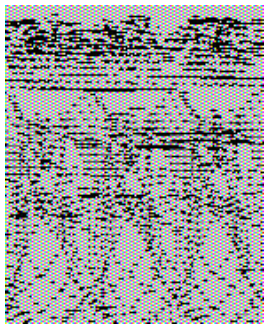

BUILD-TO-SHELVE PROTOTYPING

Undercutting Doctrinal Development

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Abstract

The lag between the fielding of systems and the development of conflict-winning employment tactics and doctrine is a historical fact we dare not neglect. Yet, DOD acquisition strategy appears to be on the path to do just that. Foregoing the expense of producing weapon systems— an understandable expedient in the budget crunch— has been widely criticized because of its effects on the defense industrial base. Former Secretary of Defense Les Aspin's new approach, called "rollover plus," recognizes the need for operational testing. What's been missing from the debate about these alternatives is how any approach that severely limits the numbers of end items fielded also adversely impacts our ability to develop conflict-winning employment doctrine.

The famous B-17 Flying Fortress illustrates where too few prototypes, and shorter than expected strategic warning, led to refining doctrine in combat. Although the B-17 prototype flew in 1935, there were never enough B-17 prototypes to "train like you'll fight" simply because the B-17 wasn't fielded in quantity until war broke out. The 13 B-17 prototypes were not used to develop, let alone practice, the "box" formations that were crucial to the notion of "self-defending" bomber formations. The B-17 history— strategic warning, production based upon tested prototypes, and employment in combat— is much like what policymakers envision for future weapon system production.

It also takes considerable time to get to a combat-lethal state. A modern illustration is the time lag between production article first flight and initial operational capability (IOC, a minimum combat capability) for current USAF fighters: for the F-15A, F-15E, F-117A, and F-16A the lag was 25, 33, 28, and 27 months, respectively. I submit it takes 18-30 months *beyond IOC* **before operators are truly ready to fight. Will we have the luxury of time in the future? To develop an employment doctrine in peace that requires the minimum of combat adjustments, we shall need the creation of a "community," so that, to paraphrase historian Michael Howard, we can get a conflict-winning doctrine right** *quickly* **when the need arises.**

I submit there are two ways we can use limited numbers of prototype systems to ensure we learn relevant tactical lessons *before* **we have to fight: (1) capitalizing on interactive computing technologies to better develop requirements and tactics throughout the system life cycle and (2) changing our concept of prototypes from the buying of one or two "experimental" items to procuring entire "prototypical" units.**

In *The Killing Ground,* **Tim Travers observed that revolutionary doctrines develop as a function of the numbers of operators exposed to a new system over time. Substantial numbers of a system must be fielded to foster the dynamic operator-developer-tester interaction that's needed for**

sound doctrine. Prototypical units and the use of interactive simulation for employment doctrine are two ways to increase the odds we will recognize the ultimate potential of future systems and develop lethal, conflict-winning doctrine and tactics.

About the Author

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The arduous process of producing a thesis requires many contributors, only one of whom gets to put their name on the cover.

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Introduction

It is the task of military science in an age of peace to prevent doctrine from being too badly wrong. . . . What does matter is the ability to get it right quickly when the moment arrives.

—Sir Michael Howard
Journal of the Royal United Services Institute for Defence Studies

Those who are ready first not only will win quickly, but will win with the fewest sacrifices and the minimum expenditure.

—Giulio Douhet
The Command of the Air

The lag between the fielding of systems and the development of conflict-winning employment doctrine is a historical fact we dare not neglect. Nonetheless, too many people within the Department of Defense (DOD) and Congress seem to believe systems are ready to go to war when they are first delivered to our fighting forces. This paper addresses the crucial role *numbers* of weapon systems and *time* play in developing conflict-winning employment doctrine during peacetime. Additionally, this paper will strive to demonstrate that *years* are required to develop mature employment doctrine.

Why is this important? Driving the problem of employment doctrine development to the fore is a DOD acquisition policy, signed by former Under Secretary of Defense for Acquisition Donald J. Yockey on 20 May 1992 (hereafter referred to as "the Yockey policy"). This acquisition policy seeks to cope with shrinking budgets and threats by avoiding the expense of producing weapons. Instead, it plans to build *and shelve* successive generations of prototypes until strategic warning hints at a need to start production.[1] One critic has called it "fly but not buy," iterating the familiar "fly-before-buy" theme.[2] In essence, the policy expects to predict when the next war will occur, and to be able to produce new weapons in time.

