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EC SUPPORT FOR AN EXPEDITIONARY AIR FORCE:

THE LESSONS OF HISTORY

by

James C. Rentfrow, LCDR, USN

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Advisor: Major Glenn Carlson

Maxwell Air Force Base, Alabama

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The United States Air Force currently faces a shortfall in the type and number of Electronic Combat aircraft capable of operating with an Aerospace Expeditionary Wing. This has a direct impact on the Air Force?s ?Global Attack? core competency, and undermines the combat power of any deployed AEW. Why have EC assets been allowed to deteriorate to this state? The answer begins with people, who have a flawed understanding of the theory of airpower. Because the theory isn?t understood correctly, money isn?t dedicated to the needed technology. Because the technology isn?t developed, or is lacking, that ?community?, if you will, fails to get representation at the higher levels of the leadership. This cycle of organizational behavior repeats itself over and over, until acted upon by an outside force?in this case the shootdown of a U.S. F-117 during the Kosovo action. This isn?t the first time that the U.S. Air Force has been through this cycle of organizational behavior. The almost exact same scenario played out in the famous ?pursuit vs. bombers? debates of the 1930?s. Pursuit lost out, and thereby lost money, technology and people in key leadership positions. It was not until the horrific bomber losses of 1943 that leaders fully realized the mistake they had made. This paper explores the connection between the two stories, looks at the current state of Electronic Combat, and offers some suggestions for the future.

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Preface

I began this paper a few months after an U.S. F-117 was shot down over Belgrade, wondering to myself "why"? Why was the Air Force so resistant to the idea of dedicated Suppression of Enemy Air Defenses (SEAD) and Electronic Countermeasures (ECM) support for its strikers? Why had they given the Electronic Combat mission almost entirely to the *Navy*? Was the technology of stealth really the driving force, or was there more?

While studying for an Air Command and Staff College exam, I literally stumbled over the answer. As I suspected, it wasn't just money, although that had a lot to do with it. As a Naval officer, flying EA-6B's, I had never heard of the "bomber will always get through" controversies of the 1930's, or the initial failure of unescorted daylight bombing during WWII. As I studied these things, I began to get a sense of the organizational culture of the Air Force. I saw how the external and internal environment that influenced the U.S. Army Air Corps of the 1930's had been responsible for the problems of early World War II. Moreover, I saw this same organizational culture at work in the late 1980's and 1990's, leading to what I perceived as a shortfall in electronic combat capability. The names had changed, but the elements were the same. People had ideas, and theories of their service and how it could radically change the history of modern warfare. They needed money and technology to make them work. In short, I found the four elements of the model I propose in the paper.

Abstract

The United States Air Force currently faces a shortfall in the type and number of Electronic Combat aircraft capable of operating with an Aerospace Expeditionary Wing. This has a direct impact on the Air Force's "Global Attack" core competency, and undermines the combat power of any deployed AEW. Why have EC assets been allowed to deteriorate to this state?

The answer begins with *people*, who have a flawed understanding of the *theory* of airpower. Because the theory isn't understood correctly, *money* isn't dedicated to the needed *technology*. Because the *technology* isn't developed, or is lacking, that "community", if you will, fails to get representation at the higher levels of the leadership. This cycle of organizational behavior repeats itself over and over, until acted upon by an outside force…in this case the shootdown of a U.S. F-117 during the Kosovo action.

This isn't the first time that the U.S. Air Force has been through this cycle of organizational behavior. The almost exact same scenario played out in the famous "pursuit vs. bombers" debates of the 1930's. Pursuit lost out, and thereby lost money, technology and people in key leadership positions. It was not until the horrific bomber losses of 1943 that leaders fully realized the mistake they had made.

This paper explores the connection between the two stories, looks at the current state of Electronic Combat, and offers some suggestions for the future.

Part 1

Introduction

> *To say that having command of the air means to fly in the face of an enemy who has been prevented from doing likewise means* ***to have the ability to fly against an enemy so as to injure him, while he has been deprived of the power to do likewise.***
>
> — Gen. Giulio Douhet
> *Command of the Air*[1]

As the 21st Century begins, The United States faces an unprecedented limitation on its ability to project combat air power worldwide. That limitation is not the number of aircraft available to drop bombs, but the number of aircraft and crews available to provide Suppression of Enemy Air Defenses (SEAD). Constrained by budget decisions, force structure and improper paradigms, the electronic combat capabilities crucial to perform effective SEAD are barely sufficient to adequately support and protect U.S. strike forces in one regional conflict. A second simultaneous regional conflict would be nearly impossible to fully support.[2]

What has allowed joint air power to reach this point? Why are its capabilities and utilization now driven by the force structure of the electronic combat community? This paper attempts to gain some insight into those questions.

Thesis Statement

The theory behind the application of air power, at least as it involves the suppression and/or destruction of enemy air defenses (SEAD/DEAD), is flawed. The proven mindset of *Offense*, one of the Nine Principles of War, has given way to a passive view of the electronic battlefield. According to current theory, *Stealth* gives the attacker the ability to strike without fighting for and winning "command of the air". This misguided view, combined with an organizational culture that favors fighters and bombers at the expense of "support" aircraft, has led to the budget, procurement and personnel decisions that have left joint air power in its current vulnerable state.

Definitions

Electronic Warfare:

(Electronic Combat) Any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions within electronic warfare are electronic attack, electronic protection and electronic warfare support.[3]

Electronic Attack:

That division of electronic warfare involving the use of electromagnetic or directed energy to attack personnel, facilities or equipment with the intent of degrading, neutralizing or destroying enemy combat capability.[4]

Electronic Protection:

That division of electronic warfare involving actions taken to protect personnel, facilities and equipment from any effects of friendly or enemy employment of electronic warfare that degrade, neutralize or destroy friendly combat capability.[5]

Electronic Warfare Support:

That division of electronic warfare involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition.[6]

Suppression of Enemy Air Defenses (SEAD):

Involves neutralizing, destroying, or temporarily degrading enemy air defense systems through either physical attack or electronic warfare.[7]

Background

Would Douhet have supported the use of air power assets to perform SEAD in the pursuit of "command of the air?" That is the fundamental question that faces students of the subject today. After all, though a small amount of controversy exists on exactly who influenced whom and when, the theories underlying the U.S. use of airpower are still his.[8]

Most readers remember Douhet for his staunch advocacy of a single type of aircraft, the strategic bomber, and fail to remember that he also argued for the achievement of air control, or "command of the air" as he phrased it, by destroying the enemy air force on the ground.[9] Only "after achieving air superiority," could the bombers then "wreck the enemy's vital centers."[10]

Douhet's strength lies, not in execution, but in his simple verbalization of some of the basic foundations of the employment of airpower. To understand Douhet's work, one has to understand that "air superiority" is made up of two equally important halves: The ability to injure the enemy and the ability to keep from being injured by the enemy. The history of U.S. airpower is a study of newer and better ways to fly against an enemy and injure him. What has often been neglected until conflict was already underway is the ability to deprive the enemy of the power to injure friendly forces.

