure that we are preserving the best mix of different types of aircraft, RPVs, and other systems.”²¹⁰ Two Air Force studies published in the mid-1970s contemplated drone programs, “The Future of Drones: A Force of Manned and Unmanned Systems” by Major Gene Bigham and “The Future of Recoverable Drones for the Tactical Air Force” by Major Donald Cunningham. These studies show that many in the Air Force foresaw a future in which these aircraft were critical to operations.

²⁰⁷ William Broad, “The U.S. Flight from Pilotless Planes,” *Science*, vol. 213, no. 4504 (1981), 189.

²⁰⁸ Broad, “The U.S. Flight from Pilotless Planes,” 188.

²⁰⁹ Donald Cunningham, “The Future of Recoverable Drone for Tactical Air Force,” *Air University Review*, July-August 1975, 1.

²¹⁰ Gene Bigham, “The Future of Drones: A Force of Manned and Unmanned Systems,” *Air University Review*, November-December 1977, 2.

Drones offered a variety of advantages over the manned aircraft. Major Cunningham pointed out four in his article: the decreasing budget for aircraft and availability of dollar resources, the increasing cost of men (in training and skill) and machine (F-15), a continually increasing enemy threat, and newly emerging dangers on men in combat.²¹¹ The first factor can be explained in fuel cost alone as Rand estimated the annual fuel consumption of an F-4 to be 460,000 gallons while an RPV at 2,280 gallons annually.²¹² Drones further offered savings in training and flying hours as fighter pilots require approximately 250 flying hours/year to maintain proficiency while it is estimated that an RPV operator would only need 6 hours a year.²¹³

Secondly, drones could be flown to reduce the need of manned aircraft in heavily defended areas with threats of enemy aircraft, SAMs, and AAAs, therefore saving a pilot's life, as used in recon missions in Vietnam²¹⁴ As shown in the previous chapter, flying jets over enemy terrain filled with a variety of deadly air defenses is extremely dangerous for pilots. Not only used for reconnaissance and mapping, drones could also serve a variety of combat missions from close air support, air interdiction, defense suppression. Major Bigham does ask the question: "Will it be able to do the most vital chore—hit the target—as effectively as our fighter pilots? That is a good question, and one that will have to remain unanswered now. The problem is somewhat lessened when we consider laser-guided weapons."²¹⁵ Advancements in precision-guided-munitions during

²¹¹ Cunningham, "The Future of Recoverable Drones," 1.

²¹² Broad, "The U.S. Flight from Pilotless Planes," 190.

²¹³ Bigham, "The Future of Drones," 3.

²¹⁴ *Ibid.*, 5.

²¹⁵ *Ibid.*, 5.

Vietnam in conjunction with drones could create a lethal combination. An assessment that has proven very prevalent in recent aerial combat operations.

The Israeli Air Force, which as it had done with F-16, demonstrated the effectiveness of drones in combat beyond reconnaissance. In the initial counterstrikes during the Yom Kippur War of 1973, Egyptian anti-aircraft defense decimated a whole flying formation of Israeli aircraft. However, as the Egyptians reloaded, a second wave of Israeli fighters slipped through and attacked targets deep within the country. The first line of aircraft were specialized “hero” drones used as decoys to trigger enemy anti-aircraft defenses. Israel used similar tactics during hostilities with Lebanon, when it used drones to trigger the Soviet made SA-6 SAMs, which had fired on them destroying the drone. But before destruction, these drones sent back targeting coordinates to Israeli controllers. This information allowed Israel to map SAMs and successfully target jammers onto those specific sites, thereby disabling Lebanon’s air defenses. Israel clearly demonstrated that these machines had a role beyond reconnaissance, but the USAF failed to show interest. As with the F-16, Israel had bought these drones from American aeronautical firms. However, the lack of production in the U.S. brought Israelis into developing their own technology by the early 1980s.²¹⁶

Not only is the drone capable of being disguised as a manned aircraft, it has the great advantage of being capable of making maneuvers not possible by manned aircraft. Where the F-16 had to be built to only achieve 9 g-forces, drones during the period displayed capabilities of up to 50 g’s. In 1971, a derivation of the BQ-34 Firebee was flown against a Navy F-4 to test possible air-to-air combat application. The Firebee

²¹⁶ Broad, “The U.S. Flight from Pilotless Planes,” 188.

averted two air-to-air missiles fired by the F-4, closed to firing position, and scored a simulated hit.²¹⁷ This could have sent shocks through the fighter pilot community as a remote controlled airplane shot down a fighter jet. However, fighter pilots and most of the Air Force did not pay attention to drones during the proliferation of the F-15 and F-16. Throughout the 1970s and early 1980s, possible money for drone programs went to allocation of manned aircraft. The sole USAF RPV development in the late 1970s was the Locust (Low Cost Expendable Harassment Vehicle), but by 1981 a mere \$6 million had been allocated for procurement and the program failed. Ironically, the sole R&D program sponsored by the U.S. military belonged to the Army, which allocated \$61 million to the reconnaissance drone, Aquila.²¹⁸

This was a situation which would continue through the 1980s. In a 1987 interview General James Mullins stated, “The Air Force has not been a great supporter of drone and RPVs (remotely piloted vehicle). Is this simply because there is no man in the cockpit? I think that has something to do with it.”²¹⁹ As had happened with Missile Command for years, drone programs and operators held little influence in the service. In an Air Force built by pilots, if you did not fly in the airplane you did not matter. A 1981 article from *Science* magazine states that “the main reason, admitted by some Air Force officials, is that it offers little by way of career opportunity and nothing by way of battlefield promotion and glory.”²²⁰ How was a toy airplane supposed to replace their missions? How could someone controlling it miles away harness the right stuff and

²¹⁷ Bigham, “The Future of Drones,” 1.

²¹⁸ Broad, “The U.S. Flight from Pilotless Planes,” 190.

²¹⁹ James Mullins, Interviewed by Jack Neufeld, 27-30 January 1987, #K239.0512-1739, transcript, U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL, 127.

²²⁰ Broad, “The U.S. Flight from Pilotless Planes,” 188.

attack the enemy. It simply was not possible. With the F-16, the future belonged the fighter pilot.

16 January 1991. Pentagon, Washington, DC.

Success in war is unlikely for the state wedded to protection of the status quo.²²¹

-Colonel John Warden III USAF

“I’ll admit it was a little bit hyperbolic but I rolled back in the chair and threw my arms up and said: ‘The war is over; we won. There is nothing now that the Iraqis can do that can prevent us from exercising our military will upon them.’ You may argue with that but I would maintain that it is a reasonable statement to make, and after only 45 seconds.”²²² The words of Colonel John Warden III reflected his feelings less than a minute into the operation against Saddam Hussein’s Iraq–Operation Desert Storm. As the satellite feed displayed Baghdad going black, Warden knew his plan was going to succeed. Warden’s plan dubbed “Instant Thunder” was a strategic bombing assault designed to cripple the Iraqi Army’s capability to wage war. The results of this operation and the air war in Operation Desert Storm have been called the pinnacle of air warfare and the renaissance of American airpower. Warden’s ideas and strategies grew from his unique strategic mind, but can also be attributed to the fact that Warden was a fighter pilot. Having served as an F-4 pilot in Vietnam and an F-15 pilot in Europe, Warden realized the capability of American air power when properly applied. It was with the aid of the newer generation of fighter-influenced aircraft and technology that the US Air Force achieved amazing results.

²²¹ John Warden, *Planning for War*, Air University Review, March-April 1983.

²²² John Andreas Olsen, *John Warden and the Renaissance of American Air Power*, (Washington D.C.: Potomac Books, 2007), 226.

It is argued by some that Colonel John Warden III is one of the most influential American air power theorist since the Second World War.²²³ Warden was far from the everyday fighter pilot and proved capable of strategic thinking on an unprecedented scale. But Warden was a fighter pilot, having flown 266 combat missions in the F-4 over the skies of Vietnam. It was in Vietnam where Warden began to realize that airpower should not be used to destroy the enemy itself, but the enemy's capability to wage war. In Rolling Thunder, the political decisions regarding enemy targets often left fighting capability untouched. Air power absolutists during Vietnam believed strategic bombing should be used to destroy the will of the enemy. Warden began to see it differently after experiencing the failure of the air power during Vietnam. He believed air power could disable an enemy's leadership, infrastructure, and weaponry, thereby destroying their capability to fight. Warden's methodological approach followed that of the legendary war theorist, Antonie-Henri Jomini, whom Russell Weigley described as the father of American military strategy in his seminal book *The American Way of War*.²²⁴ According to John Andres Olsen, "both were committed to simplification and prescription: they sought to produce practical guides to the conduct of warfare rather than abstract philosophy on the nature of warfare, and to reduce the complexity of warfare to a small number of crucial factors, rules, and principles."²²⁵ Warden put these principles down on paper in his book *The Air Campaign: Planning for Combat* published in 1988 and more importantly as the architect of the air attack against Iraq in 1991.

