Strategy Research Project

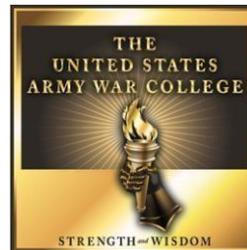# Forging Weapons Strategies for the Future Defense Landscape

by

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This manuscript is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The views expressed in this student academic research paper are those of the author and do not necessarily reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

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USAWC STRATEGY RESEARCH PROJECT

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The rhetoric is heated in the debate over the future of the A-10. The F-35, which has been touted as the replacement for the A-10 and several other legacy fighters, is behind schedule and currently lacks many of the A-10's capabilities. Critics argue that the F-35 will never match the A-10 and is a leap backwards in CAS capability, while F-35 advocates cite the impressive 5th generation capabilities the F-35 will eventually bring to the fight. Amidst this war of words, where emotions run high, it is difficult to wade through the ensembles of points and counterpoints to discern a productive path. Thus, this paper is not just about the A-10 or the F-35. Rather, it is about making tough choices to forge effective defense strategies in a complex, resource constrained, and rapidly changing environment. To this end, we will explore a series of cases from both the business world and the Department of Defense (DoD). These vignettes will reveal patterns of behavior, which converge to stifle critical thinking in competitive landscapes. This paper will present a balanced discussion on future defense strategies, allowing readers to draw their own conclusions about the future of the A-10.

Forging Weapons Strategies for the Future Defense Landscape

Bullets pelted the armored plating of the Mine-Resistant Ambush Protected (MRAP) vehicle, as the insurgents surrounded the small convoy. A rocket-propelled grenade (RPG) ravaged the lead vehicle, as the occupants dove for cover from the flames and shrapnel. The convoy was outgunned and outnumbered by the well-coordinated insurgent attack. A Joint Terminal Attack Controller (J-TAC) sprang from his vehicle and scrambled behind a nearby boulder, narrowly averting a barrage of enemy fire. Over the loud commotion of the firefight, he struggled to relay the convoy's position with a request for close air support (CAS). Minutes later the unmistakable sounds of two low-flying A-10s caused the insurgents to pause and look warily to the skies. With the help of the J-TAC, the A-10s began a series of devastating strafe attacks on the line of belligerents. The guttural sound of the A-10's 30mm Gatling gun was a source of great comfort to the pinned-down soldiers, and a cause for alarm to the assailants. In less than 30 minutes from the moment the J-TAC requested air support, the battle was over, and the few surviving insurgents fled the scene.

Scenes similar to this have occurred throughout the A-10's 40-plus years in service. The Warthog is a formidable weapon, and is arguably the most capable CAS platform in the world. Yet, the Air Force is faced with the difficult challenge of recapitalizing its fleet to face emerging threats, and retiring the A-10 will save the Air Force $4.2 billion over 5 years.[1] These resources can then be reinvested into the next generation of Air Force platforms, like the F-35, and help pay the service's $12 billion annual sequestration bill.[2] This is where the controversy begins.

Figure 1. The A-10 "Warthog"[3]

The rhetoric has become heated, as lawmakers and A-10 proponents fight for the Warthog's survival. The F-35, which has been touted as the replacement for the A-10 and several other legacy fighters, is behind schedule and currently lacks many of the A-10's capabilities. Critics argue that the F-35 will never match the A-10 and is a leap backwards in CAS capability, while F-35 advocates cite the impressive 5th generation capabilities the F-35 will eventually bring to the fight.[4]

Amidst this war of words, where emotions run high, it is difficult to wade through the ensembles of points and counterpoints to discern a productive path. Thus, this paper is not just about the A-10 or the F-35. Rather, it is about making tough choices to forge effective defense strategies in a complex, resource constrained, and rapidly changing environment. To this end, we will explore a series of cases from both the business world and the Department of Defense (DoD). These vignettes will reveal patterns of behavior, which converge to stifle critical thinking and strategy formulation in competitive landscapes.

