The University of Chicago

The Same Fight Two Ways: An Investigation of Tactical Innovation in the Skies Over Vietnam

by Noah Morgan

May 2025

A paper submitted in partial fulfillment of the requirements for the Master of Arts degree in the Master of Arts Program in the Committee on International Relations

Faculty Advisor: Robert Pape
Preceptor: Burcu Pinar Alakoc

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Abstract

Under what conditions do professional militaries innovate their tactics in war? Is this a straightforward product of responding to losses in combat or are other factors involved? This paper develops credible hypotheses to answer this question. Specifically, this paper examines the contrasting approaches of the United States Navy and the United States Air Force to the air superiority problems they both faced during Operation Rolling Thunder in the skies over Vietnam in 1965-1968. Despite facing an identical threat over the same location and even flying the same airplane, the two services arrived at significantly different solutions to their initial struggles. On the one hand, the USAF made exclusively technical adjustments to what it viewed as a problem of underperforming equipment, resisting any doctrinal or training reforms. On the other hand, the USN was willing to confront its shortcomings, which it perceived as insufficient and ineffective training regimens leading to subpar aircrew performance. The results spoke for themselves: while the Air Force remained at a 2:1 kill ratio throughout the war, the Navy's ratio jumped from 2:1 to 12:1. Drawing on primary sources, memoirs, histories, and declassified reports, this paper finds organizational flexibility, unbiased reflection, and inter-service rivalry to be key determinants of tactical innovational success. These findings offer lessons that can be applied to future conflicts and stress the importance of aligning technological advancements with the proper doctrinal innovations to construct the best force for victory in the future.

Introduction

One day in January 1967, USAF Colonel Robin Olds, a double ace in World War II and two-time "MiG killer," was leading a flight of F-4 Phantom IIs on a MiG Combat Air Patrol (MiG CAP) mission in the skies above Vietnam. Suddenly, he heard "Tampa, break left!" through his radio and saw MiGs[1] all around him. He quickly scored a kill against one, but another MiG shot down Olds' wingman. Pursuing yet another, Olds selected a close-range heat-seeking missile, and fired. This proved fruitless as this MiG was too close, even for the Phantom's shortest-ranged weapon (the F-4, by design, lacked an internal cannon). Unless Olds could increase the distance between him and his target, he had nothing else to throw at the MiG. At that moment, Olds thought "Christ, I wish I had a gun!"[2]

[1] MiG stands for the two main designers of Soviet fighters, Mikoyan and Gurevich. However, it is most often used to refer to Soviet fighter aircraft of various types (MiG-17, MiG-19, MiG-21, etc.).
[2] Olds, Robin, *Fighter Pilot*, pp. 309.

The fight lasted several minutes until the MiG made a critical mistake, opening himself up to a shot. Olds quickly took advantage of the opportunity and shot it down. Making a speedy return to base, he tallied his third and fourth MiG kills of the war.[3] However, Olds' experience of being unable to fire at the enemy was far from unique. As Marshall Michel put it in his book, *Clashes: Air Combat over North Vietnam*, "The North Vietnamese pilots were [regularly] exploiting the 'safe zone' – the approximately one-half mile in front of a Phantom created by the lack of a cannon."[4] In other words, the Air Force and the Navy needed to innovate.

This raises two questions: what drives professional militaries to tactically innovate during war, and is the desire to innovate a straightforward product of responding to losses in combat, or are other, more nuanced, factors involved? The answers to these questions are crucially important because tactical innovation itself has been critical to success in wars of the past. Key examples of this importance were Napoleon's use of column formations and artillery, which helped him dismantle countless coalitions; Guderian's use of armored divisions, which facilitated blitzkrieg defeated nation after nation in the Second World War; and, on the other side of that war, the rapid development of the convoy system and anti-submarine warfare, which allowed the Allies to defend merchant shipping across the Atlantic, delivering the aid that kept Britain in the fight.

Furthermore, instances of tactical innovation have been equally critical to deliver victory in the air. The advent and implementation of search radars allowed the British to successfully defend their island against a Nazi onslaught during the Battle of Britain, preventing an invasion of the home island. The same technology was adopted by the United States Navy in the Pacific theater to fend off wave after wave of kamikaze attacks during the war against Japan. Finally, the

[3] Ibid, pp. 309-311.
[4] Michel III, Marshall L, *Clashes: Air Combat over North Vietnam 1965-1972*, pp. 105-106.

development of long-range escort tactics allowed the USAF to successfully position its bombers and their warheads over German and Japanese cities. Furthermore, similar instances of tactical innovation will surely be required to achieve success in a rapidly changing aerial environment in the future.

Despite this importance, relevant scholarship investigating these questions has been both heavily divided and primarily focused on innovation at the strategic level instead of the tactical level. The heavyweight pieces at the strategic level are Professor Posen's *The Sources of Military Doctrine*, and Professor Rosen's *Winning the Next War*, which remain entrenched in a great debate surrounding the true origin of strategic innovation. On the other hand, literature emphasizing tactical military innovation has been extremely scarce. This is likley because controlling for losses when investigating tactical military innovation is often troublesome, making the process of objective investigation difficult.

However, the campaign for air superiority over Vietnam presents a unique opportunity to control for losses. Both the USAF and the USN had adopted the same airplane (the F-4 Phantom II) before the war began. They both fought the same enemy, the Vietnamese People's Air Force (VPAF), over the same location, and they experienced the same problem: the tactics that they had been trained to use, alongside the weapons they were given to fight with, were not getting the job done. Kill ratios, which were at 12:1 during World War II and Korea, then sat closer to 2:1 or even 1:1. For the United States, this was unacceptable: innovation, specifically tactical innovation, was necessary.

Both the Air Force and the Navy attempted innovation, but more importantly, the two branches had vastly different approaches to these innovations and therefore ended up with equally different solutions. **The purpose of this paper is to use both branches as case studies**

to investigate why they reached such different answers to practically the same problem. Once that has been discovered, this paper will use those findings to present credible hypotheses to the aforementioned questions which can be tested with additional cases through further research.

Moreover, through continued evaluation of kill ratios following the implementation of their solutions (a topic that will be examined in more detail later), it becomes clear that the Navy was markedly more successful than the Air Force. Why was this the case? In their evaluation of their initial performance, the Navy was able to set aside branch hubris and preconceived notions of what future aerial combat should be to address the root cause of the problem: poorly designed unit tactics, inadequate missile design, and poor aircrew training. The Navy launched comprehensive and objective investigations into weapons design and training protocols, identified their flaws, and – most importantly – acted decisively on the recommendations of said investigations. The Air Force, on the other hand, never launched an investigation as comprehensive as their counterparts, and even when minor inquiries identified flaws, their recommendations were largely ignored. In short, the US Navy became a flexible organization, while the Air Force remained remarkably sticky, and paid dearly for doing so.

The argument of this paper will proceed as follows: first, I will lay out the conceptualization of key concepts that must be understood to comprehend the rest of the paper, namely the differences between strategic and tactical innovations, what will count as tactical innovation, and the difference between innovation and invention. I will then outline the existing literature on tactical military innovation both within and outside the scope of the Vietnamese air war, and I will point out the gap left in that scholarship. Next, I will provide the necessary background information regarding the history of both branches, the air war itself, and basic air

combat principles of the time. Following this, I will analyze both cases and present my conclusions. The penultimate section will include the implications of the above conclusions on future conflicts, specifically a potential air war in the South China Sea, which is likely to be the next peer versus peer air theater. Finally, I will conclude with a summary of my arguments and thoughts for the future.

Conceptualization

This section will outline and define three key concepts necessary to understand this paper's purpose and arguments. More specifically, these concepts are the definitions of and the differences between tactical military innovation and strategic military innovation, the differences between tactical innovation and simple advancements in technology or adjustments to existing doctrine, and the key distinction between innovation and invention. Put more simply, this section aims to outline the specific subject of the argument itself and point out what does or does not count as tactical military innovation.

First, I will define both tactical and strategic military innovation and outline the key differences between the two. Both types of military innovation have to do with military doctrine – the way militaries plan to fight any conflict from entire wars to simple skirmishes. Strategic military doctrine is the more commonly understood and studied aspect of doctrine, especially within current academia. **Strategic military doctrine defines how militaries wage war at the most macroscopic level and includes war plans for current and potential conflicts for entire campaigns or theaters.** Notable examples include Germany's Schlieffen Plan in the First World War and the United States' island-hopping campaign in the Pacific theater in the Second World

War. Strategic doctrine plays a crucial role in deciding who will win an entire war and therefore gets a majority of the attention from military high commands and scholars.

Nevertheless, one cannot win wars on strategic doctrine alone. Although sound strategic doctrine may position a side to take favorable engagements, one must still win those engagements with sound tactical doctrine. Tactical doctrine is the microeconomics of military planning; it resides at the engagement level and dictates how division, squadron, and fleet units are to wage war against the enemy. Notable examples of tactical military doctrine are fire-by-rank tactics of the 18th and 19th centuries,[5] Germany's use of its panzer divisions within blitzkrieg warfare, or the United States' method of dismantling air defense systems during Operation Desert Storm. When planned and executed correctly, sound tactical military doctrine can take a neutral engagement position and turn it into a decisive one, or turn a losing scenario into a victory.