²²³ Olsen, *Warden*, 4.

²²⁴ Russell Weigley, *The American Way of War: A History of United States Military and Strategy*, (Bloomberg: Indiana University Press, 1960).

²²⁵ Olsen, *John Warden*, 77.

Instant Thunder grew out of the idea known as the Five Ring Model, which was Warden's most cherished notion. The Five Ring Model, graphically represented as circles, reflected the importance of the target-sets contained within a nation-state. The first and most important circle represent a state's infrastructure and ability to communicate. Then followed anti-air capabilities, such as SAMs and enemy aircraft, thus achieving air superiority. The final and least important was destroying the enemy army. Warden strongly believed that the lethality of modern air weapons teamed with the freedom of maneuver, range, and precision had revolutionized modern warfare and made the Five Ring Model possible to achieve victory.²²⁶ Many in the Air Force hierarchy shunned Warden's thinking as he was an outsider with original ideas and "not understood or often disliked by others in the Air Force."²²⁷ He was a controversial figure within the service, revered as a visionary while often scorned as a zealot.²²⁸ He frequently came into direct conflict with other officers as well as his superiors. He had particular disdain for those within TAC, who saw the Air Force's role as purely tactical in assisting the Army. Warden believed that the service had "lost its focus" by trying to "hack at an enemy's limbs rather than thrusting at its heart."²²⁹ Warden instructed his subordinates that "we are not responsible or beholden to TAC or SAC. Our charter is to think, and we can think any kind of thoughts that we want to think, and it is okay. In fact, that is what we are supposed to be doing."²³⁰ Warden found allies outside the Air Force, in Secretary

²²⁶ Olsen, *John Warden*, 108-112.

²²⁷ *Ibid.*, 137.

²²⁸ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War*, (New York: Mariner Books, 1994), 57.

²²⁹ Atkinson, *Crusade*, 57.

²³⁰ Olsen, *John Warden*, 106.

of Defense Dick Cheney and Army General Norman Schwarzkopf, who were planning the ground attack to liberate Kuwait and searching for an air option to open the war.

Warden selected targets based on the Five Ring model with the idea of destroying Saddam Hussein's capability to fight. Many predicted that since Iraq had the world's largest army, a great land battle was necessary to defeat the Iraqis. Warden insisted that his strategy would allow national security objectives to be met without a ground war.²³¹ On August 11, 1990 Warden presented his Instant Thunder plan to the Chairman of the Joint Chiefs, Colin Powell, in his Pentagon Office. Warden stated to Powell that "this plan may win the war. You may not need a ground attack.... I think the Iraqis will withdraw from Kuwait as a result of the strategic campaign."²³² Powell was impressed, but not completely convinced, for he supposed, as many did, that only a ground operation could crush the large Iraqi army. Warden then presented his plan to Norman Schwarzkopf, the Army General leading the operation, who shared Powell's beliefs, yet did find Warden's Instant Thunder an excellent option to relieve some pressure from the land assault. When presented with the plan, Schwarzkopf replied, "You have restored my confidence in the United States Air Force...do it where you want. It is up to the Air Force. Shit, I love it!"²³³ The plan was approved and Warden was tasked with leading an Air Force planning cell known as Checkmate, designated to plan the opening salvos of the air campaign.²³⁴ Warden believed the attack would knock out 60 percent of the electricity in Baghdad and 35 percent in the whole country.²³⁵ Before the first bomb

²³¹ Olsen, *John Warden*, 208.

²³² Atkinson, *Crusade*, 60.

²³³ Olsen, *John Warden*, 158.

²³⁴ Atkinson, *Crusade*, 56.

²³⁵ *Ibid.*, 61.

dropped on Baghdad, Warden had completed the picture in his mind: “the phones were dead, the lights were out, the regime was under attack but the civilians were not.”²³⁶

Warden’s combativeness ended up causing him to lose control over Checkmate when he struck back at Joint Chief of Staff, General Chuck Horner, during a briefing on Instant Thunder in Riyadh, Saudi Arabia. In true fighter pilot style, Warden complained openly about “armchair generals,” “the typical academic crap you’d expect in Washington,” and claimed the general was “too concerned with the defense.”²³⁷ When Horner asked all the staff members of Checkmate to stay in Riyadh except Warden, the message was clear. His deputy, Lieutenant Colonel David A. Deptula, became Warden’s proxy and promised to “maintain the integrity” of Instant Thunder.²³⁸ Despite many attempts by Horner and other officers to change many aspects of the operation, Deptula was able to keep his promise and continually defend Warden’s Instant Thunder. Warden continued his work preparing targets for the opening of the air strike. On paper the campaign consisted of three MAPs (master attack plans) that outlined the details of the upcoming air war. The plan consisted of the first seventy-two hours, defined minute by minute, aircraft by aircraft, and target by target.²³⁹ While Deptula worked to maintain the plan, General Horner selected a former F-4 fighter pilot, Brigadier General Buster C. Glosson, as commander of all Air Force wings in the Gulf.

Rick Atkinson described Glosson, as “among the theater’s most flamboyant fighter pilots” and “perhaps the most baroque.”²⁴⁰ General Horner selected Glosson to be

²³⁶ Olsen, *John Warden*, 226.

²³⁷ Atkinson, *Crusade*, 62.

²³⁸ *Ibid.*, 62-63.

²³⁹ Olsen, *John Warden*, 226.

²⁴⁰ Atkinson, *Crusade*, 63.

both the chief targeter and commander of all Air Force wings for the upcoming war. Glosson's Vietnam experience guided his goals in the Gulf. In May of 1971, he flew F-4s out of Da Nang Air Base with a squadron that consisted of 26 aircraft. When their mission ended three months later, only 12 F-4s were left. Glosson, like so many others, did not want to repeat Vietnam. His goal and overriding passion in the conflict was to preserve the life of his pilots. He told those pilots "the outcome of the war is not in question. The only issue is how many body bags we're going to send back across the Atlantic. The bottom line is that there's not a damn thing worth dying for in Iraq. Nothing."²⁴¹ Minimizing the loss of all U.S. personal was a reason many, such as Warden, believed a ground war would not be necessary.²⁴² However for all the planning, most thought the upcoming conflict would require significant losses. During the major air attacks in the Six Day War in 1967, the Israeli Air Force lost 40 jets during the opening day. General Horner estimated coalition losses at around one hundred planes in the war, yet others in the Air Force thought this optimistic.²⁴³

The opening assault occurred on the night of January 17, 1991 and as noted earlier Warden knew the war had been won within 45 seconds. The newest USAF aircraft and star of the war, the F-117 Nighthawk stealth fighter, dropped a laser-guided GBU-27 bomb that demolished half of the air defense center at Nukayb. One minute later a second bomb, from another F-117, destroyed the other half.²⁴⁴ Following these initial flights came an armada of twenty F-15C fighters with radar and missiles ready to

²⁴¹ Atkinson, *Crusade*, 65.

²⁴² *Ibid.*, 293.

²⁴³ *Ibid.*, 34-35.

²⁴⁴ *Ibid.*, 33.

strike any enemy aircraft which threatened. It was similar to sweeps which had occurred in World War II and over MiG alley in Korea.²⁴⁵ Iraq's elaborate Soviet air defense system launched SAMs against incoming aircraft and scored several hits. However, these were decoy drones employing tactics similar to those used by the Israelis against Syria. Once launched, SAMs were identified and F-16s swooped in to destroy them with precision-guided munitions. In less than an hour, the Iraqi air defense network, which had cost billions of dollars and years to install, was crippled.²⁴⁶ Despite earlier estimates, only one coalition aircraft was lost during the opening night of attacks when a Navy F/A-18 was shot down by a missile launched from a MiG-25.²⁴⁷ Out of a thousand sorties flown, only one loss was an incredible number and set the tone for the rest of the conflict.

The air war devastated the Iraqi army and crippled its ability to wage war. The Coalition air forces flew almost 100,000 sorties and dropped over 85,000 tons of bombs on Iraqi military targets and civilian infrastructure. This was more ordnance than had been dropped on Japan during the final six weeks of World War II.²⁴⁸ The results were exactly what Colonel Warden had predicted: the Iraqi ability to fight had been crippled, striking their will to fight. Robert Wilcox stated in his book on fighter pilots that "by the fourth day, some say sooner, the battle for the Iraqi skies—the fighter air war—had largely been won."²⁴⁹ When General Schwarzkopf and the U.S. Army began the land battle, it lasted little over a week. The Air Force provided critical tactical assistance. F-16s

²⁴⁵ Atkinson, *Crusade*, 41.