Ultimately, weapons, tactics, and business strategies are about much more than the effects they can achieve. They are also symbols of strength and sources of identity. Naturally, warfighters and business executives form powerful attachments to the tools that brought them success in previous conflicts, and they will go to great lengths to defend them, even when faced with substantial evidence that change is necessary. Their power as a source of identity and psychological strength gives them longevity far beyond what logic would dictate. With this prelude in mind, let's begin our examination with the concept of disruptive innovation.

Disruptive Technology

Harvard Professor Dr. Clayton Christensen articulated the concept of disruptive technology in *The Innovator's Dilemma.* In the book, Christensen explored the factors that caused great firms to fail in the midst of significant technological change. The cycle began when a company achieved success with a specific type of technology. Next, a variant of this technology emerged within the market, which offered new performance attributes, but lower performance. As the new entrant improved its performance, it eventually displaced the former technology.[5]

For example, the transistor radio initially had poor sound quality compared to commonplace analogue radios; however, it offered portability and low battery consumption. These innovations made the transistor radio highly appealing to teenagers who wanted to listen to music on the beach. As the sound quality improved, the transistor radio dominated the market, and analogue, big furniture radios were eventually rendered obsolete.[6]

Figure 2. Phillips Big Furniture Radio, circa 1930[7]

The dilemma for successful companies develops from their natural aspirations to continue to meet current customers' demands. Makers of analogue, big furniture radios prided themselves on excellent sound quality and elegant designs, just as their customers desired. Meeting these demands was the lifeblood of a highly lucrative business. Pouring resources into a portable, poor sound quality design was akin to turning their backs on the very foundation of their business. Ironically, previous successes caused these companies to become captive to the needs of their current customer base, and stifled their ability to incorporate transistor technology into future business strategies. The innovator's dilemma is a reminder that the traits that define an organization's strengths can also become its greatest weaknesses. There are several parallels that can be drawn from this example to the current A-10 / F-35 debate.

The lethality of the A-10 in past and current conflicts is undeniable. It is by no means a single-mission CAS aircraft. The Warthog's missions range from Forward Air

Control (FAC-A), Strike Control and Reconnaissance (SCAR), Air Interdiction (AI), to

Combat Search and Rescue (CSAR). While there are certainly other CAS capable

aircraft in the Air Force inventory, the men and women who fly the Warthog pride

themselves as CAS experts, and they are extremely proficient at the mission. A-10

pilots frequently refer to CAS as "doing the Lord's work"—a sentiment that reflects their

deep commitment to protecting soldiers on the ground. It is entirely understandable for

those that have flown, or have been supported by the A-10 to defend the aircraft. In

their minds, the notion that a less capable and more expensive F-35 might replace the

venerable A-10 defies logic.

To be fair, it was also understandable, even logical, for analogue radio

manufacturers to dismiss transistor radio technology. The analogue, big furniture radio

was an American icon, and it had been a staple of American homes for decades. It was

a symbol of quality, and a source of family unity. Presuming investment resources were

scarce, how would shareholders and current customers have responded if analogue

radio manufacturers suddenly decided to funnel capital to transistor technology?

Imagine the response to the poor executive given the unenviable task of briefing the

plan at a shareholder meeting: *"Son, do you really mean to tell us you plan to invest our*

hard-earned profits into cheap, poor quality foreign transistor radios, when we could use

that capital to continue to improve the high-quality American-made analogue radios our

customers demand?" Similarly, a loyal customer might have lamented, *"It's a shame to*

see Radio-rama (fictional manufacturer) compromising on quality for cheap foreign

technology. I guess Radio-rama doesn't care about its customers anymore." Yet, given

the benefit of hindsight, clearly Radio-rama should have ignored the protests of

shareholders and customers, and embraced transistor technology. The very survival of the company depended on it.

The Air Force is betting that the F-35 is classic disruptive technology. It offers some unique capabilities, such as stealth and sensor fusion, but in its current state it is arguably not as capable as the A-10 in the CAS environment. In time the Air Force predicts the F-35's capabilities will improve, and exceed those of the A-10 and current legacy fighter fleet. The contrast of the two platforms is another manifestation of Christensen's innovator's dilemma. In the current fiscal environment the Air Force is compelled to make the difficult choice between sustaining current technology, or divesting it in favor of new, comparatively immature technology. Yet, the Air Force cannot pursue the F-35 without provoking a strong negative response from A-10 proponents and its current customer base (the Army). This highlights another key takeaway for any organization embarking on a new strategy in an environment of rapidly changing technology—whether your strategy is exactly correct, or completely wrong, expect resistance from your current customer base. There is also another important risk to consider.