A Framework for Study

Organizational culture has been defined as "the common set of assumptions, beliefs, and values that has developed within the organization *to cope with the external and internal environment*" (emphasis added).[11] If one looks at the development of air power theory with an eye to the external and internal environment of the Air Force, a pattern forms.

There is a natural flow to the development of any theory, warfighting or otherwise. It starts with the *people*, who want something. They may want to win the next war, win a game of football, or make more money. In order to achieve their goals, someone comes up with a *theory*. These *theories* are no good, however, without *money*, so the *people* have to procure some. Maybe they need *money* to buy equipment, maybe they need to pay other *people*, or maybe they need to develop a new *asset* or *technology*. Regardless, *money* is necessary. Once *money* is secured, the *people* can develop *technology*, which they then use to apply and refine their *ideas*, create new *ideas*, request more *money* to improve their *technology*, and so on.

People drive this process, and it's a pretty healthy one so long as there are no shortages. Plenty of *people* turn out plenty of *theories* which, combined with plenty of *money*, produce plenty of *technology*, and so on. A shortage in any one area, though, causes shortages throughout the model, often with unanticipated results. As a shortage in one factor causes a corresponding shortage in the next and so on, the entire loop begins to neck down. This continues until a decisive external event shakes up the model and forces input of new *theories, people, money* or *technology* to make the model grow back to its proper size. That is the story of this paper.

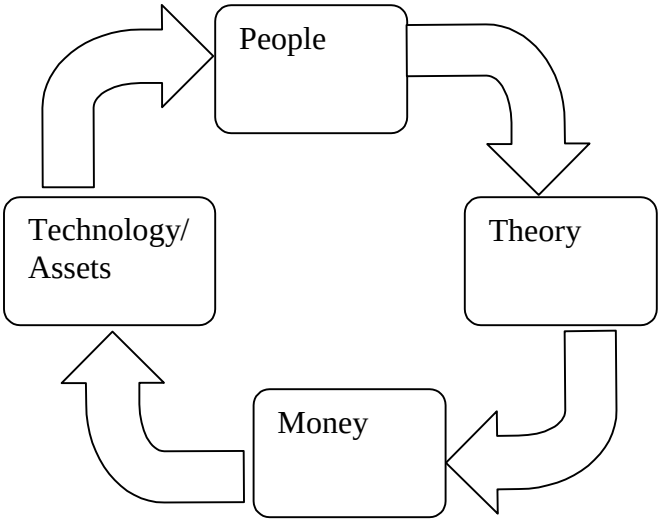

Figure 1. From People to Technology

This model will be used as a lens through which two case studies in U.S. air power theory will be discussed: The use of long-range escort for strategic bombers during World War II, and the use of electronic combat assets to escort strike aircraft during recent contingencies. Though fifty years separate the two case studies, the principles of airpower remain the same. The fighter threat has given way to surface-to-air missiles, but the attacking force must have a plan, even for a short period of time, to establish air superiority so that the bombers can do their job.

Notes

[1] Douhet, Gen. Guilio, *The Command of the Air*, Coward-McCann, Inc., New York, 1942, pg.

[2] Holzer, Robert, *Pentagon Seeks Successor to the Prowler*, Navy Times, Vol. 49, No. 12, 27 December 1999, pg. 18.

[3] Association of Old Crows, *EW Definitions*, np, available online at: http://jedonline.com/updir/shelf/ewdef.html, downloaded on 20 November 1999.

[4] Ibid

[5] Ibid

[6] Ibid

[7] GAO Report, *Combat Air Power: Funding Priority for Suppression of Enemy Air Defenses May Be Too Low*, Government Accounting Office, Washington D.C., 1996

[8] Melinger, Col. Phillip S. (ed), *The Paths of Heaven: The Evolution of Airpower Theory*, Air University Press, Maxwell AFB, 1997, pg. 98.

[9] Ibid

[10] Ibid

[11] Fritzsche, D.J., *Business Ethics: A Global and Managerial Perspective*, 110.

Part 2

"No Escort Needed"

> *"We believe that a bombardment unit, worth its salt, is imbued with determination that it will penetrate any pursuit force in the world."*
>
> — Capt. Ralph Snavely
> Bombardment Course, ACTS, 1939

Books have been written about the famous "bomber vs. pursuit" debates of the interwar period. Presenting yet another report on that controversy is not necessarily the focus of this paper. However, when used as a lens to view the rise and fall of electronic combat capabilities in the post-Vietnam Air Force, the similarities are fascinating.

Why did the Air Corps leadership allow their service to enter World War II utilizing the tactic of unescorted long-range bombing? The simple answer is that they believed that the technology embodied in the four-engine strategic bomber was unmatched by any threat, either in pursuit aviation or anti-aircraft artillery.[1] But the real answer is more complex. Referring to our model, it involves people, ideas, money and technology.

People

Any business school will teach you that the kind of people you bring into an organization has a direct impact on the culture and doctrine of that organization. "Human Resources, provide the creative spark in any organization…Without effective people, it is

simply impossible for an organization to achieve its objectives."[2] By the late 1930's, the objective of the US Army Air Service was autonomy. The vehicle for this objective was the strategic bomber, and people were the driving force. Unfortunately, while pursuing the objective of autonomy, the people in question skewed the otherwise sound theory of airpower toward bombardment at the expense of all other forms of aviation. They ultimately controlled the money and technology available to the Army Air Corps as the United States entered World War Two.

During the interwar period, the focal point of U.S. airpower research and theory was the Air Corps Tactical School (ACTS). What started out as a relatively balanced debate between pursuit and bombardment advocates gradually gave way to the "Bomber Mafia". Officers such as Robert Olds, Kenneth Walker, Donald Wilson, Harold Lee Geroge, Robert Webster, Haywood Hansell, Laurence Kuter and Muir Fairchild filled key positions on the faculty and espoused Mitchell's theories of an independent air force founded on bombardment aviation.[3] Each of these officers was destined to become an influential general during and after World War Two. With the leadership of the Army Air Corps firmly dedicated to bombardment, other forms of airpower had insufficient advocacy to command any sort of attention when the time came to divide up the budget for research and development. This under-representation would ultimately prove disastrous for the prosecution of high-altitude daylight precision bombing.