²⁴⁶ *Ibid.*, 40-44.

²⁴⁷ *Ibid.*, 47.

²⁴⁸ *Ibid.*, 293.

²⁴⁹ Robert Wilcox, *Wings of Fury: From Vietnam to the Gulf War, the Astonishing True Stories of America's Elite Fighter Pilots*, (New York: Pocket Books, 1997), 293.

dropped cluster bombs on Iraqi divisions which had bogged down the Army as they entered Iraq. As American air power destroyed the Iraqi army in the field and the U.S. army marched across the desert, Rick Atkinson points out that “here the terrible truth of this war was wholly revealed: the enemy never had a chance.”²⁵⁰ On February 28, 1991, the two sides reached a ceasefire. The Desert Storm conflict lasted only six weeks and the United States only lost 146 battle-related deaths. After the armistice President George Bush declared, “By God, we’ve licked the Vietnam syndrome once and for all.”²⁵¹

For the fighter pilots who had lived with the scars of Vietnam, this had not been a six-week conflict, but twenty-year battle. Many in the service view it as the redemption of Vietnam and the renaissance of American air power. Weaponry first introduced to combat in the Vietnam conflict, such as smart bombs and drones, added to the Air Force effort. These technologies, especially smart munitions, allowed the Air Force to redeem the effects of strategic bombing. A turning point in military history, the massive use of smart weapons led John Warden to coin it as the first “hyperwar.” This war was “one that capitalized on high technology, unprecedented accuracy, operational and strategic surprise through stealth, and the ability to bring all of the enemy’s key operational and strategic nodes under near-simultaneous attack.”²⁵² Technology was a key in victory and could be seen in the superiority of American aircraft. Designs which trace their lineage to the role of the Fighter Mafia served diligently in the Gulf War. The F-15 assured air-to-air superiority and the A-10 offered close air support to the invading American Army.

²⁵⁰ Atkinson, *Crusade*, 448.

²⁵¹ *Ibid.*, 493.

²⁵² Olsen, *John Warden*, 241.

However, it was the F-16, the fighter that the Air Force had not wanted, which was the “workhorse” of the USAF effort in Iraq. The F-16 served close-air support, air-to-ground, and air-to-air missions excellently in the theatre and assured its place as one of the greatest fighter jets of all time.

As Royal Air Force historian Lindsay Peacock points out, “When considering the F-16’s operational career, the Gulf War in 1991 ranks as the high point, as *Desert Storm* witnessed the type’s combat debut in USAF service.”²⁵³ The F-16 was by far the most numerous USAF aircraft in the theatre and it won the distinction of being both the “workhorse” and the “backbone” of the Coalition air effort.²⁵⁴ The Viper completed over 13,500 combat sorties and delivered an estimated 20,000 tons of ordnance against a variety of targets in both Kuwait and Iraq, solidifying its job as a multi-role fighter. However, the F-16 ruled aerial combat without losing a single jet to another enemy aircraft. The Air Force lost a total of five F-16: three to SAMs, one to a bomb malfunction, and another to an engine fire; yet no pilots were killed, as all ejected successfully. This meant that the F-16 came out of combat with one of the lowest loss rates among Coalition aircraft at 0.023% or 1 loss for every 4,345 sorties flown.²⁵⁵ The final Official Coalition air-to-air total was quoted at thirty-five to zero, some estimates at thirty-nine to zero.²⁵⁶ The work of fighter pilot John Boyd’s aircraft had flown successfully to implement fighter pilot John Warden’s plan. While the F-16 was the workhorse, other technologies gave a glimpse into the future of the Air Force.

²⁵³ Peacock, *On Falcon Wings*, 64.

²⁵⁴ *Ibid.*, quoted from officials within the strike force and those who serve.

²⁵⁵ *Ibid.*, 70-74.

²⁵⁶ Wilcox, *Wing of Fury*, 300.

The star of the show and the glimpse of the future as far as the Air Force was concerned was the F-117 Nighthawk Stealth Fighter. Although it had been designed and classified as a fighter, the F-117 served as ground attack instrument rather than an air-to-air combat machine. A revolutionary technology known as stealth, which made the aircraft appear nonexistent or extremely tiny on radar, was the key feature of the aircraft. Developed in top secret during the late-1970s by the Lockheed Corporation, stealth technology appeared to be the future of aircraft.²⁵⁷ Lockheed built two prototypes, code-named Have Blue, leading to the full-scale successor called Senior Trend, which became the F-117. The plane was coated in a radar-absorbing material similar to Styrofoam, painted black and void of sharp-right angles designed to deflect or attenuate radar waves. All of these features gave the F-117 a futuristic look and protected it from radar detection. For years, the F-117 had flown night-missions out of a secret base in Nevada, flying simulated bomber runs on the state capitol of Carson City. No doubt adding validity to the claims of Unidentified Flying Objects (UFOs) being spotted over the desert sky.²⁵⁸ The F-117A first saw combat during Operation Just Cause on December 19, 1989, when two aircraft attacked military targets in Panama.²⁵⁹ But it was during Desert Storm that it displayed its capabilities. The aircraft had dropped the opening munitions of the war after reaching Baghdad undetected. In all, the F-117 flew 1,271 sorties with an 80 percent success rate and without suffering any losses or battle damage.²⁶⁰ Stealth

²⁵⁷ Lockheed Corporation bought General Dynamics and is now the current producer of the F-16 Fighter Falcon. The corporation is now known as Lockheed Martin.

²⁵⁸ Atkinson, *Crusade*, 34.

²⁵⁹ United States Air Force, *Fact Sheet, F-117 Nighthawk*, Washington, D.C., July 2, 2014, Retrieved from USAF Fact Sheets via Air Force National Museum: nationalmuseum.af.mil/FactSheets.

²⁶⁰ *Fact Sheet, F-117*.

appeared to be the future for the Air Force, and the pursuit of an air superiority stealth fighter became a necessity for the fighter jock.

CHAPTER 4: THE FUTURE OF THE AIR FORCE

The Fifth Generation

In the year 2054, the entire defense budget will purchase just one tactical aircraft. This aircraft will have to be shared by the Air Force and Navy, three and one-half days per week, except for the leap year, when it will be made available for the Marines for the extra day.

-Norman Augustine "Law Number XVI"²⁶¹

The above quote is from Norman Augustine, former chairman of Lockheed Martin, and was one of his "laws" in his 1982 book. These "laws" were a series of aphorisms intended to mock and examine aspects of the defense procurement industry. Augustine based his assessment through extrapolating the cost of tactical military aircraft, such as the F-15 and F-16, from 1910 to the 1982 and into the future. Based on the rising cost of aircraft, Augustine made his satirical law to show the extraordinary trajectory of tactical aircraft. Unfortunately the satire, which Augustine sought to provoke, appears to be trending in the direction of realism. The United States Air Force, under the guidance of fighter pilots and in the aftermath of the great success of Desert Storm, is pursuing a fifth-generation of fighter aircraft. These aircraft, the F-22 Raptor and the F-35 Lightning II Joint Strike Fighter, are designed to replace the older, successful jets, such as the F-15, F-16 and A-10. These fighter aircraft are the most capable and technological advanced in history, yet have been plagued by skyrocketing budgets and lack of mission. They are being introduced into an Air Force that appears to be moving swiftly into the realm of

²⁶¹ Norman R. Augustine, *Augustine's Laws and Major Systems Development Programs*, (American Institute of Aeronautics and Astronautics: Reston, 1982) 112.

unmanned aircraft. The future of the Air Force might not remain with the fighter jock, despite their best efforts.

The idea of the fifth-generation air superiority fighter aircraft came about in 1986 due to the threat of increasing Soviet capabilities. As seen with previous aircraft, the USAF was basing procurement and technological needs on fear of newer Soviet aircraft. As with the F-15 and F-16, the need for air superiority over Europe in case of World War III dictated the idea of a new air superiority fighter to replace the F-15. In 1991, the year that USAF aircraft proved superior in Iraq, the Air Force accepted an air-superiority design based on USAF specifications from Lockheed Martin, which would be designated the F-22. This was a “paper” airplane and the design was based on desired specifications, in particular the use of stealth technology applied in the F-117. However, just as the new program was taking flight, the United States lost its great adversary with the collapse of the Soviet Union.