As a company or a military service makes a choice to embrace what it perceives as disruptive technology, there are no guarantees the strategy will succeed. This is an argument A-10 proponents make against the F-35. The transistor radio was a clear example of disruptive technology displacing a previously dominant product. However, there are certainly other instances where technology that initially showed promise, did not live up to the hype. The Segway, which first appeared in 2001, was supposed to revolutionize short-range transportation—replacing bicycles, skateboards, and roller

blades. However, at $5,000 per scooter, it received a lukewarm reception from

consumers, and was quickly relegated to a vehicle for shopping mall security guards.[8]

Figure 3. Shopping Mall Security Guard Patrolling on a Segway[9]

The Army's Future Combat System (FCS) was another example of technology

that had disruptive potential, but ultimately did not meet expectations. The FCS was an

ambitious "system-of-systems" modernization program, conceived to integrate novel

wireless, manned, and unmanned technologies across an entire brigade. Central to the

FCS concept was a fleet of light, electric-powered, networked vehicles. In theory, the

vehicles would be less armored, but would offset this potential vulnerability with

increased speed, higher fuel efficiency, and greater informational awareness.[10]

The army envisioned FCS vehicles as hybrids between light Humvees and heavy

tanks, which would replace the Army's arsenal of 6-ton Humvees, 18-ton Strykers, and

72-ton tanks. However, integrating such a broad range of capabilities into FCS vehicles

was a daunting engineering challenge. Initial designs included flat bottoms, which made the vehicles vulnerable to roadside bombs. As armor was added to offset this vulnerability, the increased weight compromised the performance of the transmissions and axles.[11] Ultimately, Secretary Gates scrapped the vehicle portion of the program, signaling the demise of the FCS enterprise. While some of the technology developed in the program was fielded, the Army's hopes to harness this potentially disruptive vehicle technology to a force transformation were at an end—at least for now.[12]
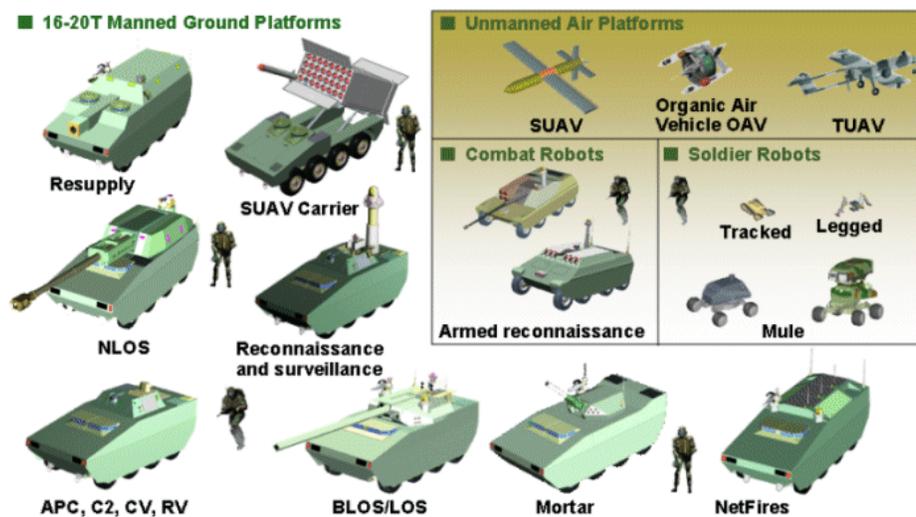

Figure 4. The Army's Future Combat System[13]

The plight of the FCS highlights an important reality: when an organization is actually in the middle of rapid technological change, it is difficult to identify disruptive technology. In reality, organizations can try to predict which technology will be disruptive, but until the disruption actually occurs, they are simply making an educated guess based on the available evidence. Advancing a new strategy can also require tremendous financial and political capital, particularly in the DoD. In this light, some worthy defense innovations simply flop because they fail to garner the necessary

resources to succeed. Perhaps the most important lesson from the FCS is not that the

Army got the strategy wrong, but rather, how difficult it is to know when a strategy is

right. Even if a strategy is sound, success is not guaranteed. These same realities are

pervasive in the F-35 program.