Critics of the Yockey policy have focused almost exclusively upon the debilitating effects on the defense industrial base. For example, Martin-Marietta's CEO, Norm Augustine, noted, "If we think it's difficult to build a new military in wartime, wait until we have to build an industry."[3] Former Secretary of Defense Les Aspin has an approach he calls "rollover plus," that calls for lengthened periods of operational testing.[4] The problem with this concept is that testing does not aim to develop employment specifics either tactically or operationally. Thus, the Yockey policy and "rollover plus" both neglect a key issue. Missing from the debate is the fact that any approach that severely curtails the numbers of fielded systems will also destroy the process the Air Force uses to develop lethal and combat-winning employment doctrine.

This paper consists of six chapters which follow an introductory overview: "Stage Setting," describing how employment doctrine develops, documenting "doctrinal lag,"

critiquing the Yockey policy's assumptions, and offering two solutions before finally concluding.

Chapter 1 lays the foundation for the rest of the paper—the background, methodology, and definitions.

Chapter 2 begins by illustrating how important employment doctrine is. In the following segment, we'll examine how employment doctrine develops today and how the Yockey policy undercuts the key component—operational units. Next, I address how significant numbers of fielded systems have historically been available to achieve a robust employment doctrine. In this chapter I also introduce the notion of "combat-lethal" doctrine.

Chapter 3 presents a rare Air Force precedent to this situation—that of the development and production of the Boeing YB-17 Flying Fortress bomber. From here, I will show how doctrinal lag is still with us today, updating the B-17 experience with our modern USAF fighter experience.

Chapter 4 focuses on judging the soundness of the Yockey policy assumptions. This will involve my making a case about the "fallacy of strategic warning" and to describe war as an inherently unpredictable, "nonlinear" phenomenon. In the latter half of this section I will present some additional examples where, despite our best efforts, we were unable to completely predict events or prepare for a conflict. All of these examples will then provide the context for two new ways to develop employment doctrine.

Chapter 5 is a salient chapter. I propose two synergistic ways to cope with defense budget realities and priorities, while ensuring we use limited numbers of systems to learn relevant employment lessons *before* we have to fight. To deal with Howard's dilemma of doctrine "always being wrong," these solutions aim to ensure employment doctrine is "not too badly wrong" by providing the conditions where a robust employment doctrine can evolve.[5]

The first solution is to better use interactive simulation by pushing the development of employment doctrine earlier into the process used to build the systems and throughout the system life cycle thereafter.

The second approach to solving this problem is to change our concept of prototypes from the buying of one or two items, to procuring entire "prototypical" *units*. This approach would generate the stresses only operations can create and could also use relatively low-cost, interactive simulators to help refine employment doctrine.

Chapter 6 will attempt to "wrap up" the whole argument concisely and cogently.

Let me briefly clarify what this paper is *not*. This paper is *not* about trying to perfectly predict what will happen in war during peacetime—it is about maximizing peacetime learning within the context of reduced budget authority. It is *not* claiming potential foes will be able to challenge US military supremacy in the short-term—it is about ways to reduce the complacency that follows a victory like Desert Storm and that invariably places military aviators at risk in the future. It is *not* about replacing flight time with simulator time—it is about complementing flight time with low-cost networking technologies.

Before moving on, it may be helpful to know why I became interested in this topic and how I researched the issue.

Notes

1. Bruce Auster, "Prototypes," *Air Force*, August 1992, 52.

2. Erik R. Pages, "The New Prototyping Strategy: Evidence and Prospects," *Defense Analysis* (Lancaster, U.K.: Brasseys, December 1992), 314.

3. Bruce A. Smith, "U.S. Firms Face Long Adjustment," *Aviation Week and Space Technology*, 15 March 1993, 50.

4. Ibid., 54.

5. Michael Howard, "Military Science in an Age of Peace," *Journal of the Royal United Services Institute for Defence Studies*, March 1974, 5.

Chapter 1

Setting the Stage . . .

My interest in this topic has literally been accumulating over ten years. Several personal experiences were crucial to stimulating it and may assist your understanding of the rest of this paper. These motivating encounters were two fighter "war stories" and two history books.