The F-22 Raptor is a truly revolutionary piece of machinery incorporating capabilities, such as supercruise, stealth, and integrated avionics. Designed to carry on the air-superiority mission of the F-15, the Air Force envisions the F-22 dominating the skies through the year 2050. The F-22 is designed to cruise at supersonic (above the speed of sound) speeds without the use afterburners, a capability known as supercruise. The previous generation’s use of afterburners to achieve supersonic speeds required tremendously high fuel consumption to maintain such speeds for short bursts.²⁶² The F-22, using two advanced jet engines designed by Pratt & Whitney, is able to reach cruise

²⁶² Michael Costigan, “The F-22: the Right Fighter for the Twenty-First Century?” *Air War College Maxwell Paper No.9*, (Montgomery, AL: Maxwell Air Force Base), August 1997, 3.

at supersonic speeds saving massive amounts of fuel. The jet design involves a sleek aerodynamic design, in which all the weaponry fits inside of the fuselage and wings. This combination allows the F-22 to cruise at speeds up to Mach 1.5 (approximately 1000 miles per hour) without the use of afterburners.²⁶³ Low drag and efficient engines give the F-22 exceptional range, minimizing the need for air refueling needed by the F-15.²⁶⁴ This integrated weaponry design is a fundamental aspect of making the aircraft less visible to radar.

One of the main reasons for the development of the F-22 was the incorporation of stealth into the tactical fighter domain. As with the F-117, the F-22 has been designed to appear invisible or too small to detect on enemy radar. This capability allows the aircraft to maintain the greatest advantage any fighter jock can have, surprise. The pilot also has less to manage in the aircraft due to the integrated avionics suite, developed specifically for the fighter jet. Where as in previous aircraft, the pilot had to operate the radar, monitor radar warnings, activate friend of foe interrogator, and many more aspects, the pilot of the F-22 can focus more on flying the aircraft and firing weapons. Many of these tasks have been integrated into a computer system, which handles the majority of sensor tasks. This frees the fighter jocks to quickly process information and do what they do best, fly fighter jets. The F-22 is also more maneuverable than its predecessor, the F-15. The combination of all of these aspects led USAF Colonel Michael Costigan to conclude, “Other fighters will not be able to detect the F-22 before its pilot has already seen a complete view of the air battle and decided how to employ his weapons. In a complex air

²⁶³ United States Air Force, *Fact Sheet, F-22 Raptor*, Washington, D.C., September 6, 2005, retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx, accessed October 8, 2014.

²⁶⁴ Costigan, “The F-22,” 4.

battle with dozens of aircraft, the integrated avionics and stealth will allow the pilot to choose where and when to engage to maximize survivability while destroying enemy aircraft that are not even aware of the F-22's presence. Simulations using projected threat aircraft for the year 2008 reveal the F-15 losses could be 20 times those of the F-22 in some situations.”²⁶⁵

Due to lessons learned in the Gulf War, the F-22 Raptor saw the addition of ground-strike capabilities. During Desert Storm, F-15s were left patrolling the skies over Iraq without any enemy aircraft to engage, as air-supremacy had been achieved early in the conflict. These aircraft lacked air-to-ground capabilities, essentially taking them out of the conflict as the battle still raged on land. A late addition to the F-22 was the ability to assess ground threats and targets and to launch missiles capable of destroying such threats. This meant that after establishing air superiority, the F-22 can attack targets deep in enemy territory with precision in all weather conditions.²⁶⁶ The Air Force added air-to-ground capability to the F-22 as it appeared that they lacked a competent air-to-air adversary.

As soon as the USSR fell, critics began to question the necessity for a new air-superiority fighter without a foreseeable mission. The F-15 had proven itself more than capable of dominating the skies against existing Soviet MiG aircraft. In a 1995 report to the Senate Armed Service Committee, the U.S. General Accounting Office questioned the need for the F-22. The report states that “the need for the F-22, based on our analysis, is not urgent. Our report concerning planned replacement of F-15s with F-22s amply

²⁶⁵ Costigan, “The F-22,” 5.

²⁶⁶ Ibid., 5.

demonstrated that the initial operational capability planned for the F-22 could be deferred.”²⁶⁷ A further problem was that the Air Force planned to procure a significant number of aircraft before testing certain capabilities. The report further elaborated that:

Although laboratory tests are underway and simulations of the avionics are planned, the Air Force does not plan to flight test several of the critical F-22 technology advances on an F-22 until well after start of production in September 1997. Flight tests of low observability are not scheduled to begin until September 1998. Although the highest risk element of the F-22 program was reported to be the integrated avionics, the first flight test of an F-22 equipped with a complete integrated avionics system is not scheduled to begin until September 1999, 2 years after the start of production. By the time that testing begins, the Air Force will have already made commitments to procure 20 aircraft and long lead materials for an additional 24.²⁶⁸

The Air Force was so convinced of the revolutionary aircraft that they were willing to start production before many of the most important systems had been tested. The DoD concurred with this assessment in 1995 that the planned production could be stalled to some extent as the Cold War had ended the resulting in no need to rush through production.²⁶⁹ However, enamored with the capabilities of the new aircraft, pilots in Air Force argued that “the F-22 fits very well into the view of twenty-first century warfare, despite the fact it was designed for a European theater Soviet threat.”²⁷⁰

It was not only the fact that the F-22 faced no foreseeable threat, the cost of the machine has grown significantly since its inception. The program received initial

²⁶⁷ United States General Accounting Office, Report to Congressional Committees, *Tactical Aircraft Concurrency in Development and Production of F-22 Aircraft Should be Reduced*, (Washington D.C.: United States Government Printing Office, April 1995), Retrieved from GAO Reports Main Page via GPO Access database: gpoaccess.gov/gaoreports/index.html, accessed October 8, 2014, 3.

²⁶⁸ US GAO, *Tactical Aircraft: Concurrency in Development and Production of F-22 Aircraft Should be Reduced*, 7.

²⁶⁹ US GAO, *Tactical Aircraft: Concurrency in Development and Production of F-22 Aircraft Should be Reduced*, 22.

²⁷⁰ Costigan, “The F-22,” 10.

approval to enter a low production rate in 2001.²⁷¹ However, its price had risen from \$13.1 billion over original estimates in 1997 to \$26.5 billion over in January 2001.²⁷² The Air Force estimated the likely cost to procure 333 F-22s at \$39.6 billion while the Office of the Secretary of Defense's estimate was at \$46.6 billion. Both of these budgets exceeded the congressional cost limitation of \$37.6 billion.²⁷³ Despite these jumps, by 2005 the program entered full rate production.²⁷⁴ A discrepancy between the number of aircraft requested by the Air Force and the number they could afford created a problem during procurement. A Government Accountability Report from June 20, 2006 stated that "based on our review, in our opinion, the DoD has not demonstrated the need or value for making further investments in the F-22A program."²⁷⁵ The current stated Air Force "need" requested 381 F-22As, however due to past cost overruns and current budget constraints, the Office of the Secretary of Defense (OSD) stated it could only afford 183 aircraft.²⁷⁶ The Air Force would begin to receive the F-22, but in fewer numbers than original requested.

There are currently 183 F-22 Raptors serving the USAF in tactical fighter wings. These fighter jets cost about \$143 million per unit, making them one of the most

²⁷¹ USAF, *F-22 Raptor, Fact Sheet*.

²⁷² United States General Accounting Office, Report to the Congressional Committees, *Tactical Aircraft: Continuing Difficulty Keeping F-22 Production Costs Within the Congressional Limitation*, GAO-01-782 (Washington, D.C.: United States Government Printing Office, July 2001), Retrieved from GAO Reports Main Page via GPO Access database: gpoaccess.gov/gaoreports/index.html, accessed October 8, 2014, 2.

²⁷³ *Ibid.*, 2.

²⁷⁴ USAF, *F-22 Raptor, Fact Sheet*.

²⁷⁵ United States Government Accountability Office, Report to Congressional Committees, *Tactical Aircraft: DoD Should Present a New F-22A Business Case before Making Further Investments*, (Washington D.C.: United States Government Printing Office, June, 2006), Retrieved from GAO Reports Main Page via GPO Access database: gpoaccess.gov/gaoreports/index.html, accessed October 8, 2014, 2.

²⁷⁶ GAO, "Tactical Aircraft," 2.

expensive airplanes in history.²⁷⁷ These costs only include the cost of purchasing the aircraft. With their high-tech equipment, estimates of maintenance costs have reached as high as \$67 billion.²⁷⁸ Although in service for over eight years and steadily replacing the F-15, the F-22 only saw combat service recently. During the United States counter-insurgency wars in Iraq and Afghanistan, the mission never required the use of an air-superiority fighter. In September 2014, the F-22 was sent into combat for the first time bombing targets in Syria in the fight against the Islamic State in Syria and Iraq (ISIS). As Spencer Ackerman pointed out in *The Guardian*, “ISIS is hardly the foe the architects, advocates and congressional allies of the F-22 anticipated the plane fighting.”²⁷⁹ Christopher Harmer, a former Navy pilot who now works for the Institute for the Study of War, stated that the F-22’s inclusion in these strikes was simply to “justify the weapons system.”²⁸⁰ This appears to be the situation, which critics of the F-22 program warned about before procurement. The GAO report from 2006 recommended that “alternatives such as the Joint Strike Fighter and F-15 might be able to execute ground attack more cost-effectively given the substantially fewer numbers of F-22As that OSD has committed to buy.”²⁸¹ While adaptations and advancements to existing aircraft might have been more fiscally responsible, the USAF has chosen instead to pursue new fighters.