Leading the fight to recognize the contributions of pursuit aviation was Claire Chennault. As a senior instructor in fighter tactics at ACTS, he waged a valiant, but ultimately fruitless battle for the development of pursuit that eventually forced him into early retirement. "With the retirement of Claire Chennault from the Air Corps in 1937",

writes Hugh Severs, "the pursuit advocates lost their leader and staunchest spokesman."[4] Severs goes on to say that:

> "With Chennault gone, the Air Corps' focus turned towards bombardment, and the pursuit advocates, perhaps recognizing that the future of the Air Corps and its officers was linked to strategic bombardment, were unwilling or unable to change this focus."[5]

The "Bomber Mafia" spilled over into the establishment of GHQ Air Force in 1935. The first commanding officer of GHQ Air Force was General Andrews, a bombardment advocate who brought a group of bomber-minded officers with him to form his staff. By 1941, even General H. H. Arnold noted that "frankly, fighters have been allowed to drift in the doldrums."[6] It would take a war to force the Army Air Corps to rethink its position on the theory of airpower.

Theory

After World War I, theorists began to debate the relative merits of the different uses of airpower. The work of two in particular stands out: Douhet and Mitchell.

General Giulio Douhet of Italy represents perhaps the extreme view of the bomber advocate. He was a former artillery officer who became convinced of the decisiveness of airpower. He postulated that war centered on "command of the air."[7] Command of the air, of course, implied destroying the enemy's air forces.[8] His idea of establishing command of the air was through the use of strategic bombers to strike and destroy the enemy's aviation facilities on the ground.[9] The first edition of his book, "Command of the Air", published in 1921, made allowances for the existence of pursuit squadrons, to perform a secondary role of homeland defense.[10] By 1927, in the preface to his second edition, Douhet admitted that he had only included the pursuit aircraft in his original

work in an attempt to not alienate the rest of the Italian military. He was sure that heavily armed bombing aircraft could prevail over what he considered to be ineffective ground defenses.[11]

Back in the United States, U.S. Army Air Corps Brigadier General Billy Mitchell was formulating his own theories of airpower. Much as Douhet, Mitchell initial position recognized a need for a "balanced" force of pursuit and bomber aircraft, but he later changed his position, calling for an air force based largely on bombardment.[12] Two factors drove this reversal: the fight for an independent Air Force, and *money.*[13]

Money

In the post-World War I U.S. military, the fight for funding was literally a fight between the Army and the Navy for the survival of their warfighting capabilities. For aviation, the first part of the four-part "People/Theory/Money/Technology" loop to face a shortage was "Money".

In 1923, the Lassiter Board recommended a ten-year expansion of the Army air arm, a balanced force of attack, pursuit and bombardment aircraft that would cost a total of $90,000,000 a year.[14] This outrageous request for over 1/3rd of the Army budget was, of course, impossible to fully fund. Between attack, pursuit and bombardment, something would have to give. As the influence of the bombardment advocates grew at ACTS and throughout the Air Corps, what little money there was for research and development began to flow towards heavy bombers. Major Robert Eslinger, in his paper *The Neglect of Long-Range Escort Development During the Interwar Years (1918-1943)* notes that, "The battle between the bomber radicals and the handful of fighter advocates grew more bitter as the competition for money got stiffer."[15] As a result, the development of pursuit

aviation began to go wanting. It was decided, conveniently as it turned out for the bomber advocates, that a single-engine pursuit aircraft could never catch, outgun or outperform a heavy bomber. "Fighters are Obsolete" proclaimed the office of the Chief of the Air Corps. To them, funds spend on pursuit aircraft were a waste, and so their development and procurement were greatly restricted.[16]

Technology

This then, led to the restriction of the third phase of the model: *technology*. By the late 1930's, the advent of the monowing and all-metal construction had led to the development of the XB-299, which would become the famous B-17. By contrast, pursuit development had stagnated somewhere around the P-26 and P-39, both all-metal monowing fighters, but both underpowered, underarmed and unprepared to meet the threats they would face in the skies of World War Two. What money was available for pursuit research became bogged down in an unproductive "sub-controversy" over multi-seat vs. single-seat fighter aircraft.[17]

Conclusions

By the eve of World War II, then, the Air Corps had come full circle. *People* (Mitchell, et.al.) with a vision (an independent Air Force) espoused *theories* ("the bomber will always get through") that drove *money* decisions (develop bombers, not pursuit aircraft) and influenced the development of *technology* (progressive bombers vs. inferior fighters). This, in turn led to more prestige for the *people* involved in bombardment, which led to enhanced *theories* of strategic bombing (daylight precision) and so forth.

The "closed loop" of the airpower model was about to be acted on by some outside influences, namely the air defenses of the Luftwaffe.

Probably the biggest shortcoming of Douhet's theory was the failure to take into account the development of radar. Radar gave an opponent the capability to find the bomber formations and position his pursuit aircraft accordingly. Once this "domino" fell, others followed. Fighter aircraft finally developed engines and armament that allowed them to climb, chase and fight successfully with the heavy behemoths. Anti-aircraft weaponry developed proximity fuses for their shells, which made them deadly to the bomber formations.

By 1939, even General "Hap" Arnold was pressing for the development of a long-range escort fighter for bomber formations, but by then it was too late.[18] 8th Air Force bombers would have to sustain heavy losses before the Air Corps could deliver them fighters capable of protecting them from the enemy defenders.

One would think that these lessons, written in blood, would be an example of what was to be avoided in the future – a template of how not to close the minds of the service to pragmatic viewpoints, but it was not to be. The organizational culture that had been built on the theory of strategic bombing was unable to define itself in any other terms. As soon as the war ended, USAAF leadership began to put distance between themselves and the fact that the unescorted strategic bomber had met with only limited success, at the cost of very heavy casualties. In *The U.S. Strategic Bombing Surveys*, among the exuberant proclamations of the success of airpower, the reader finds one tiny paragraph that mentions that fighter aircraft might have been a problem:

> "Until then it had been believed that unescorted bombers, heavily gunned and flying in well-designed formations, could penetrate this deeply [into

> Schweinfurt] over the Reich. At least, *so far as a small force was concerned*, this was proven wrong"[19] (emphasis added)

The advocates of "the bomber will always get through" theory managed to qualify the Strategic Bombing Surveys, making it sound like larger, heavier formations would have worked. The lesson that "command of the air" has to be aggressively established for bomber aircraft to do their job would have to be learned again. The "*People/Theories/Money/Technology"* model would come into play again forty five years later, advancing and countering the same arguments.

Notes

[1] Melinger, Phillip S. (ed), *The Paths of Heaven, The Evolution of Airpower Theory*, Air University Press, Maxwell AFB, 1997, 218.