The F-35 stands as the DoD's solution for what the services will need to combat

emerging adversaries for the foreseeable future. It is the offspring of brilliant tactical

minds. It is also the overpriced child of a deeply flawed acquisitions system. It is an

example of how much the services and US allies *can* achieve when they unite together.

It is also an example of how much they *can't* achieve when they unite together. It is a

flying contradiction that inspires and disappoints in the same breath.

Figure 5. F-35 in afterburner[14]

Yet, there is another narrative quietly emerging from the test community. Those

that have actually flown the jet (including this author) tell a different story. The

sophisticated sensors that revolutionize pilot situational awareness, and reduce cockpit

workloads are actually working. Its performance has been impressive in several core missions, including CAS, interdiction, and defensive counter air. There have been significant overhauls to mission systems software, which will allow far more flexibility for weapons and sensor expansion in the future. Lockheed Martin's promises are finally beginning to materialize—just a decade behind schedule, at triple the cost.

Of course, even the A-10 took time before it became the greatest CAS platform in the world, just as the P-51 evolved to become the dominant fighter of its day. In both cases, the progression of technology and the threat environment compelled the military to seek new, more survivable platforms. The nature of the future threat environment is a topic we will revisit later in this examination, but first let's turn to the past.

<div align="center">Systems of Denial</div>

Dr. Andrew Hill and Dr. Stephen Gerras described three dysfunctional responses that occurred when organizations or individuals were confronted with data that challenged their current strategies. First, they question the intentions or the legitimacy of the source. Using this paper as an example, a critic might argue: *the author is an F-35 pilot (true) and A-10 hater (not true). Obviously, his conclusions can't be trusted (not true).* Second, they question the validity of the data: *the F-35 will never attain its promised capability, and the A-10 will be survivable in the future threat environment.* Finally, they revise the theory to make it more difficult to test, and in turn more difficult to disprove.[15] This last response warrants further explanation. Our next case study will illustrate this behavior.

Shortly after the onset of the Civil War, the Model 1861 Springfield rifle entered service. It was significantly more accurate and boasted an effective range up to three times that of previous muskets of the day.[16] The proliferation of such a weapon should

have dissuaded Civil War commanders from using the bayonet charge as a primary offensive tactic,[17] and the bayonet itself should have become a weapon of last refuge for the infantryman bereft of ammunition.[18] Yet, many of the generals of the North and the South had been shaped by their experiences in the Mexican War: a conflict where smoothbore muskets and Napoleonic bayonet charges had produced impressive results. Both sides entered the Civil War convinced that these same tactics would continue to be decisive.[19] The bloodbath that followed was proof that weapons like the Springfield rifle had revolutionized warfare, and that tactics must evolve accordingly. To ignore this revolution, was akin to mass suicide—yet, the same tactics persisted through the duration of the Civil War and into the opening battles of WW I.[20]

Figure 6. Springfield Model 1861[21]

The dominant theory in the minds of Civil War generals was clear: bayonet charges would continue to bring decisive victory in battle. This theory was directly challenged, as weapons like the Springfield rifle handily defeated bayonet charges. Thus, under Hill and Gerras' construct, the generals revised the theory: bayonet charges executed by *skilled and heroic soldiers with high morale* will continue to bring decisive victory in battle. The revised theory did not compel the generals to change their tactics. The blame for failure was conveniently placed on the fact that their men

simply were *not skilled and heroic with high morale*—a revised theory that was nearly

impossible to test.[22] As Hill and Gerras explained, human beings love to be right so

much "that [they] prefer useless statements that cannot be proven false to useful

statements that expose [them] to the possibility of being wrong."[23] Tragically, the

military leaders of the day had a brilliant and horrifying ability to construct denial.[24] Yet,

many of these generals were highly respected and thoughtful strategic leaders. How

did such a flawed tactic endure?