²⁷⁷ F-22, Fact Sheet. Although this is a huge amount, it does not compare with the B-2 Spirit Long-Range Stealth Bomber. This program, which began in the 1980s, ended with a price tag of around \$1.5 billion per aircraft. There are only 20 currently in service without any future plans of procuring any more. United State Air Force, *B-2 Spirit, Fact Sheet*, Washington, D.C., April 01, 2005, retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx, accessed September 18, 2014.

²⁷⁸ Spencer Ackerman, “F-22 Raptor stealth fighter jet makes combat debut against ISIS in Syria,” *The Guardian*, September 25, 2014, accessed October 6, 2014, theguardian.com.

²⁷⁹ *Ibid.*

²⁸⁰ *Ibid.*

²⁸¹ GAO, *Tactical Aircraft: DoD Should Present a New F-22A Business Case before Making Further Investments*, 2.

Along with the F-22, the new Joint Strike Fighter has turned into the most expensive military weapon in United States history.

The Joint Strike Fighter is one of the most audacious and ambitious programs in the history of not only military aircraft, but of military history itself. With the desire to upgrade the remaining tactical aircraft to stealth, airplane developers received the Joint Strike Fighter development program in 1996. The Air Force wanted a design for a multi-role fighter-bomber jet, which could rule the skies for the next 50 years. This program was similar to the F-111 in that it was to incorporate the Navy and the Marine Corps. Lockheed Martin won the contract in October 2001 with its X-35 beating out the Boeing X-32. The resulting aircraft, the F-35 Lightning II, is currently set to replace several aircraft throughout the three branches. The Air Force model, the F-35A is a conventional takeoff and landing variant designed to replace both the F-16 and the A-10. The F-35B is a short-takeoff and vertical takeoff variant designed to replace the Marine Corps' AV-8B Harriers and F/A-18s. For the Navy, the F-35C is designed for carrier takeoff and landing and is set to replace the F/A-18.²⁸² Not only is the F-35 a multi-service jet, it is also a massive international partnership.

Taking lessons from the international cooperation during the F-16 procurement, the F-35 is a global partnership between nine countries (Australia, Canada, Denmark, Italy, the Netherlands, Norway, Turkey, U.K. and the United States). A bolder program than the F-16, this program, according to Lockheed Martin, is “leading to unprecedented

²⁸² United State Air Force, *F-35A Lightning II, Fact Sheet*, Washington, D.C., April 11, 2014, retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx, accessed October 11, 2014.

technology transfer and innovation.”²⁸³ Director of International Cooperation for Lockheed Martin, Alfred Volkman, stated that “the core objectives of armament cooperation for programs like JSF are to increase military effectiveness through standardization and interoperability, and to reduce weapon acquisition costs by avoiding duplication of development efforts with our allies.”²⁸⁴ The international process resulted from considerations regarding sharing the cost of weaponry, as well as ensuring collective security and tighter coalitions. International cooperation has resulted in fruitful and smooth aircraft procurements in the past, such as the history of the F-16 program. However, as USAF Lt. Colonel Stephen Domencio points out, “International cooperation history abounds with countries making financial decisions that appear on the surface as foolhardy. National pride and political motivations often prevail over fiscal responsibility.”²⁸⁵ While the scope of the procurement is massive, the F-35 is the most advanced fighter aircraft in history.

The F-35 is comparable in size to the F-16, allowing it superior maneuverability and capabilities of pulling 9 g’s.²⁸⁶ Similar to the F-16, it is a single-seat, single-engine aircraft designed for air-to-air proficiency as well as air-to-ground attack and close air-support. Like the F-22, the F-35’s weapons are stored inside the fuselage and wings to assure greater aerodynamics and stealth capabilities. The jet is capable of reaching speeds of Mach 1.6, but like the F-16 relies more on maneuverability than speed. The

²⁸³ Lockheed Martin, “Global Partnerships,” retrieved from Product Finder, F-35 Lightning II via Lockheed Martin: lockheedmartin.com, accessed October 11, 2014.

²⁸⁴ Stephen Di Domencio, “International Armament Cooperative Programs: Benefits, Liabilities, and Self-Inflicted Wounds-The JSF as a Case Study,” Occasional Paper No. 55, Center for Strategy and Technology, Air University, (Montgomery AL: Air University Press, February 2006), 13.

²⁸⁵ *Ibid*, 15.

²⁸⁶ The F-16 is 49 feet long with a wingspan of 32 feet. The F-35 is 51 feet long with a wingspan of 35 feet.

most innovative aspect of the F-35 is the advanced sensor package designed to gather, fuse and distribute more information than any fighter in history. The Automatic Logistics Information System (ALIS) is a computerized system which integrates behind-the-scenes monitoring, maintenance, and prognostics to help maintain the aircraft for the foreseeable future. The Electro-Optical Distributed Aperture System (DAS), according to the Air Force, “provides pilots with situational awareness in a sphere around the aircraft for enhanced missile warning, aircraft warning, and day/night pilot vision.”²⁸⁷ This is also integrated with the Electro-Optical Targeting System (EOTS), which is incorporated in the visor of the pilot’s helmet. Where the F-16 revolutionized the HUD, the visor of the F-35 pilot displays a variety of information.²⁸⁸ These systems also communicate directly to other F-35 aircraft to create a comprehensive view of the air battle.

These capabilities give the F-35 fighter jock the greatest ability to observe the air in the history of aerial warfare. The EOTS features a 360 degree view around the aircraft, which is displayed in the visor, a feature that pilots refer to as “god’s eye” perspective.²⁸⁹ This is intended to eliminate the ability of the enemy to gain surprise on the F-35. Lt. Colonel Matt Renbarger, an F-35 instructor, stated that “most pilots come from the F-16, F-15, and A-10 legacy aircraft. Sensors on the front of the F-35 allow us to have that 360-degree awareness. That was a big leap forward. Computer technology that is 30 years or more advanced than the legacy aircraft is what make the F-35 so advanced.”²⁹⁰ Displaying information in the visor allows the pilot to scan the skies and

²⁸⁷ USAF, *F-35A, Fact Sheet*.

²⁸⁸ *Ibid.*

²⁸⁹ Rich Lamance, “F-35: New Fighter Creates New Culture for the 21st Century and Beyond,” *Air Force News Service*, September 24, 2013, retrieved from af.mil/news, accessed October 11, 2014, 2.

²⁹⁰ Lamance, “F-35: New Fighter Creates New Culture for 21st Century and Beyond,” 2.

fly the aircraft without having to focus on instruments or a HUD. Tech Sgt. Andre Baskin is a USAF flight equipment technician. In his view, “With the F-35, it’s all encompassed in the helmet. The cameras on the jet work in sync with the helmet and whatever the jet picks up visually will be displayed on the visor in the helmet.”²⁹¹ Lt. Colonel Renbarger states that “the best thing about the F-35 helmet is that it has a big visor with a big display, and we can display a night vision camera visual on the visor and then a distributor aperture system that is basically a set of cameras that are all over the airplane and work in the infrared spectrum.”²⁹² Obviously, the fighter jocks are very pleased with the prospect of such a powerful tool.

On March 11, 2014 Luke Air Force Base received the first F-35s and are expected to reach a contingent of 16 fighters by the end of the year.²⁹³ Original planning to obtain 179 planes in the following two years, Air Force orders have been delayed through 2017 as costs have risen. A 2012 government report projects that the F-35 lifetime cost to taxpayers will be \$1.45 trillion, rising from a \$1 trillion estimate only a year earlier.²⁹⁴ The current estimated cost per aircraft is \$135 million a unit, not including an additional \$26 million for the F135-PW-100 turbofan engine built by Pratt & Whitney. The reason that the price reaches into the trillions is that the estimate is made on the 50-year cost of operating the aircraft. Proponents of the system claim that it is impossible to predict such long-term costs and that no other weapon program’s costs have been calculated over such

²⁹¹ Ibid.

²⁹² Ibid.

²⁹³ United States Air Force, 56th Fighter Wing Public Affairs, “First F-35 Lightning II arrives at Luke AFB,” March 11, 2014, retrieved from af.mil/news, accessed October 11, 2014.