[2] Milkovich, George T. and Boudreau, John W., *Human Resource Management, 8th ed.*, Boston, Irwin/McGraw-Hill, 1997, 2.

[3] Meilnger, 216.

[4] Severs, Hugh G., *The Controversy Behind the Air Corps Tactical School's Strategic Bombardment Theory: An Analysis of the Bombardment versus Pursuit Aviation Data Between 1930-1939.*, ACSC Research Paper, 1997, 30.

[5] Ibid

[6] Chennault, Claire, *Way of a Fighter*, New York, G.P. Putnam's Sons, 1949, 20.

[7] Douhet, Gen. Giulio, *The Command of the Air*, Coward-McCann, New York, 1942,

[8] Ibid

[9] Ibid

[10] Ibid

[11] Ibid

[12] Melinger, 95

[13] Ibid

[14] Eslinger, Major Robert A. *The Neglect of Long-Range Escort Development During the Interwar Years (1918-1943),* Air Command and Staff College, 1997, 8.

[15] Ibid, 16

[16] Ibid

[17] Ibid, 18

[18] Ibid, 23

[19] *The U.S. Strategic Bombing Surveys, 30 September 1945*, Reprinted by Air University Press, Maxwell AFB, 1987, 16.

Part 3

Air Superiority through Stealth?

> *"Stealth aircraft do not require fighter escorts and defense suppression aircraft and electronic warfare aircraft to reach their targets…"*
>
> — Senator Hutchinson, during Senate B-2 debates, 30 June 1994[1]

> *"There was nobody at the table to argue [for electronic combat] – and there is a huge debating society that argues priorities and argues relative importance and argues for ideas and for resources…The natural consequence of that was for the resources to go away, and we've made a serious misstep. I don't know how to build that back.*
>
> — General Michael J. Dugan, USAF (Ret.)[2]

Stealth offered the first real change in air power doctrine and thinking since the Second World War. For the first time, the development of radar, the "eye in the sky" that helped the defender detect bombing formations and place their defending fighters, was possibly a moot point. If this was true, then the "bomber really could get through." It was "deja-vu all over again."

People

By the early 1980's, a revolution of sorts was taking place within the Air Force. The "Bomber Mafia" of World War Two and the postwar Strategic Air Command (SAC) was being overtaken and replaced by the highly decorated fighter combat veterans of the Vietnam War.

Table 1. Rated General Officers - 1997

	Fighters	Bombers	Transport/ Helicopters/ Other	EC Operational Experience	Any EC-Related "Exposure"
Pilots	121	30	52	7	16
Navigators/ EWO	2	1	2	0	1
Total/ % of Total Rated	123/ 59.1%	31/ 14.9%	59/ 28.4%	7/ 3.4%	17/ 8.2%

Source: Official Biographies of USAF General Officers, Air Force Personnel Command, 1997.

As we look at the rise of the fighter generals[3], though, it is interesting to note how many of them had any sort of experience in Electronic Combat. As is suggested by the data in Table 1, only 7 of the 208 rated generals on active duty in 1997 had any operational experience in the field of electronic combat. Assuming for a moment that each of these seven generals was a die-hard supporter of SEAD and EC capabilities (a stretch, to say the least), that would leave them with only 3.4 percent of the service's rated general officers. By comparison, let's assume that the service's bomber generals were all firmly in support of the development of the theory of stealth and the B-2. Their combined 31 voices (14.9% of all rated general officers) were certainly louder than the SEAD advocates. A further assumption that the 59% who fly fighters would give their support to the development of the F-22, at the expense of other programs, could certainly

explain how that fighter became the Air Force's number one funding priority. Electronic Combat, as a whole, ranked 17th.[4]

A word about the methodology is appropriate here. Of the 314 general officers on active duty in the U.S. Air Force in 1997, 208 of them were "rated" (i.e. pilots or navigators). For the sake of this paper, the assumption is made that non-rated officers would not have the operational experience one way or another to be effective advocates or detractors from tactical electronic combat. Therefore, only the 208 rated officers are considered in the table. To have "EC operational experience", an officer had to have on his/her record an operational tour flying an electronic combat aircraft, namely an F-4G Wild Weasel, EF-111 Aardvark, or an F-16CJ. Expanding that category somewhat, the "Any EC-related exposure" generously gives EC credit to any officer whose record mentions that he/she has flown in, been checked out in as a wing commander, or otherwise somehow been around any electronic aircraft.

The original hypothesis of the survey of general officers was that it would uncover a significant deficiency in the numbers of generals who had had operational experience in electronic combat. The null hypothesis, of course, would be that there would exist high-ranking generals who had flown EC/SEAD aircraft. The hypothesis was found to be only partially correct.

The numbers were, in fact, small. As noted, only 3.4% of the rated general officers had had operational EC tours. However, the small numbers were compensated for by the "importance" of some of the EC alumni. For instance, the head of the Air Combat Command in 1997, General Ralston, was an F-105 "Wild Weasel" pilot. Additionally, a Vice Chief of the Air Staff, Lieutenant General Vesely, was the commander of an EF-111

squadron. One would think that these two officers would have had some input into, say, the decision to retire the EF-111. It's almost as if the organizational vision of a time when stealth aircraft could attack targets with impunity was so tantalizing, it could cause years of experience to fall by the wayside. In his excellent book, *Setting the Context: Suppression of Enemy Air Defenses and Joint War Fighting in an Uncertain World*, Lt. Col. James Brungess makes an impassioned apologetic for development of a joint SEAD capability. But even this veteran EF-111 EWO manages to note that "By being 'invisible' to radar and infrared detection, the F-117 pilot needs know only where the target is to attack it."[5] In the early 1990's, stealth was more than technology, it was a mindset. So, while General Dugan's comments that EC was not well represented at the top are partially true, there would seem to be more pieces of the puzzle for the researcher to find. A good place to begin is the *theory* behind stealth precision engagement.