  When compared to the myriad of other weapons used in close combat, the

bayonet killed relatively few soldiers. Yet, the images of hoards of screaming men

charging forward with gleaming blades mounted upon rifles gave rise to what military

historian Dr. Robert O'Connell described as "the persistent fantasy of the bayonet

charge."[25] Thus, the cult of the offensive and the mystique of the bayonet charge

endured, not because the tactics produced decisive results on the battlefield, but from

the power of the bayonet as a symbol of moral strength and courage.[26] Hence, a

weapon and tactic, which were both essentially obsolete, continued to hold a prominent

place in military strategy from the Civil War to the onset of the Great War. As a result,

hundreds of thousands of lives were lost.

Figure 7. Bayonet Charge by French Soldiers in World War I[27]

Hill and Gerras also placed this type of behavior in a social context. They explained: "[theories] can survive long after the evidence has contradicted their fundamental assumptions. Why? Because even the most abstract, politically neutral ideas are never neutral in their social implications."[28] If a Civil War general built his career on countless victories using Napoleonic bayonet charges, the notion that the tactic is flawed is not only a different theory, it is a direct assault on the very foundation of his career.[29] Perhaps the notion of retiring the A-10 is equally confronting to pilots that have flown it, and to soldiers that have benefited first-hand from its awesome capabilities. Likewise, arguments that claim the F-35 is a poor investment are confronting to those that have dedicated years of research and capital to bring the fighter to fruition. The point is not that one argument is right and the other is wrong. Rather, the lesson is that powerful human emotions cloud our judgment, when the debate becomes too personal. If these emotions are not kept in check, they can compromise our ability to make strategically sound decisions.

Returning to the present, both sides of the A-10 / F-35 debate can offer intelligent and passionate arguments for their causes. It is possible that retiring the A-10 will leave soldiers on the ground vulnerable in a future fight, while the F-35 struggles to reach its promised capability. It is also possible in an evolving threat environment, riddled with advanced surface-to-air missile systems (SAMS) and 5th generation fighters—a stealth platform will be the only viable option to provide support for ground forces, not just in close air support, but in the full-spectrum of conflict. If this description of the future materializes, perhaps the A-10 and the bayonet charge will share some similarities— they were intimidating, incredibly inspiring, and remarkably effective. Yet, as the threat environment evolved, they were simply not survivable. Rhetoric from each camp casts the debate in black and white terms. In reality, each strategy contains pros, cons, and risks. We will return to the A-10 / F-35 discussion at the end of our examination, but first some words on theory development.

Anomalies and Theory Improvement

Thus far, this paper described a series of common behaviors that organizations exhibited when confronted with anomalies. These anomalies were categorized as either disruptive technology or as evidence that contradicted current theories of victory. While we have highlighted several potential pitfalls, our examination has yet to describe how an organization should react when it encounters an anomaly. This is a critical piece of the puzzle, since an organization's response to an anomaly can either define its path to a successful strategy, or in the worst case, guarantee its eventual demise.

In a basic sense, an anomaly is simply a result that does not conform to a current theory. Using the Springfield rifle example, Civil War Generals predicted that bayonet charges would continue to be decisive. The fact that this offensive tactic resulted in

mass casualties and was rarely decisive, contradicted their theory, thus it was an anomaly. It is also interesting to note that the word anomaly itself has a negative connotation, as if it is trivial and ought to be minimized or ignored. Did the Springfield rifle actually defeat the bayonet charge, or was this *just an anomaly*? An anomaly can be a powerful catalyst for innovation and success, but to put the power of anomalies in proper context, we first need to understand how theories are improved.

In their article *Cycles of Theory Building*, Clayton M. Christensen and Paul R. Carlile described the basic constructs of theory improvement.[30] When researchers, business executives, or military strategists, test a theory on a new data set, they might find that the theory adequately predicts the outcome. This confirms the theory is valid under the specific conditions or circumstances that were observed; however, this confirmation does not present an opportunity to truly expand the theory. For example, if a bayonet charge was successful in battle, this simply verified the prediction of the theory—*bayonet charges and offensive tactics will be decisive*. Confirmation is not necessarily a bad thing; however, an anomaly presents a powerful opportunity to actually improve the theory.