²⁹⁴ Andrea Shalal-Esa, “U.S. Sees Lifetime Cost of the F-35 Fighter at \$1.45 Trillion,” *Reuters*, March 29, 2012, retrieved from reuters.com, accessed October 11, 2014.

a long period. Lockheed Martin believes that that the new fighter jet would cost the same or less to maintain and operate than the seven warplanes it will replace. The Pentagon has dropped the combined total aircraft planned to purchase for the USAF from 730 to 697 through 2037.²⁹⁵ However, early performance and testing have been marred by glitches and system failures.

The problem has been that this tool has not worked as Lockheed Martin and the DoD originally estimated adding to exorbitantly soaring costs. The project has faced repeated delays as several aspects have failed to function as specifically intended. A failure in the one of the state-of-the-art jet engines on July 23, 2014 at Eglin Air Base caused the Air Force to ground the F-35. This led the jet to miss a large airshow in Farnborough, England where, as the F-16 had in Paris, it was intended to make its international debut to government officials, defense contractors and experts. There have also been problems with the software, which as of July 2014 was still not working properly.²⁹⁶ There are also critics who believe that even if everything is fixed, the plane is not properly suited to fit its lofty mission. William Hartung of the Center for International Policy argued that the plane “will be too small to serve as an effective bomber, not maneuverable enough for aerial dogfights and too fast and vulnerable to do well at supporting troops on the ground.”²⁹⁷

The cost of one F-22 is enough to employ on average, 3,000 military personnel. Major cuts are being made to active duty military forces, while these expensive programs

²⁹⁵ Shalal-Esa, “U.S. Sees Lifetime Cost of F-35 Fighter at \$1.45 Trillion.”

²⁹⁶ The Editorial Board, “Rough Ride for the F-35,” *The New York Times*, July 27, 2014, retrieved from nytimes.com, accessed October 11, 2014.

²⁹⁷ Editorial Board, “Rough Ride for the F-35.”

are being pushed through.²⁹⁸ The average annual military budget for the United States grew 30 percent in adjusted dollars when comparing the period of 1953-62 to 2003-12. In comparison, the average cost for a tactical aircraft has grown over 300 percent during those two periods.²⁹⁹ This immense, exponential growth of spending on aircraft has caused the Air Force to reconsider its procurement tactics. The Air Force acknowledged in a strategic forecast released in July 2014 that it needs to shift away from huge, expensive weapons programs that take decades to develop and move toward high-tech armaments that can be quickly adapted to meet a range of emerging threats. The analogy was made by Secretary of the Air Force Deborah Lee James that the branch needs to behave more like an innovative 21st century company. However, the Air Force does not plan to scrap the F-22 and the F-35, which it still sees as the future, instead referring to the move as “strategic agility.” As the New York Times quoted, “after two costly and exhausting land wars and the fiscal reality of government austerity, the Air Force report could signal similar shifts by the entire military.”³⁰⁰ The future of the USAF fighter jock appears to be in limbo.

The End of the Era?

Maybe they're even The Last of Their Kind, the last honest-to-God, hotshot, single-seat, single-engine, Lord of Creation fighter pilots—making their last stand against evil empires and evildoers before the computer-driven drones push them aside.³⁰¹

-Peter Alshire, *Eye of the Viper: The Making of an F-16 Pilot*

²⁹⁸ Frederick Kagan, “The U.S. Military’s Manpower Crisis,” *Foreign Affairs*, Vol. 85, No. 4, July-August 2006, 97. The average cost to maintain one service member on active duty for a year is \$112,000.

²⁹⁹ Franklin Spinney, “Defense Time Bomb: F-22/JSF Case Study Hypothetical Escape Option,” *Challenge*, Vol. 39, No. 4, July-August 1996, 26.

³⁰⁰ Helene Cooper, “Air Force Plans Shift to Obtain High-Tech Weapon Systems,” *The New York Times*, July 30, 2014, retrieved from nytimes.com, accessed October 4, 2014.

³⁰¹ Alshire, *Eye of the Viper*, 262.

. Designed to assure that Air Force fighter pilots had the best equipment for the next fifty years, these new fighter jets are supposed to be the answer. However, there is a substantial shift taking place away from manned aircraft. This is not only due to the exorbitant cost and production problems of the fifth-generation manned fighters; since the attacks on September 11, 2001, the unmanned drone has seen a rapid proliferation in mission capability and usage. In targeting the individuals and groups responsible for the attacks, Presidents George Bush and Barack Obama have expanded the use of drones in surveillance, reconnaissance, and most significantly aerial bombardment. With the increasing accuracy of precision-guided munitions, drones have been equipped with the ability to drop munitions on designated targets. The program was first enacted by the Central Intelligence Agency in the immediate aftermath of September 11th, however the USAF has taken over a majority of the expansion of drones. The U.S. Department of Defense has committed \$30.8 billion to develop and acquire drones between 2011 and 2015 and dozens of other countries are following their lead in acquiring drone technology.³⁰²

The modern attack drone began by arming of the RQ-1 Predator drone with the addition of the AGM-114 Hellfire missile. The Predator had been acquired as a reconnaissance drone in 1996 and is now known as the MQ-1, “M” began the DoD designation for multirole and the “Q” means remotely piloted aircraft system. The “1” refers to the aircraft being the first of the series of remotely piloted aircraft system. What makes the Predator even more enticing is that the unit cost for is around \$5 million for

³⁰² Greg Miller, “Drone Wars: Are Remotely Pilot Aircraft Changing the Nature of War?” *Science*, Vol. 336, May 18, 2012, 842.

each aircraft. This includes sensors, ground control station and Predator Primary satellite link.³⁰³ This is a unit cost roughly 28 times cheaper than the new manned-fighters and does not require a pilot to be subjected to danger. The latest addition in the line of the attack-capable drones is the MQ-9 Reaper, with a price tag of \$14 million per aircraft. The Air Force describes the Reaper as “an armed, multi-mission, medium-altitude, long-endurance remotely piloted aircraft that is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets.”³⁰⁴ The Reaper can achieve a great number of recon missions, while carrying significantly more munitions than the Predator. The total force for both of these aircraft is over 300 in service for the USAF with future acquisitions increasing.

One of the obvious benefits of the drone program is that it keeps pilots out of harm’s way. Predator and Reaper drones are controlled by a two-man crew inside an air-conditioned room located at Nellis Air Base. There is little doubt that drones are changing the combat experience of those involved on both sides of the conflict. Journalist Greg Miller quotes a drone pilot in an article that “most of the time, I get to fight the war and go home to see the wife and kids at night.”³⁰⁵ Although this has been an evolution of warfare, as combatants have tried to increase the distance of strike capability throughout history, drone warfare has raised a large variety of moral and ethical questions. There are over 50 universities in the United States alone, which are

³⁰³ United State Air Force, *MQ-1B Predator, Fact Sheet*, Washington, D.C., July 20, 2010, retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx, accessed October 14, 2014.

³⁰⁴ United State Air Force, *MQ-9 Reaper, Fact Sheet*, Washington, D.C., August 18 2010, retrieved from USAF Fact Sheets via Air Force News Desk: af.mil/AboutUs/FactSheets.aspx, accessed October 14, 2014.

³⁰⁵ Miller, “Drone Wars,” 842.

involved in Unmanned Aerial Vehicle Research.³⁰⁶ In the last several years, the release of a number of books has examined the questions raised by the increased use of drones in warfare.³⁰⁷ Although there is much debate about the ethics of the program, there is little doubt that drone warfare represents a seismic shift away from the world of the fighter jock.

In their 1993 book, *The Future of War*, George and Meredith Friedman predicted that the pursuit of stealth aircraft would resemble the build-up of Dreadnought class battleships a century before. The naval rivalry between Great Britain and Germany in the years before the Great War caused the two sides to develop and construct ever larger battleships. However, these battleships soon became obsolete as naval warfare changed.³⁰⁸ They argue that although stealth is a revolutionary technology, the era of the manned aircraft has reached its twilight. Smart weapons, such as cruise missiles and drones, are the way of the future for the reasons already listed. Around this period, the Navy commissioned a study arguing that the advantages of stealth will be figured out by future enemies. However, the Air Force led by fighter generals continue to believe in the absolute necessity of stealth.³⁰⁹ The Friedmans argue that even the piloted drone is an intermediate step until machine intelligence matures further. In this work, they state, “A revolution in which the manned aircraft, an increasingly decadent, complex, and costly technology, moves to senility and is overthrown by a technology that is infinitely

³⁰⁶ Anthony Marcus, Ananthakrishnan Aiyer, and Kirk Dombrowski. "Droning On: The Rise of the Machines." *Dialectical Anthropology* 36 (2012): 2.

³⁰⁷ These included such works as *Target Killings: Law and Morality in an Asymmetric World*, a collection of essays, *Killer Robots: Legality and Ethicality of Autonomous Weapons* by Armin Krishnan, *Armed Drones and the Ethics of War: Military Virtue in the Post-heroic Age* by Christian Enemark, and *Killing by Remote Control: The Ethics of an Unmanned Military* by Bradley Strawser.