Theory: Stealth meets Douhet

Electronic Combat can be thought of as a "triad", consisting of Support Jamming, Lethal SEAD and Platform Self-Protection.[6] As authors John Knowles and Zachary Lum noted in the *Journal of Electronic Defense"*

> "Similar in concept to the nuclear triad, the EW triad relies on redundancy to defeat the evolving nature of threat systems…when threat technology progresses to where it can defeat one particular capability, such as platform self-protection, technology developments in another capability, such as support jamming or lethal SEAD, will serve to defeat the threat."[7]

As decision-making personnel within the Air Force became more and more convinced that the new "(stealth) bomber would always get through", less attention was paid to the support jamming and lethal SEAD corners of the triad. The radical thing about stealth is that it negated the years of work that had been done to develop ways to

achieve "command of the air" during an airstrike. Attacking aircraft were, supposedly, no longer vulnerable to radar and Integrated Air Defense Systems (IADS). This had obvious *money* implications. If one no longer needed to spend money on electronic combat and SEAD aircraft or the crews who flew and maintained them, mountains of *money* could be made available for the development of projects that would ensure the primacy of the USAF into the next century. Immediately, *theory* began to be restricted and even changed. Air Force thinkers began to clamor for a "new doctrine" based on the fact that U.S. forces no longer had to establish air superiority in order to prosecute an attack. As Major Kevin Kennedy noted in 1992:

> "Air Force doctrine says "Aerospace control assures the friendly use of the environment while denying its use to the enemy." Broken down into two components this says first, our aircraft will be able to use the environment as they desire. This means the enemy is not able to stop us from using it as we desire. The second component of aerospace control is denying this free use to the enemy. This means we have the ability to physically hinder his air operations. *With stealth aircraft we have free use of the environment; the first half of the aerospace control equation*."[8] (Emphasis added)

Remember that one of the Nine Principles of War is *Offense*. In the past, U.S. forces had gained "command of the air" through offensive means – finding enemy radar and missile sites and either jamming their frequencies or attacking them with ordnance. This new *theory* essentially gives up the aggressive-minded offensive means to establish air superiority. No longer would a strike lead have to "build a sanctuary and then fly in it", air defenses would be unable to keep the stealth aircraft from prosecuting their attacks. Notice how this thinking mirrors the "bomber will always get through" theories of the interwar "Bomber Mafia."

Money

If the above theory was in fact true, it had enormous financial possibilities, especially in the lean budget years of a protracted defense drawdown. In the same way that the Air Corps of the lean 1930's chose not to develop the fighter, the Air Force of the 1990's would no longer have to devote resources to the development and procurement of electronic combat aircraft, either for support jamming or lethal SEAD. That money could be poured into the more popular bomber and fighter programs, particularly the F-22.[9] It was an invitation to a party that few top Air Force officials could afford to miss. By February of 1991, Secretary of the Air Force Donald Rice was claiming to Congress that eight F-117's with PGM's "could do the work of 75 non-stealthy planes."[10] His inference, of course, was that no strike package was necessary to help the bomb-droppers fight their way into the target. Effectively, this conceded air superiority to the enemy, while relying on stealth to enter their territory, execute the mission and retire safely.

In an eerie repeat of the "Fighters are Obsolete" slogan of the 1930's, Air Force planners began to do everything in their power not to have to spend money on electronic combat, so that they could fund their favorite programs.[11] Part of that attempt was the decision to retire both the F-4G Wild Weasel and the EF-111 Aardvark. A 1996 warning by the Government Accounting Office that: "DOD's planned actions in the next few years will have a negative impact on SEAD capabilities and may need to be reversed in the future, at much greater expense and effort", fell on deaf ears.[12]

Technology

By 1997, the only SEAD assets that the USAF owned were the modified F-16 "CJ"s which carried the admittedly inferior Harm Targeting System (HTS).[13] The gamble was

that non-stealthy USAF aircraft could rely on the U.S. Navy EA-6B's for jamming support, until such time as the preponderance of the Air Force assets would be stealthy and wouldn't require any EC support.

The original F-4G follow-on was supposed to be a SEAD version of the F-15 Eagle. Called the F-15 PDF, it would have been armed with the HARM missile and deployed in great quantities with the capability to do both "reactive" and "preemptive" SEAD. Unfortunately, an inter-community squabble over whether the new aircraft should have one or two crewmembers eventually detracted enough from the program that it was killed in 1994.[14] Again, organizational culture impeded the development of *theory*, flow of *money,* and purchase of *assets* and *technology*. In place of the F-15 PDF, the decision was made to procure the F-16CJ. A "quick-reaction, interim, low-cost solution" that was originally supposed to be a stopgap measure while the F-15 PDF program reached maturity, the F-16CJ instead became the Air Force's only remaining chance to have a SEAD aircraft.[15] "It's not perfect, but it's good enough", was literally the reaction of the division chief of Air Force policy and requirements in the Pentagon at the time.[16]

Conclusions

As the U.S. prepared for conflict in Kosovo in 1999, the Air Force had come full circle. *People* (the "Fighter" generals/Stealth advocates) with a vision (Global Reach-Global Power) espoused *theories* (stealth equals air superiority) that drove *money* decisions (retire F-4G, EF-111 without replacements) and ultimately influenced *technology* development (stealth). This, in turn, led to more prestige for the *people*

involved in stealth programs, which led to enhanced *theories* of the use of stealth (Precision/Effects-based targeting, etc.) and so forth.

If this sounds like a word-for-word repeat of the conclusions of Chapter 2, you're right. The model had played out exactly as it had in the late 1930's, and like the "Bomber Mafia" of World War Two, the stealth advocates were about to have their assumptions tested in the crucible of combat.

Notes

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[6] Knowles, John and Lum, Zachary, *Into the Readiness Gap*, Journal of Electronic Defense, March 1996, np, available online at: http://www.jedonline.com/jed/html.new.mar96/feature.html, downloaded on 1 January 2000.

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[14] Knowles and Lum

[15] Ibid

[16] Ibid

Part 4

"Into the Readiness Gap"

> *Until then [future SEAD developments], it's just the F-16 HTS, the EA-6B and luck.*
>
> — Journal of Electronic Defense[1]

By February of 1997, the last F-4G Wild Weasel and EF-111's were gone from the active Air Force inventory. In their place was an innovative joint initiative to rely on F-16 CJ's and Navy EA-6B's to provide defense suppression.[2] At the same time, the Air Force agency responsible for acquiring electronic combat hardware, the "Headquarters Electronic Combat Division", was disbanded, its duties assimilated into the "Common Systems Division."[3] This decision would prove disastrous for the USAF's future electronic force structure.

Meanwhile, providing the new joint EC capability were four new EA-6B squadrons, called "expeditionary squadrons". Partially funded by the Air Force and staffed with four Air Force officers each, these squadrons together with the four USMC Prowler squadrons would cover the three traditional forward deployment sites. EC would be continuously available in Atsugi, Japan, Incurlik, Turkey, and Prince Sultan Air Base, Saudi Arabia. Or at least that was the theory.

There are two problems with the current arrangement. Firstly, the twenty-four EF-111's in service during the Gulf War were admittedly overtasked, showing their

importance to USAF strike planning.[4] Replacing them with only twenty EA-6Bs was a negative equation to start with. Moreover, in the evolving SEAD doctrine of the Gulf War, not all strike packages required jamming support. The loss of Scott O'Grady's F-16 in 1995 and the loss of an F-117 during the 1999 Kosovo conflict have changed that. Today, no strike package goes into hostile territory without electronic combat escort.[5] The twenty Prowlers thus substituted into an environment where CINC tasking now requires EC support for all aircraft, including stealth, are simply not enough.