Background

The first fighter story of note was related to me in the early 1980s. I observed to a former Aggressor F-5 pilot that flying against the F-15 must have been a humbling experience. His retort was, "It was, but for the Eagle drivers." I was surprised, as the Aggressor explained how the then-new F-15 was often poorly employed, inappropriately relying on its superior thrust for vertical plane maneuvers. These tactics tended to present the F-5 with excellent infrared (IR) missile engagements—hot afterburners climbing into a cold sky. I was astounded, to say the least—the state-of-the-art fighter was being handily defeated in exercises by the low-tech F-5.

Some five years later I had a similarly unsettling conversation with an F-15 pilot. This time the topic was the abilities of the Navy/Marine Corps F/A-18. Interestingly, the Eagle pilot observed that the kill ratios heavily favored the older F-15 because "the Navy and Marines haven't figured out how to fly the F/A-18 yet." I asked myself: Was this just an Air Force fighter pilot ego at work—putting down naval aviators—or was it actually an example of an aircraft with mature employment doctrine defeating a new, high-tech system?

During 1992 we read two books in the School of Advanced Airpower Studies (SAAS) that further placed pieces in this mosaic. Both Tim Traver's *The Killing Ground* and Robert Doughty's *The Seeds of Disaster* examined how militaries missed the potential of new technologies prior to a brutal realization on the battlefield. The lack of appreciation for the impact of the machine gun prior to World War I, and the tank prior to WWII, detailed how the few favoring revolutionary employment concepts were usually silenced by the many who favored fitting the system into established doctrines. Retired Air Force Reserve Maj Gen I. B. Holley, Jr., cogently comments that this phenomenon ". . . doubtless arises from the fact that improvement in weapons is due to one or two men, while changes in tactics have to overcome the inertia of an entire conservative class."[1] I perceived a pattern of missed opportunity developing.

The last piece fell into place with the demise of the Soviet Union. The Bush administration's "build-to-shelve" prototyping acquisition policy seemed to be ignoring the time needed to make a weapon system reach some degree of combat-ready status, let alone to fulfill its potential. The assumptions for strategic warning appeared to me to be hopelessly optimistic. This shortsightedness is spurred, I believe, primarily by a desire to balance budgets. In other words, short-term budget-efficiency is gained at the expense of future combat effectiveness.

From these events I began formulating an approach for questioning the ways sound employment doctrine is and could be developed. The next section will outline how I approached this problem.

Methodology

The first step in approaching this problem was to understand what doctrine is, how it develops, and how much time it takes to develop. To do this I read books, articles, and USAF regulations. However, the linchpin of my research involved 25 interviews with a variety of fighter aircraft aviators from the test, tactics development, and operational communities. I sought out the full-range of experience levels, ranks, and requisite backgrounds—A-10, F-111, F-15, F-16, and F-117. I also had the pleasure of interviewing a test group commander and two retired general officers.

My research was greatly aided by a trip to Nellis Air Force Base (AFB), Nevada, the home of the USAF's tactics development and evaluation (TD&E) community, the 57th Test Group. There I conducted many of the interviews mentioned above and reviewed mission statements and TD&E process briefings. I also met with several USAF Weapons School instructors.

Next, I ventured to the 33d Fighter Wing based at Eglin AFB, Florida, to visit with operational units (the 58th Fighter Squadron), with the Air Warfare Center (AWC), and with the Aeronautical Systems Center's (ASC) long-range planning (XR) division. The visit to the 33d provided an opportunity to meet a wide variety of operators, including some with combat time. The AWC visit provided an electronic combat complement to the airframe perspectives of the Nellis trip. The ASC/XR visit provided focus on emerging Air Force simulation efforts. A broad look at the operator interviews is at figure 1.

BY AIRCRAFT		BY HOURS	BY LOCATION	
14	F-15C/E	0-1000: 10	NELLIS:	10
7	F-16	1-2000: 13	EGLIN:	11
1 ea	F-111 2000+: A-10 F-4G F-117	2	AU:	4

Figure 1. Operator Interview Demographics

I must point out that the goal of the interviews was less to "prove" and more to educate myself about employment doctrine while gaining insight into problems, concerns, and procedures.

It was also important to see if there was a historical precedent. The early history of the Boeing B-17 seemed to fit the mold, so I read the Albert Simpson Historical Research Agency's entire file on the only pre-1939 B-17 unit, the 2d Bombardment Group, located at Langley Field, Virginia. This file included official documents of the group and unit histories. Additionally, I read books about the B-17 and oral histories and/or biographies of several of the important personalities including Hugh Knerr, Bob Olds, and Haywood Hansell.