³⁰⁸ George and Meredith Friedman, *The Future of War*, 296.

³⁰⁹ George and Meredith Friedman, *The Future of War*, 295.

superior—the hypersonic, intercontinental projectile.”³¹⁰ Among these projectiles are drones and cruise missiles.

Among fighter pilot culture, there is a sweeping realization that the future is not bright, despite the introduction of new fighter jets. The jocks are excited for the fifth-generation, but believe that the F-16 is still the most capable aircraft in the world and can continue to be upgraded.³¹¹ This is a view shared by Tom Christie and Pierre Sprey, members of the Fighter Mafia. Both have been openly critical of the F-35 believing that it represents the kind of Vietnam-era thinking, which the Mafia fought against.³¹² Like the F-111, the F-35 is the “do-it-all” aircraft designed to function for multiple branches. Although this jet is supposed to complete every mission, will it bring the glory of making ace back to the USAF?

In 2007, Major Cesar Rodriguez retired from the US Air Force as the jock with more air-to-air kills than any other active pilot in the US Armed Forces. An F-15 pilot, Rodriguez had two confirmed kills in Desert Storm in 1991 and another against the Serbian Air Force in the skies over Kosovo in 1999. With his three kills, Rodriguez was the closest any American fighter jock has come to making ace, since the Vietnam War.³¹³ There are no doubt active pilots who have caused greater death and destruction through aerial bombardment, but air-to-air is where you make your name. The era of the ace and

³¹⁰ Ibid., 298.

³¹¹ Alshire, *Eye of the Viper*, 205.

³¹² Kelley Vlahos, “Forty Years of the Fighter Mafia,” *The American Conservative*, September 20, 2013, retrieved at theamericanconservative.com, accessed October 25, 2014.

³¹³ Mark Bowden, “The Last Ace,” *The Atlantic*, March 1, 2009, retrieved at theatlantic.com, accessed on October 25, 2014.

the rise of fighter pilot culture could be a remnant of the past, but there can be no denying their influence and legacy in the US Air Force.

The shock and failure in Vietnam caused former fighter pilots to take on the Air Force in true fighter style fashion. By not obeying rules or blindly following superiors, they promoted a new set of ideas, which set the Air Force on a course of redemption. The errors of Vietnam taught this new generation many lessons, and they applied them to create some of the most successful tactical fighter jets in history. These jets dominated the skies over Iraq in Operation Desert Storm during an air operation masterminded by a former Vietnam fighter pilot, Colonel John Warden III. The fighter pilots also saw the future in this conflict with the introduction of stealth. Implementing this new technology in the fifth-generation of fighter jets, the jocks appeared to be assuring a future in which they would remain dominant. However, rising costs and the proliferation of unmanned drones have created a nebulous future for the fighter pilot community. Will *the right stuff* matter in future conflicts? Only time will truly tell.

BIBLIOGRAPHY

Primary

- Agan, Arthur. Interviewed by Jack Neufeld, 2 October 1973. #K239.0512-857, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Ackerman, Spencer. "F-22 Raptor Stealth Fighter Jet Makes Combat Debut against ISIS in Syria." *The Guardian*, September 25, 2014. Accessed October 6, 2014. Retrieved from theguardian.com.
- Air Combat Command. *A Concise History of Nellis Air Force Base*. Office of Air Force History, Air Warfare Center, Las Vegas, NV. 15 March 1997.
- Alison, John. Interview by John Dick, 27 January 1977. #K239.0512-1065, transcript. U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL.
- Alpers, John. Interview by Dr. James Hasdorff, 5 May 1992. #K239.0512-2242, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Ayres, Timothy. Interview by Dr. James Hasdorff, 17 October 1991. #K239.0512-2237, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Bowden, Mark. "The Last Ace." *The Atlantic*, March 1, 2009. Retrieved at theatlantic.com. Accessed on October 25, 2014.
- Bigham, Gene. "The Future of Drones: A Force of Manned and Unmanned Systems." *Air University Review*, November-December 1977.
- Bliss, Ronald. Interview by Dr. James Hasdorff, 17 October 1991. #K239.0512-2241, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Boyd, John. Interview by Jack Neufeld, 23 May 1973. #K239.0512-859, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Broad, William. "The U.S. Flight from Pilotless Planes." *Science*, Vol. 213, no. 4504 (1981): 188-90.
- Cooper, Helene. "Air Force Plans Shift to Obtain High-Tech Weapon Systems." *The New*

- York Times*, July 30, 2014. Accessed October 4, 2014. <http://www.nytimes.com>.
- Cunningham, Donald. "The Future of Recoverable Drone for Tactical Air Force." *Air University Review*, July-August 1975.
- Defense Clandestine Service, Headquarters Pacific Air Force. *North Vietnamese Air Force Fighter Patterns*. Osan Air Base, Republic of Korea. 28 March 1968.
- Driessnack, Hans H. Interview by Hugh Ahmann, 18-19 October 1987. #K239.0512-1769, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Gable, Deborah. *Acquisition of the F-16 Fighting Falcon 1972-1980*. Report No. 87-0900. United States Air Force Air Command and Staff College, Air University: Maxwell Air Base. March 1987.
- Gailer, Frank. Interview by John Dick, 19 January 1977. #K239.0512-1065, transcript. U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base Montgomery, AL.
- Geesey, Arthur. *Air to Air Engagements in SEA 1968-1972*. Project Checo Report, Seventh Air Force Command. Osan Air Base, Republic of Korea, 31 December 1972.
- Geiger, Clarence. *Small Wonder: Development of the F-16 Fighting Falcon 1975-1980*. Narrative Report. Aeronautical Systems Division, United States Air Force Systems Command, Washington D.C. January 1980.
- Hill, David. Interview by John Dick, 20 January 1977. #K239.0512-1063, transcript. U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL.
- Jackson, Charles. Interview by Dr. James Hasdorff, 6 June 1991. #K239.0512-2231, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Kagan, Frederick. "The U.S. Military's Manpower Crisis," *Foreign Affairs*. Vol. 85, No. 4. July-August 2006.
- Kula, James. Interview by Dr. James Hasdorff, 30 August 1991. #K239.0512-2236, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.
- Lamance, Rich. "F-35: New Fighter Creates New Culture for 21st Century and Beyond."

Air Force News Service, September 24, 2013. Retrieved at af.mil.news. Accessed October 6, 2014.

Lockheed Martin Aeronautics Company. *F-16 Fighting Falcon: The Most Technologically Advanced 4th Generation Fighter in the World*. Sales Brochure, Fort Worth, TX, 2014. Retrieved at lockheedmartin.com. Accessed on July 22, 2014.

Lockheed Martin Aeronautics Company. "Global Partnerships," Product Finder, F-35 Lightning II via Lockheed Martin. Retrieved at lockheedmartin.com. Accessed October 11, 2014.

Lyons, Robert. *The Search for the Advanced Fighter: A History from the XF-108 to the Advanced Tactical Fighter*, Report No. 86-1575. United States Air Force Air Command and Staff College, Air University: Maxwell Air Base, August 1986.

Marsh, Robert. Interview by Charles Gross and Walter Kraus, 26 July 1984. #K168.03, transcript. U.S. Air Force Systems Command Oral History Interview, Andrews Air Force Base, Alexandria, VA.

Miller, Greg. "Drone Wars: Are Remotely Pilot Aircraft Changing the Nature of War?" *Science* Vol. 336 (May 18, 2012).

Mills, Marvin. "Fighter Pilots Prepare for War." *Los Angeles Times*. 22 April 1966.

Momyer, William. "Address to the 4th Annual Fighter Symposium." Speech, Nellis Air Force Base, Las Vegas, NV, 28 April 1969.

Mullins, James. Interview by Jack Neufeld, 27-30 January 1987. #K239.0512-1739, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Myers, Charles. Interview by Jack Neufeld, 18 July 1973. #K239.0512-971, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Olds, Robin. Corona Harvest Interview, 12 July 1967. #K239.0512-160, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Olds, Robin. Interview by John Dick, 17 January 1977. #K239.0512-1063, transcript. U.S. Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL.

Rhodarmer, Roger. Interview by Jack Neufeld, 23 March 1973. #K239.0512-972,

transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Ritchie, Richard. "End of Tour Report." Interview by Lyn Officer, 11 October 1972. U.S Air Force Corona Ace Interview Collection, Maxwell Air Base, Montgomery, AL.

Rogers, Felix M. Interview by Jack Neufeld, 17-18 July 1974. #K239.0512-943, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Scheid, Frank. *History of the Directorate of Budget 1 July 1975-31 December 1975*. Headquarters USAF, Washington D.C. Declassified February 10, 1984.