Despite this, tactical doctrine and its respective innovations receive significantly less attention from military commanders and scholars. This is due to a couple of reasons: first, from the perspective of the entire conflict, tactical doctrine has relatively less impact on the final outcome when compared to its strategic counterpart. Second, and more relevant to scholarly focus, tactical doctrine often requires a higher level of expertise and military background knowledge to fully understand and follow. Much of the scholarship on tactical doctrine is therefore done by historians and scholars within the military itself, often behind closed doors to maintain security of information. Despite this, it is still important for the civilian world to understand and track developments of tactical doctrine as it allows for better comprehension of the conduct of past wars and how we may expect the way war is fought to change in the future.

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[5] Posen, Barry R, *The Sources of Military Doctrine*, p. 77.

The second key conceptualization is understanding the differences between tactical innovation itself and simple advancements in technology or slight adjustments to existing doctrine. In other words, it is critical to outline what counts as tactical military innovation from the perspective of this paper. To best understand what truly makes up tactical military innovation, we must first understand what it is not. Tactical innovation cannot simply be the incorporation of a new military technology without any change to how that technology is employed by warfighters. A good example of this was the advancements in tank warfare technology between the two World Wars. In the interwar period, armored technology advanced for every great power, but the powers vastly differed in how they employed their improved tanks. British strategists designed their tanks to remain attached to the standard foot soldiers during the battle. This was not innovative in the slightest, but rather the British seemed intent on reusing tactics of the last war. On the other side, as briefly mentioned above, Heinz Guderian and other members of the German High Command developed armored divisions that were largely independent of foot infantry units, allowing for rapid advance across the battlefield.[6] This is a prime example of tactical innovation – taking an advancement in technology and changing the way the warfighters use it to create advantages. The disparity in results speaks for itself: in 1940 the Germans routed the combined British and French armies with ease.

Additionally, there are key distinctions between tactical military innovation and simple adjustments in pre-existing doctrine. For a change to be truly "innovative," pre-existing doctrine must be replaced entirely or, at the very least, fundamentally altered. To use a hypothetical example from the subject of this paper, if a standard USAF MiG CAP mission was typically flown with four F-4 Phantoms, and the Air Force adjusted their tactics to mandate a minimum of eight Phantoms instead, this would not be considered innovation. For an adjustment to the Mig

[6] Posen, *The Sources of Military Doctrine*, p. 88.

CAP doctrine to be counted as tactical innovation, the fundamental way aircrew were trained to execute the mission or characteristics of how the mission was to be flown must be fundamentally altered. An example of such an adjustment would be loosening the rules of engagement (ROE) to allow pilots to fire beyond-visual-range (BVR) to better take advantage of their longer-ranged missile systems.

Therefore, to be counted as tactical military innovation, a change in planned execution must take place that exceeds simply replacing old technology with something new or slightly adjusting pre-existing doctrine. However, it is important to caveat this concerning the cases of this paper: the relationship between new technology and doctrinal innovation can be blurry and dynamic. The tactical innovations made by both the USAF and the USN during the war over Vietnam were oftentimes strongly affected by advancements in technology. Likewise, technological advancements were often driven by innovational needs where current technology fell short of requirements. This relationship will be discussed further in the case study sections of this paper.

The final distinction that delineates what counts as tactical military innovation is the difference between innovation and invention. There were many cases of invention throughout the air war in Vietnam where mid-tier commanders attempted novel ideas and momentary tactical shifts in an attempt to gain advantages. The best example of such an invention was Colonel Robin Olds' planning and execution of Operation Bolo in 1967.[7] However, such operations were not feasible to replicate due to their requirements for execution. Furthermore, deceptive

[7] Olds, *Fighter Pilot*, pp. 271-283. The plan for Operation Bolo was to clear the airspace of all US aircraft not involved in the operation in order to take advantage of the F-4's beyond visual range (BVR) capabilities. In order to lure the MiGs up to fight, Olds acquired special electronic countermeasures pods that had previously only been used by F-105 Thunderchiefs (the main USAF strike platform). Vietnamese ground controllers would see the pods' emissions and send the MiGs up to fight what were presumably defenseless F-105s. Operation Bolo was the most successful single aerial engagement for the USAF of the entire war, leading to the destruction of six MiG-21s for no American losses.

operations have short windows of opportunity that close as soon as the enemy catches on to the ruse. Instead, innovation must fundamentally alter how the entire organization operates on a long-term basis. In other words, true innovation changes the whole system instead of creating an exemption within the system.

Literature Review

In this section, I will outline the existing literature on military innovation and point out the gap it leaves. More specifically, I will show that there are two bodies of literature on innovation by professional militaries in war: strategic innovation and tactical innovation. I will further show that the first has been highly developed, while the second has received far less attention. Further, I will explain why the causes of tactical innovation are unlikely to simply be a reflection of the causes of strategic innovation.

As mentioned in the previous section, the majority of the scholarship on military doctrine and innovation focuses on strategic military innovation. This is because strategic doctrine is easier to understand and analyze without a comprehensive background in niche military tactics. Additionally, strategic doctrine has a larger impact on the course of a war, so there is increased attention placed on understanding what makes successful strategic doctrine. Although I aim to focus on the tactical side of military innovation, it still makes sense to examine the literature studying strategic innovation to determine where the two align and differ.

A foundational debate has been running through the last four decades within the study of strategic military doctrine. In one corner, MIT Professor Barry R. Posen argues that innovation of strategic military doctrine can be best understood through the frameworks of organizational theory and balance of power theory.[8] He uses these frameworks to examine one key case: the

[8] Posen, *The Sources of Military Doctrine*, p. 34.

battles of 1940 and the preceding planning actions during the interwar period from the perspective of France, Britain, and Germany. Through this examination, Posen argues that needed innovation comes in the form of "political mavericks," who are civilians that interject into military affairs to advocate in favor of new doctrine when they recognize that current doctrine will lead to defeat.[9]

In the other corner of the debate stands Stephen Peter Rosen, who argues the opposite. Rosen argues that civilian leadership lacks the expertise required to effectively understand and dictate military doctrine.[10] Instead, he claims that it is military leadership that formulates new doctrine through careful consideration of the requirements of the next war.[11] In other words, Rosen rejects the premise that civilian authorities will have the insight, understanding, or capabilities necessary to significantly alter the path of military doctrine. Instead, "military innovation occurs when respected senior military officers formulate a strategy for innovation, which has both intellectual and organizational components."[12]

Although both Posen and Rosen make their claims from the standpoint of strategic military doctrine, their positions are not irrelevant to the realm of tactical military innovation. Despite not making the connection themselves, it is certainly feasible that some of their presented sources for innovation could occur in the tactical realm. However, it is crucial to point out that these connections do not imply that all causes of strategic innovation are the same for tactical innovation. For example, Posen's argument that political mavericks could insist upon innovating upon their nation's strategy makes little sense at the tactical level, as the civilian leadership will have little to no comprehension of battlefield tactics and unit capabilities. Instead,

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[9] Posen, *The Sources of Military Doctrine*, p. 239. For additional explanation of Posen's argument, see Stephen Peter Rosen's, *Winning the Next War*, p.10.
[10] Rosen, *Winning the Next War*, pp. 10-11.
[11] Ibid, pp.19-22.
[12] Ibid, p. 21.

Rosen's argument that civilian leadership likely lacks the necessary knowledge and expertise to issue such a command carries more weight and reasonably applies at the tactical level. It seems more likely that such a maverick would have to arise from within the military itself to understand both the current tactical shortcomings and the pathway to improve.

The rest of the existing literature examined in this section places significant emphasis on tactical military innovation, but the works do so in a variety of different ways. There are a great number of excellent histories that provide descriptions of the events and actions taken by the USAF and USN during the air war over Vietnam. There are also several memoirs of individual pilots that act as primary source insights into why specific decisions were made and actions were taken. Furthermore, there is a great deal of primary source material such as military investigations and reports that provide additional technical insight into the minds of USAF and USN leaders at the time. Finally, there is a very limited amount of scholarly literature that addresses the tactical environment in the air over Vietnam. All of these categories leave gaps that ought to be addressed. I will now outline each of these in more detail to distinctly point out where such gaps exist.