I looked to establish modern parallels by engaging Air Combat Command and Air Force Materiel Command historians, source documents, congressional reports, and major command staffs. I contacted the US Navy and US Army facilities engaged in similar pursuits. I discovered high-tech, little-known simulation efforts at Kirtland AFB, New Mexico; Williams AFB, Arizona; and at the Naval Warfare Center at China Lake, California. The highlight of this search effort was a trip to the Army's Aviation Test Bed at Fort Rucker, Alabama.

Before moving on, I'd like to clarify why I chose to deal with current fighters. First, dealing with an entire category of aircraft helps defuse any critique that I chose examples to fit my preconceived notions. Second, they are the most numerous and, as a class, most modern of Air Force aircraft.

With that background and before plunging into history and solutions, it is crucial to have a mutual understanding about the definitions of doctrine.

Military Doctrine: Definitions and Types

At the heart of warfare lies doctrine. It represents the central beliefs for waging war.

—General Curtis LeMay
Basic Aerospace Doctrine of the United States Air Force

To begin, it is important we understand what doctrine is, the types of doctrine, and why doctrine is important to militaries.

There are many interpretations, both organizational and individual, of what doctrine is. I propose to use the following definition: "Doctrine is simply what we believe and teach others about the best way to conduct military affairs."[2] With that definition as our reference point, we can investigate the different types of doctrine.

In *Making Strategy: An Introduction to National Security Processes and Problems*, Dennis Drew and Donald Snow divide doctrine into three types: fundamental, environmental, and organizational. Fundamental doctrine is broadly scoped, and ". . . almost timeless."[3] It is conceptually abstract and the least tied to particular systems. Environmental doctrine, while narrower than

fundamental doctrine, still involves broad notions pertaining to the land, sea, or air.[4] Lastly, Drew and Snow define organizational doctrine to be ". . . basic beliefs about the operation of a particular organization," in this case, the United States Air Force.[5] It brings ". . . the abstractions of fundamental and environmental doctrine into sharper focus . . ." and is "very narrow in scope."[6] The types of doctrine are summarized in figure 2.

TYPE	CHARACTERISTICS	EXAMPLE
FUNDAMENTAL	BROAD, ABSTRACT, TIMELESS	PRINCIPLES OF WAR
ENVIRONMENTAL	TIED TO TECHNOLOGY	AIR/LAND/SEAPOWER
ORGANIZATIONAL	SPECIFIC ORGANIZATION OR GROUP	USAF DOCTRINE

Figure 2. Types of Doctrine

With the definitions established, let's concentrate on organizational doctrine.

Organizational doctrine is defined in Air Force Regulation (AFR) 1-2, *Assignment of Responsibilities for Development of Aerospace Doctrine*, as having three varieties: basic, operational, and tactical.[7] Much like the hierarchy of doctrinal types in the previous paragraph, one encounters more detail moving from basic "towards" tactical doctrine. Basic and operational doctrine tend to be vague so they apply regardless of current and future systems. Basic doctrine is beyond the scope of this paper. Like basic doctrine, operational doctrine does not change very quickly either. To illustrate, Air Force Manual (AFM) 2-1, *Aerospace Operational Doctrine: Tactical Air Operations*, dated 2 May 1969 is still current. However, because operational doctrine is the link between strategy and tactics, the distinction between it and tactical doctrine can sometimes blur.[8] Operational doctrine's fundamental focus is on the large-scale employment of forces in a theater or major campaign. Perhaps even more so than operational doctrine, tactical doctrine is at the crux of this issue.

Tactical doctrine is defined by AFR 1-2 as "establishing the *detailed tactics, techniques and procedures* (TTP) that guide the use of specific weapons systems to accomplish specific objectives." "Tactical doctrine presents guidance for how specific aerospace forces should be employed in engagements and battles."[9] Timothy Lupfer captures the link—the need for systems in the hands of operators that will produce the facts that become TTPs—in discussing the importance of inductive reasoning to German tactical doctrine during World War I.[10] Webster defines inductive reasoning as ". . . drawing a general rule or conclusion from particular facts."[11] A robust tactical doctrine—the narrowest and most detailed type of doctrine—cannot evolve if we do not have hands-on experience with the performance of actual weapon systems. An interim USAF doctrine summary is at figure 3.