Secondly, after the agreement was struck between the USAF and USN, a fourth forward deployment site was added to the list: Aviano, Italy. Covering three sites with eight squadrons was conceivably an achievable goal, but the eight squadrons (four Navy/Air Force and four USMC) cannot support four deployment sites continuously. Doing the math, this would result in a deployment every six months for each squadron. Obviously, this cannot be done while remaining within DOD PERSTEMPO guidelines. The answer, therefore, is to substitute fleet EA-6B squadrons, who would otherwise be engaged in inter-deployment training at their home bases, into coverage gaps at the different deployment sites. This has resulted in unacceptable OPTEMPO for the tasked fleet squadrons. In retrospect, one could say that the Air Force paid for four squadrons and got 14."

This has led to a sort of "shell game" of EA-6B squadrons attempting to cover the forward deployment sites. VAQ-132's schedule in 1999 is an illustrative example. Flying out of Prince Sultan Air Base, Saudi Arabia in early 1999, VAQ-132 was "covering" one of the gaps in the forward deployment bases. This was in addition to their "normal" workup and deployment rotation with their aircraft carrier. The squadron

was scheduled to come home after 56 days at PSAB. (Anything 57 days and over is counted as a "deployment", 56 days and under is simply a "detachment".) Because of Kosovo, the USMC was unable to support its scheduled deployment to Incurlik, Turkey in support of Northern Watch/Provide Comfort. To cover the gap, VAQ-134, 132's replacement at PSAB, was sent to Incurlik instead. VAQ-132 was extended on station "indefinitely." Meanwhile, VAQ-136, the EA-6B squadron based in Japan as part of the forward-based Kitty Hawk battle group was pulled off the Kitty Hawk and sent to PSAB to relieve VAQ-132. VAQ-132 eventually made it home with 70 days of deployment on the books, only to begin preparing for their "real" cruise. All of this left the FDNF (Forward Deployed Naval Force) without any EA-6B's. One wonders what they would have done if a crisis had broken out in Korea. As the EA-6B Wing Requirements officer put it:

> "During peak operations of Allied Force, 26 EA-6B aircraft – nearly one third of all operational EA-6B aircraft at the time – were deployed in support of Operation Allied Force. At the same time, EA-6Bs continued to support Operations Northern and Southern Watch over Iraq, the North Korean contingency and three carrier deployments. As a result, the EA-6B community was tasked well beyond the typical deployment schedule, creating significant demands on aircraft, aircrews and squadron personnel alike."[6]

Obviously, this pace couldn't continue. With the shootdown of an F-117 and the subsequent CINC requirement for EA-6B support of all strike packages, the newly-declared "Expeditionary Air Force" suddenly found its combat power tied to the availability of about 96 to 104 (on a good day) 15 to 20-year-old Navy aircraft. [7] Something would have to be done differently.

Notes

[1] Knowles, John and Lum, Zachary, *Into the Readiness Gap*, Journal of Electronic Defense, March 1996, available at: http://www.jedonline.com/jed/html/new/mar96/feature.html., downloaded on 1 January 2000.

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Part 5

The Future of Electronic Combat

There has to be "a balance between stealth…jamming…and info warfare. They all play a role in this force-protection business."[1]

— General Mike Ryan, USAF
Air Force Chief of Staff

After a slow start, the joint community is coming around to the realization that the capabilities of the EA-6B will have to be improved upon and eventually replaced. Dependence on the internal qualities of strike aircraft (stealth, self-protection) has been shown, at least at the current level of technology, to not work as completely as designers had hoped. Success in future conflicts, and *Command of the Air* will depend on developing and strengthening all three legs of the Electronic Combat "triad": Lethal SEAD, Support Jamming, and Aircraft Self-Protection. "The idea that stealth could solve all problems was abandoned in favor of an active mix of stealth technology, active air-defense suppression and electronic suppression."[2]

So, what's being done? First, the U.S. Air Force has gotten real serious, real quick about electronic combat. A classified RAND report on Air Force capabilities is currently making the rounds at senior levels in Washington D.C. It is said to recommend major changes to the way the USAF approaches electronic combat. If the recommendations are carried out, EW will be put on an organizational level with stealth, the offices responsible for setting operational requirements for EW will be reinstated (they were slashed in the

early 1990's), and an EW acquisition office parallel to the stealth acquisition office will be created.[3]

Secondly, Congress is now actively encouraging the Pentagon to get serious about augmenting and/or replacing the EA-6B. The establishment of a fifth joint Air Force/Navy "Expeditionary" squadron was announced.[4] The new squadron will be made up of aircraft from existing assets in the training or depot (maintenance) pipeline.[5]

Meanwhile, just after the Kosovo conflict, Congress included $10 million in the FY 2000 budget for an Analysis of Alternatives (AoA) to assess follow-on designs to replace the EA-6B Prowler by 2010. Basically, there are five alternatives that are said to be on the table. First, new EA-6B's could be built, incorporating the new ICAP III (Improved Capabilities III) suite of jammers and transmitters. Secondly, a smaller version of the ICAP III system could be placed in an existing tactical airframe, such as the F-18F, MV-22, JSF, F-22 or F-15E. An entirely new aircraft, such as an electronic combat version of the Joint Strike Fighter (JSF) could be considered. An Unmanned Aerial Vehicle (UAV) containing an electronic combat payload is being considered. Finally, miniature airborne electronic attack munitions could be delivered into the battlespace by such systems as the Army Tactical Missile System (ATACMS) or the Navy's Tomahawk.[6] A brief discussion of each of these options follows:

A "Designed From Scratch" Aircraft

Documents from both the Air Force and Navy suggest that the idea of building a new aircraft from scratch is not being considered seriously. Lack of funding and the urgency of the requirement are the main arguments against this. "There is not sufficient funding available in the time of concern to build an airborne platform and integrated system from

scratch."[7] This would seem to rule out either re-opening the long-defunct Grumman EA-6B production line (Option 1), or marrying into a new airframe initiative, (Option 2). That leaves putting a system on an existing airframe, UAVs, or devices carried on munitions.

Unmanned Aerial Vehicles (UAVs)

The electronic combat mission profile would seem to lend itself to the use of Unmanned Aerial Vehicles (UAVs). EA-6Bs generally fly out ahead of the strikers and establish a jamming orbit that covers the striker's inbound and outbound routes of flight. Flying a UAV into the battlespace and setting up a loiter pattern while the strikers hit their targets makes some sense. The question is: "is the technology there yet?" The development of electronic combat payloads for UAVs faces three obstacles: priority, size and adaptability.