The first category of literature that begins to address tactical military innovations within the air war over Vietnam is the histories that provide descriptions of key events throughout the air war. Three of the best and most relevant pieces within this category are R. Frank Futrell's *Aces and Aerial Victories: United States Air Force in Southeast Asia*, Commander John B. Nichols and Barrett Tillman's *On Yankee Station: The Vietnam Naval Air War*, and Marshall L. Michel's *Clashes: Air Combat Over North Vietnam 1965-1972*. Futrell's work on the Air Force's battle for air superiority paints a good picture of the situation the USAF was dealing with, and the stories provided by aircrew give added insight into the battles that occurred. However, as the

book is primarily a history, there is little to no argument or analysis. Nichols and Tillman's work on the Navy's history over Vietnam and Michel's general history of the air war provide excellent descriptions of events. These allow the reader to better understand and orient themselves in the timeline of the conflict, but they provide little in terms of scholarly analysis. Michel begins to approach the borders of analysis at certain points throughout his book, describing key operational differences between the Navy and the Air Force, but he does not reach the level of detail required to fully explain the disparity in results over time.[13]

The next category of literature that begin to address tactical innovation above Vietnam is the set of primary sources from individual aircrew and military investigators within both branches. These also take a wide variety of forms from memoirs to official declassified reports. Key memoirs from aircrew include Robin Olds' *Fighter Pilot* from a USAF point of view and Dan Pedersen's *Top Gun: An American Story* from a USN perspective. Both of these memoirs provide valuable information regarding what happened in the air, which gives equally valuable insight into the improvements made. Moreover, because both authors were in mid-level leadership positions during the Vietnam War, they both had opportunities for both invention and innovation. Their leadership positions also allowed them to witness and document key decisions made by their superior officers. One could argue that Pedersen was a leading innovator during the war, as he founded the Navy's Fighter Weapons School, more commonly referred to as Topgun. However, these sources also have weaknesses: the memoirs do not provide scholarly analysis, and they are both only from the perspective of one branch. In other words, when standing alone, they do not cover the whole story for this paper. Despite their individual shortcomings, when put together, they are incredibly effective sources for further analysis.

[13] Michel, *Clashes,* pp. 181-188.

Other available primary sources are also important for further analysis. The most important among these are the Navy's exhilaratingly-named "Report of the Air-To-Air Missile System Capability Review," more famously referred to as "The Ault Report" for its author, Captain Frank Ault, and the Air Force's Southeast Asia Counter-Air Alternative (SEACAAL) report. Both of these reports were the findings of investigations launched in both branches to find the root causes of sub-par performance by both aircrew and their weapons systems during the beginning years of the air war. The Ault Report was substantially more comprehensive, addressing issues across the board instead of simply weapons systems. However, like the histories and the memoirs, these pieces serve much better roles as sources for further analysis than as standalone works.

The final category of literature that addresses tactical innovation is a small set that addresses both innovation in the skies above Southeast Asia and tactical innovation more broadly. The subset of pieces that address tactical innovation more broadly includes Stephen Biddle's book, *Military Power*, and Timothy T. Lupfer's article titled "The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War." Biddle argues that warfare is rarely, if ever, on the verge of revolution, and therefore radical changes in doctrine are oftentimes unnecessary or undesirable.[14] Next, Lupfer investigates tactical changes made by the German army on the Western Front from 1917 to the end of the war and concludes that tactical innovations often do not come until an impetus is created by disadvantages or unacceptable losses.[15] Once an impetus is achieved for innovation, it becomes implemented through decisive leadership from within. Lupfer also warns that, when evaluating tactical innovations for their success, one must always also factor in the response of the enemy and that

[14] Biddle, Stephen. *Military Power*, p. 206.
[15] Lupfer, Timothy T. "The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War." pp. 55-58.

response's effect on the innovation itself.[16] While these both provide unique arguments to the world of tactical military innovation, they lack generalizability to other scenarios without adaptation. In other words, these provide a strong foundation that must be tailored further to be analyzed in the context of this paper.

The other subset of scholarly literature specifically addresses tactical innovation in the skies above Vietnam. Robert Pape's *Bombing to Win* is one example of such a text. *Bombing to Win*'s Chapter Six addresses the struggles of the USAF's strategic bombing campaign over the North to cripple or affect the North Vietnamese war effort, concluding that the North Vietnamese were simply invulnerable to such a campaign until they began to fight the war conventionally in 1971 and 1972.[17] The book provides an excellent description of the overall objectives of the air campaign but does not directly address the campaign for air superiority or the struggles therein.

Steven A. Fino's "All the Missiles Work," Richard P. Hallion's "A Troubling Past: Air Force Fighter Acquisition Since 1945," and Jim Cunningham's "Rediscovering Air Superiority: Vietnam, the F-X, and the 'Fighter Mafia'" all fit into a category of scholarly articles directly related to the fight for air superiority over Vietnam. All three of these make important and relevant arguments: Fino argues that the Air Force's obsession with technological superiority led to a hyper-fixation on underdeveloped missile technology for frontline fighter aircraft.[18] Hallion and Cunningham both argue that the dominance of Strategic Air Command (SAC, or the branch of the Air Force that oversaw strategic bombing campaigns) over Tactical Air Command (TAC, the branch dealing with tactical air strikes and air superiority) led to TAC becoming ill-prepared for an environment like the one that appeared over Vietnam.[19] All of these arguments provide

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[16] Ibid.
[17] Pape, Robert. *Bombing to Win*, pp. 174-210.
[18] Fino, Steven A, "All the Missiles Work: Technological Dislocations and Military Innovation," pp. 73-86.
[19] Cunningham, Jim, "Rediscovering Air Superiority: Vietnam, The F-X, and the 'Fighter Mafia,'" pp.1-2. And Hallion, Richard, "A Troubling Past: Air Force Fighter Acquisition Since 194." pp. 4-16.

valid conclusions as to why the Air Force struggled early on in the air war, but they lack the same level of detail on the period following Operation Rolling Thunder, where the USAF had time to step back and analyze the previous years. Moreover, they do not provide any comparison with the Navy and its efforts to improve following Rolling Thunder.

With the preexisting scholarship now laid out, I will now outline the gap left by this literature that this paper aims to fill. The tactical successes and failures of the USAF and USN, as well as tactical military innovation more broadly, have been widely examined. What has not been studied is how and why these successes and failures differed so vastly following Operation Rolling Thunder, specifically concerning the development of tactics for squadrons flying the F-4 Phantom II. The rest of this paper aims to investigate in detail the innovations attempted by each branch as well as the rationale driving such innovations. Then, I will outline the key reasons why the Navy's innovations led to more success than those of the Air Force.

Context and Background

Before analyzing the two cases, it is first necessary to outline the critical context and background of aerial warfare in the 1960s and 1970s. Without such, it would be nearly impossible for readers who do not have a comprehensive and nuanced background in air power to understand the root causes of the struggling campaign for air superiority or the attempted solutions to these struggles.

The first piece of context that is necessary to understand is the relationship between Strategic Air Command (SAC) and Tactical Air Command (TAC) in the years leading up to the war in Vietnam as well as during the war itself. As mentioned above, Strategic Air Command is the department of the Air Force that oversees strategic bombers and their campaigns. Established

following the end of World War II, SAC was set up to plan and execute strategic nuclear strikes against the Soviet Union during the Cold War. At the same time, Tactical Air Command was formed, but they were tasked with all of the other mission sets besides strategic bombing. This included traditional missions such as air superiority, close air support (CAS), battlefield air interdiction (BAI), and others.

However, as jet technology improved, allowing strategic bombers to fly farther and faster than ever before, Air Force leadership became hyper-fixated on the nuclear strike mission. If all future wars were going to be nuclear wars, top brass leaders such as Curtis LeMay saw little purpose or use for the other mission sets covered by TAC. In their eyes, TAC ought to solely focus on two tasks: intercepting enemy nuclear bombers and escorting our own to their targets. Cunningham describes these motivations and their effects well in his description of the Air Force's priorities before Vietnam: "The ideas and doctrines of the American government and military were preoccupied with an over-emphasis on nuclear warfare. For [TAC], this meant playing second-fiddle to the 'Bomber Mafia' of the Strategic Air Command."[20]

Once TAC was subordinated to SAC, their mission sets and aircraft design were heavily affected. Hallion's article on fighter jet acquisition since World War II provides the best description of these effects. He describes the USAF acquisition of the century-series (the fighter aircraft designed and purchased in the late 1950s) as follows: "With [one] exception…the Air Force's century-series fighters were either interceptors…or, on the other hand, nuclear-strike aircraft."[21] Five out of six century-series fighters were designed for only two roles: nuclear strike and interception. This emphasis on interception, escort, and nuclear strike within TAC fundamentally changed how fighter aircraft were designed to fly. Previously critical

[20] Cunningham, Jim, "Rediscovering Air Superiority," p. 1.
[21] Hallion, "A Troubling Past," p. 9.

characteristics of a fighter aircraft such as maneuverability, cockpit visibility, and even the inclusion of internal cannons were subordinated to new characteristics critical to the interception mission, such as high top speeds, climb rates, and long-range missile capabilities.

Furthermore, the training for fighter pilots during that time was completely overhauled. With the advent of long-range missiles, most USAF and USN leadership saw the days of the dogfight as over, and therefore close-range aerial combat was seldom practiced. A quote from General Bruce K. Holloway in 1968 demonstrates the mindset of the Air Force training regimen:

> Between 1954 and 1962, the USAF training curriculum for fighter pilots included little, if any, air-to-air combat. This omission was partly a result of doctrine, which then regarded tactical fighters primarily as a means for delivering nuclear ordinance…It was [also] partly a reflection of concern for flying safety. In any event, as late as October 1963, it was reported that only four of 30 pilots in one fighter squadron had ever shot aerial gunnery.[22]

Although this had positioned the USAF well for the execution of nuclear war plans, it left the entire branch, and especially TAC, completely unprepared for the kind of air war that was fought over Vietnam.