Let me simplify the problem of trying to remember which type doctrine is what by proposing a moniker of "employment doctrine." This notion combines the detail of tactical doctrine with operational doctrine's use of large numbers

Basic Doctrine = fundamental principles, **broad guidance** about airpower, **least detailed**
Operational Doctrine = large numbers in campaigns, major ops, links tactics with strategy
Tactical Doctrine = **detailed** tactics, techniques and procedures **employing specific weapons**

Source: AFR 1-2, *Assignment of Responsibilities for Development of Aerospace Doctrine*, 10 September 1990, 3–4.

Figure 3. Types of USAF Organizational Doctrine

of a system interacting with other systems in a theater or campaign. When the term *employment doctrine* is used in this paper it will therefore refer to the combination of tactical doctrine with that part of operational doctrine that involves both larger numbers of that system *and* how these numbers interact with other systems in the theater/campaign.

For example, how to defeat an individual MiG-29 with an individual F-15C would involve tactical doctrine. Operational doctrine would influence how to best take advantage of these individual F-15C tactical advantages when the 1st Fighter Wing's F-15Cs (i.e., 72 F-15s) were employed alongside Navy F-14Ds against Iranian MiG-29s in a "multiple-on-many" scenario in the Persian Gulf. The combination of individual, multiple-ship, and multiple systems doctrine is what this paper refers to as employment doctrine (see fig. 4).

		Tactics, Techniques, Procedures (what's known as tactical doctrine)
Employment Doctrine	=	+
		Multiple Systems and Types in Theater (what's known as operational doctrine)

Figure 4. Employment Doctrine Defined

Notes

1. I. B. Holley, Jr., USAFR, Retired. "The Doctrinal Process: Some Suggested Steps," *Military Review* 59 (April 1979): 3.
2. Dennis M. Drew and Donald M. Snow, *Making Strategy: An Introduction to National Security Processes and Problems* (Maxwell AFB, Ala.: Air University Press, 1988), 171.
3. Ibid., 168.
4. Ibid., 169.
5. Ibid., 170.
6. Ibid.
7. Air Force Regulation 1-2, *Assignment of Responsibilities for Development of Aerospace Doctrine*, 10 September 1990, 3.
8. Ibid., 3–4 (see note on p. 4).
9. Ibid., 4. Emphasis added.
10. Timothy T. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, Leavenworth Papers (Fort Leavenworth, Kans.: Combat Studies Institute, July 1981), 58.
11. *Webster's New World Dictionary*, 2d college ed., s. v. "inductive reasoning."

Chapter 2

Developing Robust Employment Doctrine

Like a blueprint, if the doctrine is flawed the result can be the collapse of the entire edifice.

—Col Harry G. Summers, US Army, Retired

Why Employment Doctrine Matters

Doctrine is important to militaries because it is crucial ". . . guidance for conduct of battle approved by the highest military authority."[1] *In the "winner-take-all" game of combat, a marginal advantage due to such guidance may mean the difference between a mission accomplished or not. Maj Gen I. B. Holley, Jr., captured the essence by observing that employment doctrine is what enables armed forces to capitalize upon available technology, "Napoleon had no better weapons than his adversaries, he merely took better advantage of them."*[2] *Employment doctrine matters for three reasons: (1) the better the doctrine in peace the lower the cost in war; (2) trust in the system is crucial to success; and (3) history bears these points out.*

In the past decade, Americans have had the luxury of abundant resources for developing doctrine during peacetime. Why a luxury? Because dollars invested during peacetime can have a disproportionately positive effect in combat. Training programs like the Navy's Top Gun and the Air Force's Red Flag have shown we can reduce combat losses via peacetime training. In other words, combat is the place you least prefer to be developing and/or refining tactics. Air Force General Laurence S. Kuter wrote, "I do not relish watching doctrine developed the hard way in battle and paid for in casualties. . . ."[3] *This is not solely an American preference, former Soviet Colonels Yuri Kislyakov and V. Babich understate, "Our pilots ended up having to restruc- ture their combat formations in the course of combat (WWII) . . . which was felt to be least desirable."*[4] *Yet, as chapter three's YB-17 experience will show, without enough "end items," it is extremely difficult to develop a lethal doc- trine in peacetime. I submit that this is exactly the position the Yockey policy may force us into. Trust is another reason why employment doctrine is important.*