There are a total of six UAV programs at various stages of development within the US military. They are controlled by the Defense Airborne Reconnaissance Office (DARO).[8] The very name of the organization controlling the development of UAVs should give the reader a sense of the current priorities for UAV utilization. Within the military, the CINCs interact with DARO to voice their equipment needs[9] In the words of one senior US military official: "They're gonna want pictures. Pictures, pictures, pictures."[10] Overall, 13 different payloads have been identified as having potential to be placed in a UAV. They run the gamut from EO/IR and SAR reconnaissance and imaging to communications/data relay and laser designating/range finding.[11] Of the six UAV programs, only two are currently being developed with an electronic warfare variant, and these only in terms of SIGINT, not active jamming.[12] The current focus certainly seems

to rest on reconnaissance, although electronic warfare proponents are working to change that.

Another barrier to the use of UAVs to perform SEAD is the size of the payload that the relatively small airframes are able to carry. Jamming a radar, literally overwhelming its signal with your own stronger one, takes a lot of power generation capability. The jamming pods that currently hang on an EA-6B weigh almost 1000 pounds each. In contrast, the maximum payload that can be carried by *Predator* is 450 pounds. Even the larger *Global Hawk*, which can carry up to 1,960 pounds, can't keep up with the EA-6B, which routinely carries 3,000 pounds of jamming transmitters in addition to its internal receivers and signal processing equipment. Equal to the task, leading companies have been working to overcome this limitation. Northrop Grumman is developing a Tactical Radar Jammer (TRJ) as an electronic attack payload to be placed on the *Hunter*, one of the smaller UAV programs, currently active only for demonstration and testing purpoese. With its 100 pound size, TRJ is able to operate with as little as 1kW of input, allowing it to be powered by most UAV engines.[13] Ultimately, Northrop Grumman is working to integrate the TRJ with a sensor package.[14] That would then approximate the capabilities of the EA6B. As the *Hunter* is too small for this combined package, another platform will have to be found. The *Global Hawk* has been mentioned in connection with this concept.

The final barrier to the electronic combat use of UAVs is flexibility. Human intervention is what makes the EA-6B unique. The ability to listen to, display and evaluate/analyze electronic signals in real time is what gives the Electronic Countermeasures Officers (ECMOs) in an EA-6B the crucial edge in combat. This

human interaction protects friendly systems from fratricide, ensures compliance with applicable rules of engagement, and enables rapid reaction to the ever-evolving conditions of combat. There is some debate over whether or not a system that is flexible enough to cope with the immediate demands of electronic warfare has been perfected yet.

Nonetheless, UAVs seem to be the preferred plan of the future for the Air Force, as it doesn't involve diverting aircraft development money from the F-22. "I don't see another airplane," a senior official said. "We will do something less expensive. I think you will see a decoy or an unmanned aircraft."[15] Current development is taking place at the Air Force UAV Battlelab. There, Air Force developers work to "leverage upon the UAVs strengths of endurance and survivability to perform all aspects of the non-lethal SEAD mission."[16]

Existing Aircraft

The option that has had the most proven success is the modification of an existing airframe to perform the EC mission. Past aircraft that were originally designed for different purposes, but proved to be effective warfighters in an EC configuration include the EF-111A, the F-4G and the EA-6B.[17]

This option has a number of things going for it. For one, it is substantially cheaper, as it builds on a platform that already has a production line open. It is also a known quantity. The manned tactical electronic warfare aircraft have proven combat records. With the state of the world today, it might not be the best time to experiment with unproven EW concepts.

This option also has the advantage of timing. There is a "ready-to-go" airframe that is just beginning to come off the production lines. The U.S. Navy's F-18F, the two-seat

version of the Navy's new multi-purpose fighter, lends itself beautifully to being crewed with a pilot and an Electronic Countermeasures Officer. Indeed, McDonnell Douglas has already build a mock-up, the proposed F-18G. From the reviewed concept briefings, this appears to be the Navy alternative of choice. This would fit with the Navy's traditional advocacy of manned electronic combat assets. Navy officials, such as Rear Admiral John Nathman, director of air warfare, continue to insist that everything is on the table until the 18-month analysis of alternatives is completed.[18] A survey of recent coverage in various journals, however, will quickly show the reader that the Navy is talking about almost nothing but the F-18G. A joint Air Force/Navy buy of this aircraft, similar to the joint development of the F-4 Phantom II in the 1960's, would solve a lot of problems for both services.

SEAD Munitions

Imagine if, instead of sending aircraft into the battlespace to suppress enemy air defenses, friendly forces could launch a series of missiles, either from aircraft flying well out of threat range, or from a ground-based system. These missiles would autonomously search for, detect, identify, attack and destroy SAM systems.[19] That's the idea behind the Low Cost Autonomous Attack System, or LOCAAS. These munitions would, in effect, become miniature "Wild Weasels", loitering while strike aircraft prosecute their targets, ready to pounce on any SAM system that becomes active.

As envisioned, LOCAAS has a standoff range of over 90 miles, a search area of 33 square miles and a turbojet engine capable of powering the munition for 30 minutes.[20] On 17 December, 1998 the Air Force Research Laboratory awarded Lockheed Martin a

$32 million contract to produce an Advanced Technology Demonstration (ATD) of the LOCAAS. The expected contract completion date is 10 December 2001.[21]

There are concerns with this approach. The idea of launching an autonomous weapon which seek out and attack its own target raises the spectre of fratricide. The contract with Lockheed Martin specifies that "the system will be capable of discriminating between classes/types of targets and between targets and non-combatants."[22] How exactly they propose to accomplish that in a coalition environment where the enemy may very well be operating some of the same weapons systems as friendly forces remains to be seen. At any rate, assuming that the selectivity issue could be worked out, a fielded capability is (optimistically speaking) several years away.

Conclusions

Upon review, the hodgepodge of platforms and systems that represent the future of electronic combat and SEAD suffer from a lack of funds and attention. While most of the attention over the last decade has been lavished on the USAF's #1 funding priority, the F-22, electronic combat as a whole has languished at #17.[23] Which of the five programs considered will represent the future of electronic combat? No one is seriously considering re-opening the EA-6B production line. The design is too old and only marginally survivable in today's battlespace. Building a new airframe as an electronic combat platform is almost entirely out of the question, both for the USAF and the Navy. UAV programs are so overly concerned with getting good film footage for CINCs and their commanders, that electronic combat payloads are almost an afterthought. SEAD munitions are years away from any sort of operational capability.