It is important to note that the departmental separation between SAC and TAC only occurred in the USAF, but a similar phenomenon occurred in the USN. The Navy placed much less emphasis on the nuclear delivery mission, although it did exist for the Navy, and instead focused much more heavily on interception and fleet defense from Soviet bombers, who might attempt an attack with long-range anti-ship missiles. Therefore, the same design characteristics that were emphasized by the USAF were paramount for the USN, and air combat maneuvering (ACM) training was also largely forgotten.

This brings us to the second piece of necessary context: we must also consider how the F-4 Phantom II was originally designed to be flown. Designed in 1958, the Phantom was an

[22] Hallion, "A Troubling Past," p. 15.

interceptor, originally built for fleet defense interception for the Navy.[23] It possessed Mach 2 capability in conjunction with a capable radar to fire and guide the Navy's new long-range missile, the AIM-7 Sparrow, at ranges up to 20-25 miles. The Phantom was also equipped with the shorter-ranged AIM-9 Sidewinder for closer engagements between a third of a mile and 2 miles in range. However, the AIM-9 sidewinder was guided by an infrared seeker, which meant a pilot could only fire it from behind his opponent, as it had to lock on to the heat signature emitting from the rear of their aircraft.[24] Although originally designed for the Navy, the Phantom was forcibly adopted by the Marine Corps and the Air Force during the McNamara era.[25] Air Force Phantoms were largely unchanged from their Naval relatives. This made the Phantom the standard front-line fighter jet for the entire US Military.

The Phantom was designed to be employed as follows: following takeoff, pilots were to climb to altitudes exceeding 30,000 feet and accelerate to Mach 2 to intercept Soviet bomber formations. In the back seat, the WSO (weapon systems officer), or RIO (radar-intercept officer) in the Navy, was supposed to acquire and lock the bombers with the radar, allowing the Phantom to fire Sparrow missiles beyond visual range. After one or two bombers were destroyed in the forward quarter (while they remained in front of the phantom), the pilots were instructed to maneuver behind the remaining bombers and use their AIM-9s to shoot down any "leakers". In short, the Phantom was designed to shoot down unmaneuverable bombers at high altitudes using its superior speed, climb rate, and range. It was not designed to fight maneuverable aircraft at low altitudes within visual range.

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[23] Nichols, John B. and Tillman, Barrett, *On Yankee Station: The Naval War Over Vietnam*, Naval Institute Press, 1987, pp. 71-72.
[24] Futrell, R. Frank, *Aces and Aerial Victories: United States Air Force in Southeast Asia*, Air University, 1976, pp. 155-159.
[25] Hallion, "A Troubling Past", pp. 10-11.

This brings us to the final piece of important context: how the air war over Vietnam was fought in actuality. Both branches faced a common opponent, the VPAF. The North Vietnamese possessed seventy fighter jets by June of 1965, and that number would further rise with the addition of Soviet MiG-21s, codenamed the Fishbed, later that year. While the MiG-21 was a fearsome and contemporary adversary for the F-4, the rest of the Vietnamese aerial fleet was comprised of older, slower, but more maneuverable MiG-17 Frescoes.[26] Although the Fresco did not seem like a match for a Phantom on paper, it specialized in what the Phantom could not: low-speed, close-ranged dogfighting. If forced into a close-range fight, the MiG-17 could easily outturn an F-4 and exploit the advantage gained through the use of its internal cannons.[27]

However, on paper, a Phantom would never have been forced into a close-in fight, as it should have been able to destroy the MiG beyond-visual-range with its radar and AIM-7s. In reality, the rules of engagement over North Vietnam prohibited the use of any missiles beyond-visual-range due to fear of friendly fire on unidentified aircraft. When assessing the Sparrow missile's effectiveness in combat, Nichols and Tillman wrote, "Even when it might have worked, the rules of engagement often militated against its use. Visual identification of bogies was a cornerstone of fighter ROE, but the Sparrow was designed to shoot down radar blips – not close-in, maneuvering fighters."[28] Phantoms were forced to get close enough to "bogies," unidentified radar contacts, to visually confirm that they were hostile. By that time, the range had closed so much that it was too late to employ AIM-7s, forcing the aircraft into a dogfight. This forced the Phantom into the MiG's world, and therefore also the MiG's ideal fight. Furthermore, the Phantom's other weapon, the AIM-9 sidewinder, also proved ineffective in this arena. Michel writes, "The Sidewinder did have some disadvantages…[it] had been tested against relatively

[26] Nichols, John B. and Tillman, Barrett, pp. 67-68.
[27] Ibid, p. 72.
[28] Ibid, p. 77.

non-maneuvering bomber targets at high altitude; the AIM-9's performance against low-altitude or maneuvering targets was still unproven."[29] Pilots described the sidewinder as not being able to pull enough G's to hit a target in a tight turn and also complained about its small launch envelope.[30]

Therefore, the beginning of the air superiority campaign over Vietnam took the Americans' prime front-line fighter and placed it in its weakest position against an enemy outclassed in every arena except the one the Phantoms were forced to fight within. Moreover, since pilots rarely received substantial training in close-range aerial combat, the aircrews flying the Phantoms were significantly less experienced than their Vietnamese counterparts in the art of dogfighting. This led to the initial struggles and poor exchange rates throughout the first years of the air war during Operation Rolling Thunder.

Case Analysis

Now that the critical concepts have been defined and the essential context has been outlined, we may analyze the two branches' attempted solutions to their early struggles. These two case studies will begin following the end of Operation Rolling Thunder, during which both the USAF and USN participated and struggled to achieve outright air superiority over North Vietnam. At the end of Rolling Thunder, the Air Force's kill ratio against MiGs over the North was roughly 2:1,[31] and the Navy's was roughly the same.[32] The period following Rolling Thunder saw a significant slowdown in air operations over the North as both sides shifted their focus to

[29] Michel, *Clashes*, p. 14.
[30] Fino, "The Gun Resurrected," p. 78. The AIM-9 had an incredibly restrictive launch envelope. In order to guide correctly, the missile had to be fired while the aircraft was under 2G or less, a state that fighter jets rarely found themselves in during intense turning engagements at high speeds.
[31] 50-Year Anniversary of Operation Rolling Thunder," Rolling Thunder Remembered, accessed April 6, 2025, https://www.rollingthunderremembered.com/50-year-anniversary-operation-rolling-thunder/.
[32] Nichols and Tillman, *On Yankee Station*, p. 80.

the South and negotiations for peace. This allowed both branches to stand back and assess what went wrong. Michel described this opportunity best when he wrote, “The judgments about air-to-air combat during Rolling Thunder were a Rorschach test for the U.S. Air Force and Navy, and the two services drew almost exactly the opposite conclusions from their battles with the MiGs.”[33]

The Air Force

Overall, the Air Force's solutions to struggles during Rolling Thunder remained primarily technical; the USAF attempted to solve problems by implementing improved technologies that could change how pilots fought in the Phantom. There had been attempts to fix issues before Rolling Thunder even ended. As mentioned earlier, Robin Olds had a brief moment of invention during Operation Bolo, using deceptive tactics to bait the MiGs into attacking Phantoms already waiting for a fight. However, such tactical shifts were not sustainable in the long term, as the entire airspace above the North had to be cleared of any U.S. aircraft that were not taking part in the operation to ensure the identification of friend and foe.

Another Air Force Commander, Colonel Frederick ‘Boots’ Blesse, made the first USAF attempt at tactical innovation for the F-4. Upon arriving at the 366th Tactical Fighter Squadron, he requested and received permission to install the SUU-16 20mm gun pod, an attachable external cannon, on their Phantoms to provide a cannon to be used in combat.[34] This was a highly contentious and controversial change. Up until that point, the Phantom community had been incredibly divided on whether or not the addition of a cannon on the Phantom would be a net positive or negative for aircrew performance. On one side of the debate, pilots like Robin Olds and Captain Kenneth Holcombe warned that the addition of a gun would tempt Air Force

[33] Michel, *Clashes*, p. 181.
[34] "The Gunfighter Name," 366th Gunfighters Association.

fliers to get in close to shoot down MiGs, an arena in which the Phantom already had real disadvantages against the MiG.[35] In his article, Fino quotes another pilot who remarked, "If you are in a position to fire [the gun], you have made some mistake."[36]

However, other pilots argued that the lack of cannons was being constantly exploited by MiG pilots. As mentioned at the beginning of this paper, Michel described that MiG pilots constantly exploited the "safe zone" that extended out roughly one-half mile in front of any Phantom due to the lack of a gun combined with the minimum ranges required for missiles.[37] This was backed up by a report from the SEACAAL investigation that wrote, "The lack of a gun on the F-4 is considered one of the factors for the low kill rate in the MiG encounters."[38] Resultantly, Colonel Blesse got his wish, and the installation of gun pods on F-4s was approved. These augmented F-4s had some initial success: "During the period April 23 - June 5, 1967, eleven MiG's were downed by aircrews of the 366th Tactical Fight Wing – four to the 20 mm guns. No USAF Tactical Fighter Wing downed as many aircraft in such a short period in the entire eight years of the air war in the skies over Southeast Asia."[39]