In many respects, the import of employment doctrine can be simplified to one word—trust. The operator must have enough experience and training to know that a new weapon will work reliably, fits into his scheme of operations, and provides him or her with some type(s) of advantage(s). There are

examples of how prototype “wonder weapons” were refused during Desert Storm precisely because operators preferred to carry another canteen over a weapon they had not trained with extensively.[5] Sound far-fetched? Air Force F-15 units in Desert Storm turned down the opportunity to carry operational AIM-120 advanced medium range air-to-air missiles (AMRAAM) for the same reason—little or no prewar training at the unit, thus, no use.[6] Since they didn’t know when the shooting would start, they chose not to take a chance with a new, unproven weapon—this despite at least *three years* of prior operational testing and tactics development.[7] A policy that assumes a weapon can be taken off a shelf, in time to be delivered and then quickly employed, does not seem to have much historical support.

Academic analysis aside, there are many practical instances, beyond that of the tank and machine gun, where the equipment-employment doctrine relationship was important. Two World War II examples include US anti-submarine warfare (ASW) and close air support (CAS) efforts. Despite circumstances where the Navy, in the case of ASW, and the Army Air Forces (AAF), in the case of CAS, recognized the need to perform these respective missions, neither service seriously practiced them. As a result, neither was very ready to perform them during the early stages of conflict.

The Navy, despite the World War I experience in sub warfare, did not have suitable depth bombs for its ASW aircraft, with this condition persisting until 1943.[8]

The AAF, despite having a part of its force dedicated as “attack aviation,” was not ready for the Kasserine Pass debacle of early 1943. William Jacobs notes, “. . . when the Air Corps entered the war in 1941 [these] aircraft were . . . clearly not intended for the sort of precision work required . . . .[9] Attack aviation had not realistically exercised until too late, and in their rush to get ready they found they were not as capable as they needed to be. I submit people died on the ground and in the air, perhaps unnecessarily, as a result. The matchup between equipment and employment doctrine has been an enduring indicator of how well we will fight, especially during the initial stages of conflict. These examples also point to a related question: What is the current system for developing employment doctrine?

How Employment Doctrine Develops

Doctrine too often lags far behind our technological advances.

—Maj Gen I. B. Holley, Jr., USAFR, Retired

Employment doctrine develops in a dynamic “trinity” of test, tactics development, and operational communities. AFR 1-2 purposefully spreads the responsibility amongst many organizations to be sure no single perspective dominates. Despite several reorganizations, there is still some complementary overlap between the test community and tactics development and evaluation

(TD&E) community. Let's briefly examine their duties. The developmental test community is what we think of when the term *test pilot* is used. Located primarily at Edwards AFB, California, this group generally has little to do with employment doctrine development. However, their brethren in the combined test forces (CTF) at Edwards include initial operational test and evaluation (IOT&E) pilots who work for the Air Force Operational Test and Evaluation Center (AFOTEC). Employment doctrine for a system begins its gestation with these pilots.

Development, test, and evaluation (DT&E) and IOT&E tests generally have a narrow focus—they work to ensure contract performance requirements are met. The DT&E test pilots are focused on the meeting of contractually specified performance requirements. The IOT&E pilots assess whether the specified requirements truly have operational utility.[10] Neither group is *officially* chartered to develop tactics.[11] Tests look to quantify what is measurable for *individual systems*—time to accelerate, radar detection ranges, sustained turn rates, and the like. (In contrast, tactics development is an interactive process involving threats and pilot skill levels and can go beyond what a contract specifies.) Nonetheless, the process of performing "operational" tests involves assessing how well a system meets specified contract requirements, which often include tactically and operationally driven employment requirements. An effect of the varieties of developmental and operational testing is the formation of an unofficial "body of knowledge" regarding how a system might best be employed. This knowledge begins to filter to official tactics developers when follow-on test and evaluation (FOT&E) and TD&E representatives witness both developmental and operational tests.[12]