Shalal-Esa, Andrea. "U.S. Sees Lifetime Cost of F-35 Fighter at \$1.45 Trillion." *Reuters*, March 29, 2012. Accessed October 7, 2014. Retrieved at reuters.com.

Spinney, Franklin. "Defense Time Bomb: F-22/JSF Case Study Hypothetical Escape Option." *Challenge*. Vol. 39, No. 4. (July-August 1996).

Sprey, Pierre. Interview by Jack Neufeld, 12 July 1973. #K239.0512-969, transcript. U.S. Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Storey, Thomas. Interview by Dr. James Hasdorff, 9 October 1992. #K239.0512-2235, transcript. U.S Air Force Oral History Program, Maxwell Air Force Base, Montgomery, AL.

Strategic Aircraft Study Group Briefing, Headquarters USAF. Briefing to the Chief of Staff, USAF. 13 April 1965.

Suter, Richard. Interview by John Dick, 26 January 1977. #K239.0512-1065, transcript. U.S Air Force Corona Ace Interview Collection, Maxwell Air Force Base, Montgomery, AL.

The Editorial Board. "Rough Ride for the F-35." *The New York Times*, July 27, 2014. Accessed October 11, 2014. Retrieved at nytimes.com.

Vlahos, Kelley. "Forty Years of the Fighter Mafia." *The American Conservative*. September 20, 2013. Retrieved at theamericanconservative.com. Accessed October 25, 2014.

Warden, John. "Planning to Win." *Air University Review*. March-April 1983.

United States Air Force Air Command and Staff College. *Air Superiority Tactics over*

North Vietnam 1964-1972. Maxwell Air Force Base, Montgomery, AL, 9 August 1972.

United States Air Force, 56th Fighter Wing Public Affairs, "First F-35 Lightning II arrives at Luke AFB," March 11, 2014, Retrieved from af.mil/news.

United States Air Force. *Fact Sheet, F-111A Aardvark*, Washington, D.C. April 24, 2014. Retrieved from USAF Fact Sheets via National Museum of US Air Force. Accessed December 1, 2014. nationalmuseum.af.mil/factsheets/factsheet.asp.

United States Air Force. *Fact Sheet, F-16 Fighting Falcon*. Washington, D.C. October 8, 2005. Retrieved from USAF Fact Sheets via Air Force News Desk. Accessed July 18, 2014. af.mil/AboutUs/FactSheets.aspx.

United States Air Force. *Fact Sheet, F-177 Nighthawk*. Washington, D.C. July 2, 2014. Retrieved from USAF Fact Sheets via Air Force National Museum. Accessed September 14, 2014. nationalmuseum.af.mil/FactSheets.

United States Air Force. *Fact Sheet, F-22 Raptor*. Washington, D.C. September 6, 2005. Retrieved from USAF Fact Sheets via Air Force News Desk. Accessed October 9, 2014. af.mil/AboutUs/FactSheets.aspx

United State Air Force. *F-35A Lightning II, Fact Sheet*. Washington, D.C. April 11, 2014. Retrieved from USAF Fact Sheets via Air Force News Desk. Accessed October 11, 2014. af.mil/AboutUs/FactSheets.aspx.

United State Air Force. *MQ-1B Predator, Fact Sheet*. Washington, D.C., July 20, 2010. Retrieved from USAF Fact Sheets via Air Force News Desk. Accessed October 14, 2014. af.mil/AboutUs/FactSheets.aspx.

United State Air Force. *MQ-9 Reaper, Fact Sheet*. Washington, D.C., August 18 2010. Retrieved from USAF Fact Sheets via Air Force News Desk. Accessed October 14, 2014. af.mil/AboutUs/FactSheets.aspx.

United States General Accounting Office, Report to Congressional Committees. *Tactical Aircraft Concurrency in Development and Production of F-22 Aircraft should be Reduced*, (Washington D.C.: United States Government Printing Office, April 1995). Retrieved from GAO Reports Main Page via GPO Access database. Accessed October 8, 2014. gpoaccess.gov/gaoreports/index.html.

United States General Accounting Office, Report to the Congressional Committees. *Tactical Aircraft: Continuing Difficulty Keeping F-22 Production Costs Within the Congressional Limitation*. GAO-01-782 (Washington, D.C.: United States

Government Printing Office, July 2001). Retrieved from GAO Reports Main Page via GPO Access database. Accessed October 8, 2014.
gpoaccess.gov/gaoreports/index.html.

United States Government Accountability Office, Report to Congressional Committees. *Tactical Aircraft: DoD Should Present a New F-22A Business Case before Making Further Investments*. (Washington D.C.: United States Government Printing Office, June, 2006). Retrieved from GAO Reports Main Page via GPO Access database. Accessed October 8, 2014.
gpoaccess.gov/gaoreports/index.html.

United States Military Assistance Command. *Fact Sheet, US Air Force in Vietnam, The Mission of the Seventh Air Force*. Washington, D.C, 1966.

Secondary

Alshire, Peter. *Eye of the Viper: The Making of an F-16 Pilot*. Boston: Lyons Press, 2004.

Atkinson, Rick. *Crusade: The Untold Story of the Persian Gulf War*. New York: Mariner Books, 1994.

Augustine, Norman. *Augustine's Laws and Major Systems Development Programs*. Reston: American Institute of Aeronautics and Astronautics, 1982.

Belyakov, R.A. and J. Marmain. *MiG: Fifty Years of Secret Aircraft Design*. Annapolis: Naval Institute Press, 1994.

Clodfelter, Mark. *The Limits of Air Power: The American Bombing of North Vietnam*. New York: The Free Press, 1989.

Coram, Robert. *Boyd: The Fighter Pilot Who Changed the Art of War*. New York: Back Bay Books, 2004.

Costigan, Michael. "The F-22: The Right Fighter for the Twenty-First Century?" *Air War College Maxwell Paper No. 9* (Montgomery AL: Maxwell Air Force Base, August 1997).

Domencio, Stephen. "International Armament Cooperative Programs: Benefits, Liabilities, and Self-Inflicted Wounds-The JSF as a Case Study," Occasional Paper No. 55, Center for Strategy and Technology, Air University, (Montgomery AL: Air University Press, February 2006).

- Friedman, George, and Meredith Friedman. *The Future of War: Power, Technology and American World Dominance in the Twenty-first Century*. New York: St. Martin's Griffin, 1998.
- Futrell, Robert Frank. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1961-1984 - Volume Two, Air Power, Tactical Air Command, Air Mobility, Space, MOL, Manned Space Flight, Strategy*. Montgomery: Air University Press, 1989.
- Lambeth, Benjamin. *The Transformation of American Air Power*. Ithaca: Cornell University Press, 2000.
- Marcus, Anthony, Ananthkrishnan Aiyer, and Kirk Dombrowski. "Droning On: The Rise of the Machines." *Dialectical Anthropology* 36 (2012): 1-5.
- Michel, Marshall. *Clashes: Air Combat over North Vietnam, 1965-1972*. Annapolis: Naval Institute Press, 1997.
- Office of Air Force History, Headquarters USAF, Alfred F. Simpson Historical Research Center. *Aces and Aerial Victories: The United States Air Force in Southeast Asia*. Maxwell Air Force Base, Montgomery, AL, 1976.
- Olsen, John Andreas. *John Warden and the Renaissance of American Air Power*. Washington D.C.: Potomac Books, 2007.
- Peacock, Lindsay. *On Falcon Wings: The F-16 Story*. London: Orion, 1999.
- Shaw, Robert. *Fighter Combat: Tactics and Maneuvering*. Annapolis: Naval Institute Press, 1985.
- Sherwood, John. *Fast Movers: Jet Pilots and the Vietnam Experience*. New York: The Free Press, 1999.
- Thompson, James. *Rolling Thunder: Understanding Policy and Program Failure*. Chapel Hill: University of North Carolina Press, 1980.
- Van Crevald, Martin. *The Age of Airpower*. New York: Public Affairs, 2011.
- Weigley, Russell. *The American Way of War: A History of United States Military and Strategy*. Bloomington: Indiana University Press, 1960.
- Wilcox, Robert. *Wings of Fury: From Vietnam to the Gulf War, the Astonishing True Stories of America's Elite Fighter Pilots*. New York: Pocket Books, 1997.

Wolfe, Tom. "Jousting with Sam and Charlie: The Truest Sport." *Mauve Gloves & Madmen, Clutter & Vine*. New York: Farrar, Straus, and Giroux, 1973.

Wolfe, Tom. *The Right Stuff*. New York: Farrar, Straus, and Giroux, 1979.

Worden, Mike. *Rise of the Fighter Generals: The Problem of Air Force Leadership 1945-1982*. Maxwell Air Force Base: Air University Press, 1998.