In addition to the installation of gun pods on Phantoms, the Air Force had also approved the design of an entirely new F-4 variant, the F-4E, which possessed an internal cannon in the nose. The impetus for the F-4E came from Col. John Burns, who requested the internal gun because "we became concerned that [the Air Force was] putting too much reliance on missiles

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[35] Fino, "The Gun Resurrected," p.75. Fino quotes Holcombe, writing "adding a gun to the F-4 'will just get people into trouble' by tempting aircrews to get dangerously 'low and slow' with the MiGs." Robin Olds seconded this notion on multiple occasions throughout the chapters on Vietnam in his memoirs.
[36] Fino, "The Gun Resurrected," p. 76.
[37] Michel, *Clashes*, p. 106.
[38] Fino, "The Gun Resurrected," p. 84.
[39] "The Gunfighter Name," 366th Gunfighters Association.

alone."[40] These first arrived over the North shortly after the conclusion of Rolling Thunder and tallied up a total of seven kills with their cannons throughout the war.[41]

The implementation of cannons on Air Force Phantoms did allow for aircrews to fly a fundamentally different way: they no longer had to worry about MiGs exploiting the minimum ranges of their missiles, and could now close in the range while still allowing opportunities for a kill. However, these implementations came with drawbacks. The gun pods were difficult to aim, as the Phantom variants that carried them lacked a lead-computing gunsight, and they added drag to the plane, making the Phantom even more difficult to maneuver in engagements.[42] On the F-4E, the implementation of the internal gun forced the Air Force to use a smaller and less powerful radar, which made finding targets at long range increasingly difficult. Moreover, the F-4E was less maneuverable due to the increased weight of the cannon and its ammunition in the nose, something that was feared by anti-cannon aircrews even before their implementation.[43] Therefore, although the gun was useful in several engagements throughout the war, it was not a game-changing solution.

The addition of cannons to their Phantoms was not the only technical solution attempted by the Air Force during and after Rolling Thunder. Throughout the entire war, the USAF was constantly trying to improve the missiles that they had previously believed were the end-all-be-all of aerial warfare. Improvements in missile technology had the potential to truly change air combat – if the missiles could do the work instead of the airplane, the Phantom's disadvantage in dogfights would disappear. However, for the Air Force, the impetus for these

[40] Fino, "The Gun Resurrected," p. 84.
[41] Michel, *Clashes*, p. 181. And Cunningham, "Rediscovering Air Superiority," p. 2.
[42] "The Gunfighter Name," 366th Gunfighters Association.
[43] Fino, "The Gun Resurrected," p. 76.

attempts was not always rooted in a desire for improvement. Moreover, they were almost all unsuccessful.

The first of such attempts to improve missile technology came about halfway through Operation Rolling Thunder. As described in the context section, the primary short-range weapon for the F-4, before the implementation of cannons, was the AIM-9 sidewinder. Nevertheless, the Air Force attempted to replace the AIM-9 with a new missile, the AIM-4 Falcon. The reason for this change was not a desire for better missile performance, but rather it came out of branch hubris.[44] The AIM-9 Sidewinder was a Navy missile – it had been designed and implemented first by the Navy. In many respects this made the USAF look bad, and its top leadership pushed for the AIM-4, which had been developed and used entirely by the Air Force, to be the heat-seeking missile of choice for the F-4D (the Phantom variant preceding the F-4E). However, the AIM-4 was hated by the pilots. Although, on paper, the AIM-4 was supposed to improve on many of the features of the AIM-9, the reality was starkly different, and the missile performed terribly in combat, only tallying 5 kills throughout the entire war. Olds famously referred to the AIM-4 as "a piece of shit."[45] This confirmed to the Air Force that the Sidewinder truly was the future, and they began designing their own variants of the Navy missile.

This, too, did not pan out well for the Air Force. Since they had selected the AIM-4 in the F-4D variants, the USAF had elected not to accept the new AIM-9D variant from the Navy, a missile that was effective by multiple accounts.[46] The reason for the departure from the new

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[44] Michel, *Clashes*, p. 172.
[45] Ibid, "pp. 110 and 155-156. Additionally, Nichols and Tillman, *On Yankee Station,* p. 78. The AIM-4 had to be armed prior to being available to fire, which allowed coolant to flow into the seeker-head. This allowed the missile to have an improved sensor over the AIM-9. However, the coolant would only last for a matter of minutes, and once it was expended, the missile effectively became an oversized paperweight. This forced Phantom pilots to guess when they would need their AIM-4s. Additionally, AIM-4s had to directly impact the target, while AIM-9s just had to get close with their proxy fuse. All of these factors combined for a terrible performance rate over the North for the AIM-4.
[46] Nichols and Tillman, *On Yankee Station*, p. 76.

Sidewinder was that the AIM-9D required its coolant to be stored in the pylons it rested on. When the USAF declined to include space for coolant in the F-4D pylons, "Navy AIM-9s [became] incompatible with Air Force AIM-9 rails and vice versa.[47] This forced the USAF to develop their own Sidewinder, the AIM-9E. However, relative to the previous variant, the AIM-9B, "the E incorporated only a few modified components…These limited modifications still left the AIM-9E's performance well below the AIM-9D."[48] Therefore, the AIM-9E could not solve the Air Force's missile problem, leaving them behind further than their counterparts.

This motivated the USAF to develop an even newer and improved Sidewinder: the AIM-9J. Despite this realization, this attempt would also be unsuccessful . After initial testing did not meet expectations, and in a sequence of events that only goes to display the USAF's poor leadership and priorities at the time, "the test program was stopped and the entire AIM-9J program put on hold, reflecting the low priority the Air Force gave to air-to-air combat."[49] Even after the AIM-9J program was restarted and the missile was deployed to Phantoms over the North, it still only had a 13% hit rate.[50] In the end, the Air Force was unable to solve their air superiority issue through innovations in their missile technology, largely because their attempts to improve said missiles were fueled by the wrong intentions and ultimately proved unsuccessful.

There were several other technical innovations proposed and attempted by the Air Force following Rolling Thunder. One such example was the implementation of a modification codenamed Combat Tree, which was considered by some to be "[t]he most important F-4 modification [of the war]."[51] Combat Tree allowed F-4s to effectively IFF (Identify Friend or Foe) unknown radar contacts to confirm if a contact was hostile, theoretically allowing F-4s to

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[47] Michel, *Clashes*, p. 156.
[48] Michel, *Clashes*, pp. 182-183.
[49] Ibid.
[50] Ibid, p. 278.
[51] Ibid, p. 181.

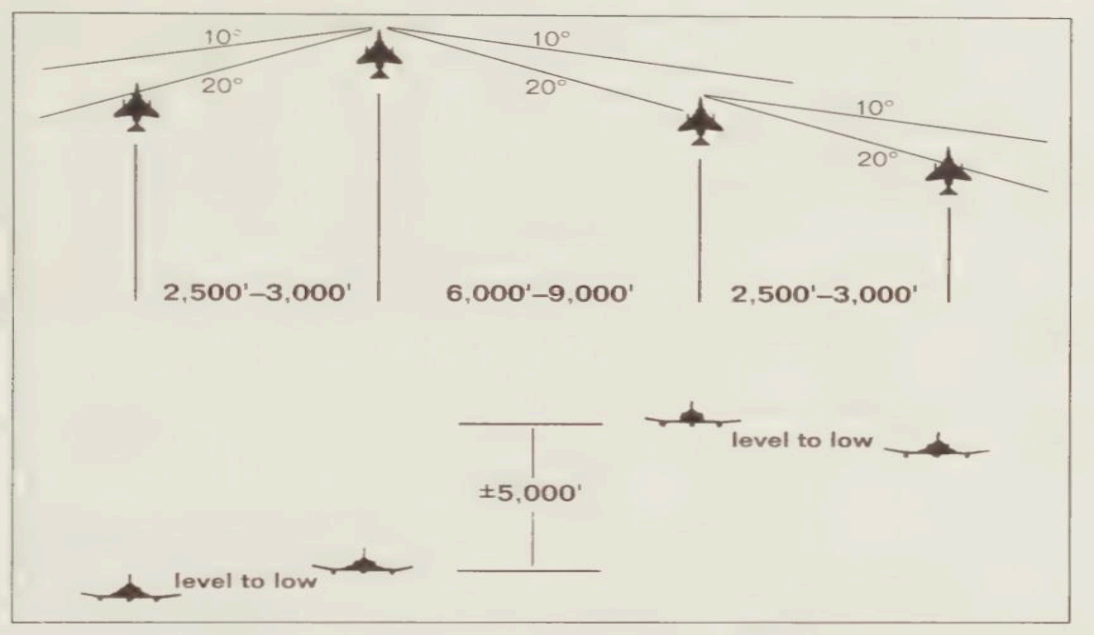
finally exploit the advantageous long range of their AIM-7s. However, the effect of Combat Tree was not as significant as Air Force leadership might have hoped. In the period following Rolling Thunder, "281 AIM-7E2 dogfight Sparrows had been fired and had scored about 34 kills, for about 12%: the percentage of hits was about the same for both services."[52] It is important to note that the Navy did not provide Phantoms with Combat Tree modifications. Therefore, if Combat Tree had provided Air Force Phantoms a better ability to utilize the long range of the Sparrow, the hit rates for the USAF should have been significantly higher than the USN, as they would have been able to employ them more successfully and more frequently within the proper firing envelopes. This was not the case, and Combat Tree did not solve the Air Force's problem.