The FOT&E/TD&E community in the using command picks up where the others leave off, usually when a system is fielded. TD&E looks beyond performance requirements and seeks to maximize the operational utility of a system by refining a "menu" of tactical entrees. For example, depending on differing weapons loads, threats, aviator experience levels, and targets, the Multi-Command Manual (MCM) 3-1 "menu" might suggest one-half dozen techniques or more to accomplish a specific mission. The MCM 3-1 is, according to AFR 1-2, the place where "tactical doctrine is published."[13] (It developed from the Vietnam experience, where various squadron-level weapons officers had compiled a book of lessons learned called the "Bag of Tricks." Afterwards, the idea was codified into the MCM 3-1.) According to Tactical Air Command Regulation 23-46 (still current), the USAF Fighter Weapons Center at Nellis AFB, Nevada, " . . . is assigned the tactical fighter mission area for TD&E."[14] The Air Warfare Center at Eglin AFB, Florida, is assigned remaining areas such as electronic combat, armament systems, reconnaissance, and C^3I.[15] Although TD&E procedures also quantify results, they are not constrained by a specification. To illustrate, if a contract requires an aircraft to carry, say, six radar missiles, the 422d Test and Evaluation Squadron (TES) at Nellis might yet hang eight radar missiles and two infrared (IR) missiles to evaluate the benefits. Additionally, the 422d TES is

constrained by a budget and time. A TD&E case was related to me as, "we wanted to run 24 tests to validate the results but we only had funding for six. So we ran the six most representative."[16] The TD&E units are normally producing tactics based upon suggestions called tactics improvement proposals, known as TIPs. The large majority of TIPs are submitted in response to, or directly by, operational units. Operators also comprise a prime part of the tactics and employment doctrine trinity.

Operators comprise the large bulk of the test/tactics-developer/operator "community." For example, of 200 F-15Es fielded, only 5–10 are dedicated to TD&E at any one time.[17] This is because the 195 operational crews are able to provide the impetus and feedback for the testers and tactics developers. Operators begin assessing and modifying the tactical menu for their specific environment almost immediately. Through formalized and long-accepted processes, they drive and fund the TD&E community to refine existing tactics and create new ones. Because the large bulk of personnel are in operational units (relative to test or TD&E), this is where the majority of tactical employment innovation occurs. Historically, about 80 percent of the TIPs submitted each year have been submitted by operators.[18] Figure 5 summarizes the employment doctrine trinity.

Community	Effect on Employment Doctrine	Doctrine Development Strengths/Weaknesses
Testers	Test to spec, establish capability baseline & initially gauge potential of system	Pros: Technical experts Cons: Employment NOT their focus
Operators	Develop initial approaches for dealing with threat, geography, or climate. Document further needs.	Pros: Threat Motivated, large number of people and aircraft Cons: Demands thwart focus, Inexperience
Tactics Developers	Refine, suggest, and create a menu of employment options to be tailored by operator specifics such as threat, war plan, geography. . .	Pros: Experience, Focus Cons: Funds limit sorties, small "community," "Nellis War" syndrome

Figure 5. The Dynamic Trinity of Employment Doctrine

Historically, we have had substantial numbers of weapon systems available to refine employment tactics, techniques, and procedures. For example, the F-15 had 92 operational airplanes delivered in the first two years (1973 and 1974), while the F-16 had 250 (1978 and 1979).[19] The numbers of delivered systems—manned at crew ratios of approximately 1.25:1—provided literally hundreds of aviators thinking about the best way to employ the new capabilities of these fighters. (If you're thinking why not develop the doctrine as we build up for the next big war, then wait until the YB-17 example is shown in the next chapter.) This is a prime reason why this "numbers and doctrine" problem hasn't surfaced earlier—we have always had a relatively large community of people thinking creatively about the best ways to employ a system.

In addition, and somewhat surprisingly to me, I found no one part of the "trinity" can, wants to, or is suited to develop operational or tactical doctrine by itself.[20] I was especially surprised when the organizations at Nellis with superior reputations for experience and ability—the 422d TES and the USAF Weapons School—were adamant that they could not do better than a "fair" job without operators.[21]

By severely limiting the numbers of end items fielded the Yockey acquisition policy *effectively eliminates operational units.* Thus, a key component of the doctrine development "trinity" is artificially, or unwittingly, sacrificed. Of the 25 aviators I interviewed, only four (16 percent) felt the current test and tactics development communities would have a high or extremely high chance of developing a robust employment doctrine without operational units.[22] No policy, in print or publicly contemplated, explicitly recognizes this interactive and mutually supportive relationship. As mentioned earlier, interviews with operators, testers, and tactics developers were surprisingly uniform in standing against any concept that effectively eliminates the operator component from a major role in developing employment doctrine.[23] Twenty of the 25 aviators saw either the operational units alone (11), or in concert with the TD&E community (9), as being the prime drivers behind employment doctrine.[24] The loss of operational units is seen by these professionals as being extremely detrimental to our ability to develop sound tactics and doctrine. For example, to quote one of Air Combat Command's tactics developers, ". . . we rely on the operational world to provide us requirements, to point us in the right direction, and to give us feedback on the suitability of tactics we do develop. Without operators there is no process and anything we develop will be tainted."[25]