As Christiansen and Carlile described, the "discovery of an anomaly gives researchers the opportunity to revisit the categorization scheme—to cut the data in a different way—so that the anomaly and the prior association of attributes and outcomes can all be explained."[31] In other words, when a Springfield rifle defeated a bayonet charge, the theory could be expanded or refined to describe specific conditions or causal mechanisms that produced the different outcome.[32] After the results of the anomaly were sufficiently replicated, the improved theory might state something like*:*

the bayonet charge will be decisive against adversaries equipped with smoothbore muskets, however it should not be used against forces equipped with long range precision rifles. The example of the airfoil is another clear illustration of this concept.

Bernoulli's Principle predicted that an object with camber would produce lift as it moved through the air. This theory was continually validated, as aviators successfully flew airfoil-equipped machines.[33] Yet, there were some cases where these machines crashed, and Bernoulli's Principle failed to predict or explain how the crashes occurred.[34] Ultimately, these anomalies allowed aviators to categorize and avoid dangerous circumstances (high winds, icing, fog, thunderstorms) and improve equipment in order to aviate safely.[35] The theory of flight expanded well beyond Bernoulli's Principle. Now a pilot had better equipment, could understand how to alter flying techniques under certain conditions, and what conditions made flight dangerous or impossible.[36] All of these benefits emerged from an anomaly. In reality the process of recognizing and harnessing the power of anomalies is a difficult task, and as this examination has already revealed, there are a myriad of other forces that stand in the way of productive theory improvement. To revise a theory, one must be open to the idea that a theory can actually be improved. Unfortunately, in many competitive environments there is a void of intellectual humility—a critical ingredient to the process of theory improvement. Ultimately, the theories we embrace drive our strategies, so let's shift the discussion to the types of strategies organizations adopt to maintain their competitive advantage.

Exploration and Exploitation

In a relatively stable environment, successful organizations maintain their dominance by fortifying current strategies—by refining or getting better at what they

already do well.[37] In contrast, under conditions of rapid or dramatic change,

organizations thrive by adopting strategies of exploration, finding new avenues to

innovate and experiment beyond their current paradigms.[38] In a general sense, success

is a function of an organization's ability to correctly match a strategy to the current

environment. Yet, in the real world there is not necessarily a clear line between

exploitation and exploration. For example, there are elements of the F-35 concept that

represent a strategy of exploration. The fact that the aircraft emphasizes stealth and

sophisticated sensor fusion, vice speed and maneuverability, is a significant departure

from previous fighter designs. Likewise, the concept of a large coalition of partner

nations flying a common 5th generation stealth platform is unprecedented. While the F-

16 was highly exported, the F-35 represents the first time cutting edge stealth

technology has been freely shared with allies. On the other hand, we could also argue

that the F-35 is another manifestation of the same manned-fighter paradigm—the same

tricks with more advanced toys—an example of exploitation, championed as

exploration.[39] Of course, the complexity of the defense environment makes any

radically new strategy a gamble. We are not simply wagering on the success of an

innovative product line, we are betting on our national security. When the stakes are

this high, strategies must always be tempered to balance risk. Perhaps this risk

aversion, coupled with fiscal and political restraints will forever stand in the way of truly

revolutionary strategies. Yet, we can't help but wonder—if these constraints were not in

place, and we let our imaginations run wild—what might true exploration and

transformation look like?

In the not too distant future, in a world of coordinate seeking precision weapons, and missiles that are employed well beyond visual range, a relatively inexpensive swarm of RPAs could replace the wings of multi-million-dollar-manned fighters. The RPAs could be employed in large numbers, utilize stealth technology, and employ missiles, bombs, or directed-energy weapons at whatever targets the remote operators deemed necessary. Human endurance (and survival) would no longer stand as performance barriers. The face of aerial combat would be forever changed, and fighter pilots would take their place in a military museum alongside other obsolete weapons of the past.