The final technical solution attempted by the USAF following Rolling Thunder was the Teaball program. Teaball was a ground controller intercept (GCI) program that was designed to give Phantom crews radio warnings when MiGs were spotted on search radars in a position to ambush the Phantoms. Notably, in the period after Teaball was implemented, the USAF experienced some of its best exchange rates with the MiGs of the entire war. Due to this perceived improvement, Teaball has received much praise for fixing the USAF's poor exchange rate in the last few months of the air war. In reality, the program's effects have been largely overstated. Among the GCI programs operating at the time, Teaball was rated as the least effective by pilots.[53] Additionally, their radios were unreliable and often too slow to convey warnings in time. The real factors that led to the improved kill ratio were a combination of poor Vietnamese pilot performance, increased U.S. aircrew experience over the North, and the improving effects of the newly effective bombing campaign at deteriorating VPAF sortie rates

[52] Michel, *Clashes*, p. 279.
[53] Ibid, p. 284.

(readiness).[54] In the end, none of the Air Force's technical solutions showed any progress in remedying their exchange rate problem over the North.

This poses a final question: what non-technical innovations were attempted by the USAF during the period following Rolling Thunder? The answer is quite simple – *none.* As Michel puts it, "The Air Force essentially ignored the possibility of improving their air combat results by examining their training and tactics."[55] In fact, an argument can be made that the Air Force actively prevented itself from making any innovations in air-to-air tactics or training. There are two reasons for this: air-to-air combat stood relatively low on the Air Force's list of priorities and the alternatives heralded from its rival branch, the Navy. A prime example lies in the formations that the USAF and USN flew over North Vietnam. The USAF used the same formation they had flown in over World War II and Korea: the fluid four, shown below.

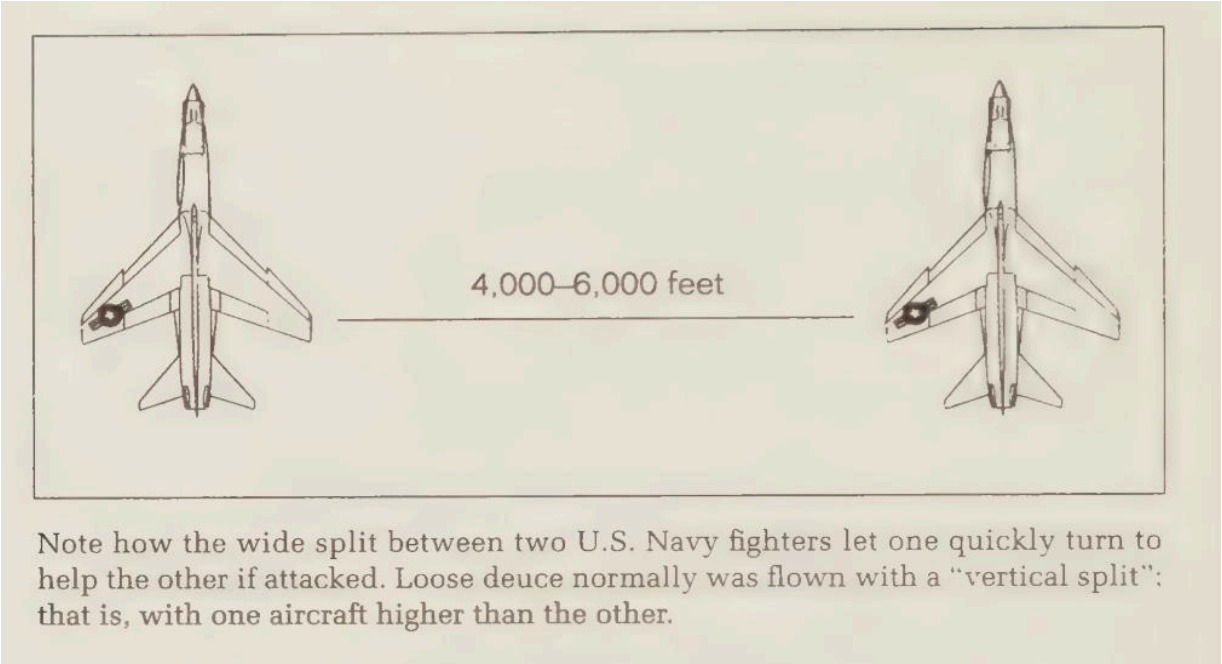


The Fluid Four Formation[56]

[54] Michel. *Clashes*, pp. 282-285.
[55] Ibid, p. 183.
[56] Michel, *Clashes*, p. 171.

In this formation, the most senior pilots flew the number one and three airplanes, while the wingmen flew the two and four airplanes, which were expected to remain attached to their leads at all times to provide cover. In reality, this placed the 3 and 4 as cannon fodder to protect the lead element, as an enemy approaching from behind would be in the range of the rear-most aircraft first. Additionally, fluid-four tactics dictated that the lead pilot was to be the "single shooter," thus limiting the number of missiles that could be employed by the four Phantoms at any given moment.[57]

On the other hand, the Navy flew their Phantoms in what was referred to as the loose-deuce formation, shown below:



Note how the wide split between two U.S. Navy fighters let one quickly turn to help the other if attacked. Loose deuce normally was flown with a "vertical split": that is, with one aircraft higher than the other.

The USN Loose Deuce Formation[58]

As Michel describes in his history, "[the loose deuce] was easy to fly, the space between the aircraft allowed the formation to operate at full power, and the relatively long distance between

[57] Ibid.
[58] Michel. *Clashes*, p. 170.

the aircraft gave each crew plenty of chances to look for enemy fighters."[59] Additionally, once engaged by fighters, all aircraft in the formation were authorized to fly freely to engage enemies and cover one another most effectively. It is also important to note that "by 1965, the two-ship loose-deuce formation was the standard fighter formation for most air forces in the world,"[60] except the USAF.

However, the Air Force was not unaware of the disadvantages of the fluid-four, especially in comparison to the loose deuce. One USAF report, codenamed Feather Duster II, found that the formation was ineffective, especially against ambush tactics, and its recommendations were to shift to a formation similar to the loose deuce when attacked.[61] Notably, the report never explicitly mentions the loose deuce itself. Furthermore, in a 1971 article published by the Air Force's Fighter Weapons School, the school stood up to improve aircrew training and counterpart to Topgun, the fluid-four was directly compared to the loose-deuce flown by the German Air Force. The author points out numerous advantages of the loose deuce and disadvantages of the fluid-four, but, most crucially, "felt obligated to include a disclaimer stating that the article was not an endorsement of [loose-deuce]...The next two issues included articles giving the party line – that fluid four was the only way for Air Force fighter pilots to fly."[62] In other words, despite pointing out and acknowledging multiple disadvantages of their current combat formation, the Air Force insisted upon maintaining that formation as doctrine for no other reason than it was developed "in-house," while the alternative originated from its rival branch. Throughout the entirety of this paper, I can provide no more substantial piece of evidence demonstrating the Air Force's "stickiness" as an organization than this.

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[59] Ibid, p. 169.
[60] Ibid, p. 169.
[61] Ibid, p. 172.
[62] Ibid, p. 184.

Overall, none of the Air Force's attempted technical innovations solved its air superiority problem over the North, it simply did not attempt any improvements to its training and tactics regiments, and its kill ratio at the end of the war remained largely unchanged from that of Rolling Thunder. It stayed firmly seated at 2:1. The Air Force was a sticky organization concerning the air superiority campaign and its struggles over North Vietnam.

The Navy

As mentioned, the Navy experienced the same early exchange rate problems as the Air Force during Rolling Thunder. Navy F-4 kill ratios had sunk to 2:1.[63] Despite this similarity, the Navy took a drastically different approach than the Air Force with regard to how they assessed their problems and devised solutions. Initially, the Navy, like the Air Force, had believed that missile technology had made dogfighting and ACM tactics obsolete, which later proved incorrect. However, unlike the Air Force, one of the first things the Navy did following the conclusion of Rolling Thunder was to commission a comprehensive investigation into why this premise failed and why the missiles had not done what they had hoped. Following the conclusion of this investigation, a report authored by Captain Frank Ault was released. It was titled "Report of the Air-to-Air Missile System Capability Review," but it is now more commonly called "The Ault Report."