The most likely scenario involves a two-tiered approach: near-term and long-range. In the near term, modification of an existing airframe to produce a new combat aircraft capable of both jamming and firing anti-radiation missiles, is the only option that is going to alleviate the current critical shortage of assets. Joint development is a must. The armed forces of the 21st century no longer have the luxury of simultaneously developing their own programs, as the EF-111 and EA-6B were. The USAF and the Navy will have to work together to field a platform that can quickly fill crucial joint power projection shortfalls. But the long-range options should not be ignored. The era of cruise missiles and "zero-casualty " warfare demands further development of the unmanned options. The future of electronic combat almost certainly lies in unmanned aerial vehicles and "smart" munitions.

Notes

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Part 6

Conclusions

> *"I think we all agree it's time for a fundamental review of our electronic warfare posture."*[1]
>
> — Gen. John P. Jumper, USAF
> U.S. Air Forces Europe

By 1941, the Air Corps leadership knew they had a problem. At that point, though, it was too late to do anything about it, and the 8th Air Force eventually paid the price. As Claire Chennault later remarked:

> "It is in time of peace that we must develop our technical equipment and train our personnel. We cannot do these things after the beginning of hostilities nor can we suddenly shift from one type of vital technical equipment to another after the fighting starts. Our leaders in peacetime should have sufficient imagination, vision, and experience to direct technical development and personnel training upon sound lines."[2]

The challenge before the USAF is to recognize the problem that exists today with electronic combat force structure and capabilities, and act to "direct technical development and personnel training" before a tragedy is allowed to occur.

According to Capt. Kenneth Krech, USN, there are three realities in today's force structure: "First, the level of military presence overseas has not decreased. Second, the need for SEAD has also increased. Finally, the 'savings' of decreased support-jamming requirements are not being realized."[3] Change needs to occur. Looking at the model of *People, Theory, Money, Technology*, the place where change has to begin is *theory*.

Change won't come easy. The organizational culture of the Air Force is such that it is difficult to admit that *technology* can't overcome defenses. Airmen must understand that "command of the air" is vital. It is not something that can be passively taken for granted, it must be fought for each and every time a U.S. aircraft flies into hostile territory.

As this paper has shown, World War II and the recent events in Kosovo have both highlighted the importance of "command of the air." U.S. forces must "deprive the enemy of the power to injure", to put it in Douhet's terms. A strong balance of capabilities must include being able to shoot down the enemy's aircraft, destroy them on the ground, or destroying his surface-to-air missile batteries. Only then can strike aircraft effectively carry out their mission. In order to leverage the combat power available in the F-117, B-2 and F-22, effective electronic combat capabilities will have to be paid for and utilized. These electronic combat capabilities must include research and development of all three sides of the "EW Triad": Support Jamming, Lethal SEAD and Self-Protection.

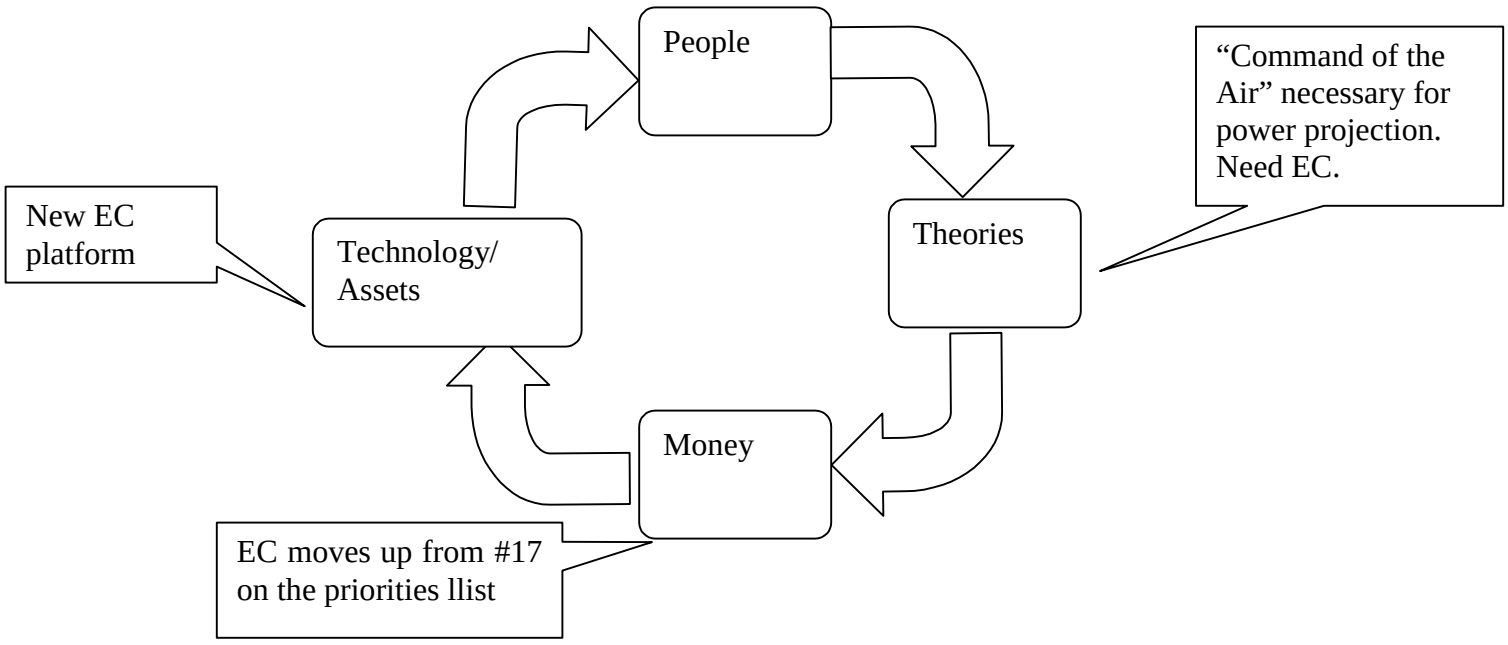

Figure 2. How Change Could Occur

Once the *people* involved are able to overcome the paradigm of stealth and return to the real meaning of "command of the air", the *theory* will change. That's already started. General Ryan's remarks at the beginning of Chapter 5 show how the Air Staff is beginning to consider this issue. As Congress continues to take an interest in this issue, *money* will become available. This will lead to new *technology*. In the near-term, the USAF and Navy must work together to field an aircraft that will ensure that U.S. forces will be able to aggressively take "command of the air." Long-term goals should include a renewed effort to utilize unmanned aerial vehicles and "smart" munitions. Regardless of the technology eventually developed, it is the theory that's important, not the platform. Nothing less than the United States' power projection capability in the 21st century depends on a correct interpretation of a *theory* from the 1920's: Douhet's "Command of the Air".

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