Yet, before they fade into oblivion, fighter pilots remind us one last time why we still need them. "There are moments in any kind of flight when an illogical, instinctive, inspired input is suddenly needed—a time for controlled recklessness. So far, no computer can handle this kind of directive. It can only be hatched in the human computer—the brain. And the kind of brain with the right mixture of emotions—courage, madness, passion, and blinding revelation—has so far belonged either to a woman or to a fighter pilot. Surely, somehow, they'll both evade extinction."[40] That's a clever statement. It's catchy, and it invokes a sense of awe in the airmen that fly, fight, and win. However, I write it to emphasize a larger point: it is really just another theory that is impossible to disprove.[41] Let's conclude with some final thoughts on the A-10 / F-35 debate.

Conclusion

Congresswoman Martha McSally, a former A-10 pilot and squadron commander, recently sent a letter to President Obama urging him not to retire the A-10 in the 2016 budget. She declared, "The decision to retire [the A-10] is reckless and will put

American lives at risk."[42] This type of rhetoric implies that the Air Force is willfully

embarking on an unnecessary campaign against the A-10, but such statements

completely ignore the real challenges the entire DoD is facing. Air Force Chief of Staff,

General Mark Welsh described the scope of these challenges:

> The sequestration is the law and it's time to start thinking about what that
> means to us. One of the things that I'll tell you is it puts us in kind of a
> surreal position now, as we try and figure out the way ahead to meet the
> requirements of the law. I find myself arguing to get rid of things that I
> don't want to get rid of to pay a bill we've been handed. And the people
> [that] tell me I can't give up anything to pay it, are the people who gave us
> the bill. It's a strange situation. [43]

Sequestration slaps a $12 billion annual bill on the Air Force, and the kind of cuts

necessary to pay this bill will not come from shedding bloated staffs or limiting travel.

Even closing facilities and cutting military and civilian pay will only pay a small fraction

of the bill. Ultimately, to achieve the kind of savings sequestration demands, the Air

Force has to target readiness, force structure, and modernization.[44] As General Welsh

stated, "Do I want to get rid of the A-10? No. Can I afford to keep everything we have

right now and pay a $12 billion bill? No."[45]

Will retiring the A-10 place American lives at risk, as Congresswoman McSally

claims? The Air Force argues that the real risk to troops comes when airpower fails to

compete in the full-spectrum fight. How vulnerable would a ground force become, if air

superiority was no longer guaranteed? How many more soldiers' lives would be at risk,

if the Air Force lacked the ability to strike deep and target an enemy's second echelon

forces? If retiring the A-10 is the only means for the Air Force to preserve the capital to

succeed in these missions, while relying on other platforms like the F-16 to fill the CAS

role—perhaps the strategy is regrettable, but necessary. Again, there are no obvious

choices, or "slam-dunks" in this highly complex and competitive environment. With this

in mind, let's step back from the A-10 and F-35 debate, and conclude with the broader lessons of this discussion.

Central to this entire examination was the notion that a variety of forces, including human emotions can drive counterproductive strategies. As our examples have shown, human beings have an intrinsic desire to recreate the world around them in familiar terms. Even when faced with overwhelming evidence that a new path may yield a far greater effect, we naturally cling to the solutions that do not force us to redefine ourselves. In those rare and precarious moments when we do recognize the potential of disruptive technologies or anomalies, our current patterns of success and internal biases often stifle our abilities to fully exploit the innovation. This is the tactical innovator's dilemma.

Perhaps the most important lesson from this dilemma, and certainly the most difficult to internalize and apply—the best strategies for success in the future may require defiance of the very strategies that have produced substantial success in the past. That type of defiance demands intellectual humility and courage, and it carries great risk. As each of our case studies have illustrated, taking risk is almost always a precursor to achieving success. Yet, taking risk is also frequently the first step towards failure. This paradox compels leaders to face risk head on and continually refine their strategies, as the environment reveals subtle indications of success or failure. General Mark Welsh said it best, ". . . our job hasn't changed a whole lot since General Washington had it. It's to fight and *win* the nation's wars *no matter what*." That *win no matter what* sentiment applies whether you are an executive at an analogue radio manufacturing company trying to adapt to emerging transistor technology, or a 4-star

General trying to equip a force for the future fight amidst budget sequestration. After all,

the survival of an organization and the security of a nation are at stake. When the

stakes are this high, success is born from an awareness of our own biases, and through

prudent strategies harvested from unemotional and critical thinking.

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