The comprehensiveness of the Ault Report was unmatched by any of the investigations launched by the USAF, and it provided the Navy with a blueprint for solutions going forward. It came away with three principal conclusions concerning why the missiles currently available to the Navy were underperforming: missiles were unreliable due to suboptimal storage conditions and poor maintenance protocols, aircrew did not correctly understand the capabilities of their

[63] Nichols, John B. and Tillman, Barrett, p. 80.

missiles, and missiles were consistently fired out of their firing envelopes with no chance of ever hitting their targets.[64] In providing these conclusions, the Ault report clarified what steps had to be made by Navy commands to see direct and immediate improvements in missile performance. Repeated takeoffs and landings on and off aircraft carriers battered missiles almost daily. These harsh impacts significantly affected the missiles' electrical sensors and mechanical components, especially the AIM-7, leading to catastrophically high malfunction rates. To remedy these problems, Ault recommended that the maintenance programs for the missiles be reformed, standardized, and rigorously enforced to ensure improved malfunction rates.[65] However, the most important recommendation made by the Ault Report was this:

> CNO and ComNavAirPAc establish, as early as possible, an Advanced Fighter Weapons School in RCVW-12 at Miramar for both the F8 and the F4. Concept and plans for this school have already been formulated by ComRCVW 12 and ComFairMiramar. After operation through a suitable trial period, evaluate its worth and expand within RCVW-12 or extend to RCVW-4 as indicated.[66]

Putting aside the extensive acronyms and complicated language, this directive gave birth to the Navy Fighter Weapons School, or Topgun. This was the Navy's recognition that the real nature of the struggles during Rolling Thunder was that the problem was inherently one of tactics and training. The lack of specific or rigorous air-to-air training regimens left F-4 pilots woefully unprepared for the environment they encountered over the North. As an example, AIM-9 Sidewinders, with their low G tolerance, were being fired out of the envelope at rates as high as 28%.[67] Whenever a pilot fired out of the envelope, the missile was immediately a wasted shot. No missile fired in such conditions would ever be capable of reaching its target. This was the demonstrated need for Topgun.

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[64] Ault, Frank, "Report of the Air-to-Air Missile System Capability Review."
[65] Ibid, p. 18.
[66] Ibid, p. 37.
[67] Michel, *Clashes*, p. 155.

The initial objectives of Topgun were twofold: first, the school had to cultivate a set of tactics that would be successful against North Vietnamese MiGs. Second, they had to fit this new set of tactics into a curriculum taught to classes of promising aviators. However, contrary to what Hollywood would have one believe, Topgun was not exclusively for the "best of the best," and it did not involve any competition between the students of each class. Instead, the students selected to attend Topgun were intended to be promising junior officers whose purpose would be to return to their squadrons after attending in order to become training officers. These training officers would then disseminate the new tactics and curriculum to the rest of the aviators in the squadron, thereby rapidly dispersing tactical innovations to the entire cadre of pilots.[68] This proved very successful, with the following MiG engagements over Vietnam showing rapidly improving results.

The Ault Report was not the only way by which the Navy realized the problem was inherently a training and tactics one. Unlike the Air Force, the F-4 Phantom was not the only fighter jet used by the Navy at that time. In addition to Phantom squadrons, the Navy operated several F-8 Crusader squadrons. Unlike those of the Phantom, which had been stood up and designed around the idea of fleet defense, the F-8 squadrons had been built from the ground up to be air superiority squadrons. As such, the cultural differences between the two types were monumental. Crusader squadrons had never stopped training air-to-air combat and ACM, even when it led to increased numbers of training mishaps and lost aircraft.[69] Moreover, when improving their ACM skills, F-8 squadrons were incredibly efficient at providing internal feedback. Nichols and Tillman describe this process: "The F-8 squadrons lived and dreamed fighter combat…In the better squadrons, the debriefs resembled perhaps the self-criticism of a

[68] Pedersen, Dan, *Top Gun: An American Story*. p. 105.
[69] Nichols and Tillman, *On Yankee Station*, p. 72.

communist cell meeting. Comrade X might criticize himself for going low instead of high against Comrade Y, even if X were senior to Y."[70] This was not the case in most Phantom squadrons before Rolling Thunder. Nichols and Tillman continue, "The F-4 squadrons, being state-of-the-art in equipment and doctrine, seldom bothered with "outmoded" pastimes such as dogfighting."[71]

This stark disparity in preparedness for the ACM environment above North Vietnam manifested itself. In engagements against MiGs, Crusaders logged 0.72 kills per engagement, while Phantoms had a mere 0.3 kills. Additionally, the Crusaders did not suffer nearly as severely as the Phantoms when considering loss rates to MiGs, scoring closer to 6:1.[72] This forced the Navy to ask why the F-8s were doing so much better than the Phantoms. The answer was clear: training. This realization, paired with the findings of the Ault report, gave a clear mandate to Navy commands to improve their training curricula extensively concerning fighter combat. These improvements were based mainly on the existing knowledge held within F-8 squadrons, and F-8 pilots were rapidly transitioned to the Phantom to begin training the rest of the fleet.[73] Such a rapid evaluation of pre-existing doctrine and acceptance of its flaws, paired with an even more rapid adjustment and innovation to improve, was a feat unmatched by the Navy's counterparts in the Air Force. It was a critical reason for the disparity in success in the final half of the air war.

However, unlike what limited previous scholarship has argued,[74] the Navy's evaluation of their training and tactical doctrine was not their only differentiator from the Air Force after Rolling Thunder. The Navy also had a markedly better approach to improving its missile

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[70] Nichols and Tillman, *On Yankee Station*, p. 79.
[71] Ibid, p. 74.
[72] Ibid, p. 78.
[73] Ibid, pp. 79-80.
[74] Nichols and Tillman, *On Yankee Station*, p. 79. and Michel, *Clashes*, p. 181.

technology than the Air Force. The first example of this appeared before the conclusion of Rolling Thunder when the Navy rolled out a substantial improvement of the Sidewinder, the AIM-9D. As mentioned, this missile proved much more successful than its predecessor or USAF alternatives like the AIM-4 or AIM-9E. Moreover, the Navy did not stop there. Through extensive testing, Topgun had concluded that with the given technology and equipment, the AIM-7 Sparrow was effectively useless due to catastrophic failure rates and poor missile performance when it did function properly. This directed the Navy's technical improvement efforts towards further improving the Sidewinder. Following Rolling Thunder, the Navy scheduled the production and implementation of the AIM-9G.[75] According to historians and the pilots that used it, the AIM-9G was a successful improvement upon the already solid AIM-9D, and it was in a different league altogether from USAF missiles like the AIM-9E and J. While USAF Sidewinders had hit rates around 12%, the hit rate of the AIM-9G was nearly four times that, sitting around 46%.[76] It's important to note that this improved hit rate was probably due to a combination of enhanced weapons technology and increased pilot skill due to the disseminating effects of Topgun. Overall, the Navy was more successful than the Air Force in reforming and improving their training regimen and innovations concerning improving missile technology, which were vastly more successful than those of their rival branch.

In conclusion, the Navy proved to be a much more flexible organization than the Air Force regarding improvements upon its initial struggles over North Vietnam. This flexibility manifested in the Navy's ability to reform its tactical training curriculum and the branch's ability to prioritize the correct technology to improve. The Navy did not waste time attempting to enhance the Sparrow further and instead went and made improvements where they would matter

[75] Michel, *Clashes*, p. 279.
[76] Ibid.

most – with the Sidewinder. In the end, the results showed that, as mentioned above, the USAF ended the war still trading around 2:1 with the MiGs. In contrast, the USN ended the war with the exchange ratio back up to 12:1.[77]

Case Findings

After analyzing the cases of the Navy and the Air Force's adjustments following Rolling Thunder, we can arrive at two primary conclusions. The first is that technological improvements alone will rarely solve problems in war, especially when the actual cause of said problem originates from a lack of adequate or relevant training. The Air Force learned this lesson the hard way over Vietnam – despite numerous attempts to provide technical solutions that would allow their Phantoms to shoot down MiGs sooner (Combat Tree and Teaball) or more effectively (improvements to their missile suites), Air Force kill ratios never exceeded their early war purgatory of 2:1. Rather, this failure to improve was due to the complete lack of any actual air-to-air training regimen combined with the continued use of a blatantly outdated and obsolete combat formation, which the Air Force had already realized was inferior to alternative options. The USAF's unwillingness to change doctrine away from interception and nuclear strike primacy was apparent, and their aircrew paid the price. Loss rates remained high, and MiG kills per engagement remained low.

This failure starkly contrasts the Navy's adjustments following Rolling Thunder. The Navy realized fundamental tactical change was urgently necessary and was quick to take action, commissioning the Ault Report and investigating the disparity between Phantom and Crusader squadrons. Most importantly, once the Navy understood the path to improvement, it immediately took action, establishing Topgun and filling it with leadership that genuinely understood that

[77] Nichols and Tillman, *On Yankee Station*, p. 80.

aircrew training and performance had to change. Furthermore, the Navy compounded the improvements caused by enhanced training through precise and efficient technological improvements; instead of continuing down the dead-end of the AIM-7, the design and implementation of the AIM-9D and the AIM-9G allowed their pilots access to cutting-edge technology that truly worked. In other words, the Navy understood that the actual cause of the poor performance was aircrew training, not inadequate weapons, and they took direct action to remedy that issue while simultaneously providing aircrew with tools that made their jobs easier.

The second critical conclusion from these case studies is that it is vitally important that military branches do not allow interservice rivalry and hubris to prevent needed doctrinal innovation. Like most instances of competition, interservice rivalry is usually a net positive, pushing both parties involved to grow and improve. However, this rivalry can manifest adverse side effects if left unchecked, especially when congressional funding is at stake. This paper defines hubris as actions taken by one branch that contradict their goals of improvement in battle for the sake of continuing preexisting beliefs (either regarding technology or tactics). Clear examples of when this occurred during the air war over Vietnam were the USAF's decision to replace the AIM-9B with the "designed-in-house" AIM-4 instead of the Navy's improved AIM-9D, and when the USAF refused to change their tactical formation of choice from the fluid-four to the loose-deuce. Both of these examples include decisions to use inferior tactics or technology for the sake of maintaining USAF independence from Navy weapons or doctrine. Although it is impossible to say with absolute certainty that these decisions were made out of branch rivalry and hubris, providing adequate alternative reasoning is even more difficult. In the example of the Falcon versus the Sidewinder, the AIM-9D was a respected missile by historians and aircrew alike. At the same time, the AIM-4 was unilaterally viewed as an inferior missile and

a failed project, especially hated by the pilots who used it. Although the AIM-9B's performance had been subpar, the only negative trait of the AIM-9D, from a USAF perspective, was that it hailed from the Navy.[78]

Furthermore, as mentioned above, the Air Force had several internal reviews and reports illustrating the disadvantages of the fluid-four formation against the loose deuce.[79] Additionally, by 1965, the loose deuce was already flown by every significant air force except the USAF.[80] Similar to the AIM-9D case, the only negative trait of the loose deuce was its creator. The only exception to this similarity was that in order to transition to the loose deuce, some aircrew retraining would have to be done. Despite this, the simple counterargument to any notion that the USAF had sound reasoning to remain with the fluid-four is that the USAF transitioned to the loose deuce almost immediately following the end of the Vietnam War, and a variation of the formation is still the Air Force's primary choice today. Therefore, it is reasonable to believe that the USAF made several decisions solely based on interservice rivalry and branch hubris during the war in Vietnam. These decisions directly led to the continued loss of U.S. aircraft and aircrew at unacceptable rates throughout the remainder of the war. They must not be repeated in the future.

It is also essential to briefly caveat that the USAF did significant self-reflection following the conclusion of the war in Vietnam and internally remedied all of the failures addressed in this paper. It adopted the loose deuce as its tactical formation, improved missile technology in partnership with the USN, and resumed a heavy emphasis on practical and relevant air-to-air training. Furthermore, the USAF and USN used the lessons learned from Vietnam to design their

[78] Michel, *Clashes*, p. 172.
[79] Ibid, p. 184.
[80] Ibid, p. 169.

next generations of fighter aircraft, giving the aviation world legendary aircraft such as the F-14, F-15, F-16, and the F/A-18, all including a gun.

Implications for the Future

Following the examination and analysis of both case studies, we can now move to the implications of the lessons learned in those cases for future conflicts. More specifically, this section will apply the lessons learned from the previous sections to a hypothetical future conflict between the United States Navy and the People's Republic of China in the South China Sea (SCS), which I view as the most likely next aerial conflict at the peer versus peer level. Such a conflict would inevitably be focused on the use of the carrier strike groups and hypersonic missiles.

Recently, there has been a debate surrounding the carrier strike group in the military strategy world. Some have argued that the carrier is simply reaching the end of its relevancy in the modern world. For example, Cameron Rountree argued in his article that the carrier should not be the USN's frontline response to a conflict in the SCS, and it instead ought to be relegated to a support role, allowing other weapons platforms such as ships armed with hypersonics of their own to become the main instruments of war.[81] Strategists like Rountree see the carrier as too vulnerable a target to be allowed to enter within range of enemy hypersonic missiles (which can extend thousands of miles), and they do not foresee the interception technology that could counter the hypersonic threat to be ready in time to protect the carrier. On the other side of the debate, strategists like John Lehman and Steven Wills argue that land-based substitutes for naval air power will not always be available, especially in theaters where the distances are as large as the SCS. Despite this lack of ground-based airpower, surface ships will always need air cover,

[81] Rountree, Cameron M, "The Final Countdown?" pp. 15-44.

which in such a case could only be provided by the aircraft carrier, which mandates its necessity in such a conflict. They also mention that large fleet carriers have repeatedly proven to be resilient to damage in high-threat environments, citing that no large fleet carriers were ever sunk by the intense kamikaze threat in the Second World War.[82] One exemplary example of the carrier's resilience was when the *Enterprise* "was assessed to have survived the equivalent of six heavyweight Soviet cruise-missile strikes…but could have resumed air operations in several hours."[83]

The specifics of whether or not the carrier strike group is still the correct answer for the USN in a potential conflict in the SCS is outside the scope of this paper. However, by applying the lessons learned in the case studies mentioned above, it will be crucial that the Navy does not fall victim to the same mistakes that it and the Air Force made in the past. They must ensure they do not become so infatuated with new technologies that they allow their training and readiness standards to fall. As Nichols and Tillman put it, "Americans have a tendency to trust technology more than skill, but we periodically rediscover the truth."[84] At the same time, the Navy must not allow interservice rivalry with the Air Force or pride in its air capabilities to drag them into a fight they might not be prepared or well-suited for. Instead, they should continue executing constant and comprehensive self-reflection to evaluate their readiness and capabilities should such a conflict arise. They must be able to see where they are weak and adjust with the required technological advancements paired with efficient doctrinal innovation at both the strategic and tactical scales.

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[82] Lehman, John F. and Wills, Steven, "Aircraft Carriers," pp.15-36.
[83] Ibid, p. 22.
[84] Nichols and Tillman, *On Yankee Station*, p. 80.

Limitations

It is important to note that this paper is neither the authority on tactical innovation of military doctrine, nor it does not attempt to be. This paper attempts to lay a foundational framework through which further research can examine and analyze additional cases of tactical innovation. In order to reach any authoritative status within the realm of tactical innovation, the trends and findings of this paper would need to be replicated or corroborated through numerous additional cases, which would require a work similar to Pape's *Bombing to Win*, Posen's *The Sources of Military Doctrine*, or Rosen's *Winning the Next War*. This paper only examines a singular case in detail, which is not enough to establish any definitive rules or theory.

Additionally, using purely air-to-air kill ratios as a measurement of organizational success has its limits. Although the cases of the USAF and USN are remarkably similar in the skies over Vietnam, there still exists some differences between the two. For example, the two branches had slightly different mission-sets as well as different resources available to them.[85] However, these differences are marginal, and kill ratios were the measurements used by the branches themselves at the time to determine their performance against the VPAF, so this particular limitation is relatively minor.

Despite these limitations, it is also important to outline the uniqueness of this paper's case. The opportunity to examine two different organizations' decision-making processes while simultaneously controlling for losses on the battlefield is rare. However, there still exist some additional opportunities for research. Further scholarship could potentially conduct similar case studies using the War on Terror or other counter-insurgency operations where multiple

[85] The Air Force had considerably greater access to assets such as heavy tankers for extended missions, while the Navy had greater access to ground controllers and early warning due to the ability to communicate with shipboard and airborne controllers just off the coast of North Vietnam.

organizations were fighting a common enemy. This continued research would allow the findings in this paper to be compared and hopefully strengthened in the future.

Conclusion

In conclusion, the United States Navy proved to be a much more flexible organization following its initial struggles during Operation Rolling Thunder, making effective and efficient technological and doctrinal adjustments to turn a neutral fight into a decisive victory in the air. On the other hand, the Air Force proved to be much more sticky. Their adjustments remained exclusively technical and ineffective, ignoring any possibility for tactical or training reforms. The consequences of their inaction were apparent: their kill ratio against the VPAF remained at 2:1, while their rival branch soared back to 12:1. Their case studies emphasize the importance of a holistic approach to tactical military innovation. One cannot simply throw improving technology at a problem, especially when that problem is one of inadequate training at its core. Likewise, one cannot always solve a problem through just improved doctrine. Instead, innovations in doctrine must walk hand in hand with technological advancements to combine to form truly dominant forces for victory.

The tactical innovation lessons of Vietnam are still relevant today and can even be applied to potential future conflicts across the globe. The USAF and the USN must prepare for a conflict in the South China Sea, which will undoubtedly include a constantly growing range of new threats. To meet such a challenge effectively, the branches of our military must set aside all inter-service rivalry and hubris and instead fight together as partners to find the best solutions to the innovation problems of tomorrow.

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