On top of all this, Holley postulates there are generally only four prime ways to develop doctrine: combat, full-scale maneuvers, unit exercises, and command-post war games.[26] Without sufficient numbers of fielded systems, at least of a unit size, how is it possible to accomplish the first three?

Before moving further, we must understand the important distinction between what is officially "blessed" as combat-capable for a new system, and when that system really becomes lethal.

Combat-Capable versus Combat-Lethal Doctrine

No one wants to fight with equipment that isn't perfected or is unsafe. Yet, doctrine is somehow assumed by the Yockey policy to be transferable to a new system *based on the systems preceding it.* This is an acute problem for systems just being fielded. Let me provide some examples where initial combat- capable doctrine was eventually succeeded by a combat-lethal doctrine.

A joint example involves the way the US Navy integrated stealthy, nuclear attack submarines (SSN) into the fleet back in the early sixties. Until this

time, older diesel attack subs attacked in multiship "wolf packs." Capt James Patton, USN, Retired, relates how the Navy originally ". . . viewed the SSN as a somewhat faster conventional attack sub, whose greatly increased costs made its justification questionable."[27] Patton goes on to say how the Navy was, except for the small cadre of Admiral Rickover disciples, ". . . slow to notice a new function made possible by a radical development." Through the course of several years and exercises, the SSN radically changed the employment doctrine governing the way the attack submarine would fight, enabling SSNs to function as a "lone wolf," and with higher probability of success than the packs they replaced. Certainly the SSN would have been combat-capable had it only performed older attack sub tactics; but it became a potentially war-winning asset when its lethality was recognized and demonstrated to an ever-larger audience.

The Desert Storm experience with space intelligence systems also supports this notion. Because systems were not deemed vital enough in peacetime, items like *Constant Source* terminals were not procured or fielded in any significant numbers.[28] As a result, the terminals were initially ignored or poorly utilized. Few operators knew what the system could do and fewer had any training.[29] Nonetheless, CENTCOM certainly had a doctrine they could have gone to combat with without these assets. However, with war looming, and with five-plus months to train, the operators were able to capitalize on the *Constant Source* information, moving CENTCOM to the lethal doctrine that was displayed to Iraq. Although *Constant Source* is not a fighter aircraft, it illustrates the link between numbers and exercising the capability over time to develop a robust employment doctrine.

The F-15E provides one last illustration of the import of tactical and operational doctrine. When the F-15E deployed to the Persian Gulf, follow-on test and evaluation had not begun, let alone tactics development and evaluation, and it was cleared to drop one kind of bomb—Mk 82, low-drag, 500 pounders.[30] Without the five months to train in Saudi Arabia and develop an employment doctrine, I submit several more probably would have been lost, and the F-15E certainly wouldn't have been as effective as it was. Moreover, had the Yockey policy been in effect, the F-15E might never have gotten "off the shelf" in time for Operation Desert Storm.

These examples highlight the importance of employment doctrine, the significance of numbers, and the time it takes to develop a robust, war/conflict-winning doctrine. Retired Air Force Major General McInerney, creator of the medium-altitude "Big Mac Attack," highlights additional warnings, ". . . the acceptability of new ideas and approaches is inversely proportional to the amount of investment in the old idea or approach. It takes an accumulation of evidence to shift paradigms . . ."[31] The Yockey and Aspin policies are built upon the paradigm of programs like the F-22 advanced tactical fighter (ATF), where only two prototypes were built. As I have demonstrated, lethal, potentially war-winning doctrines are a function of numbers and time to overcome old ideas. It's hard to fathom how decision makers in Washington, D.C., can reasonably expect that extended testing of a

few prototypes could achieve the same results as hundreds of aircraft and hundreds of people.

We now have a grasp of how new and evolving acquisition policies threaten to reduce our ability to develop employment doctrine. We can profit by searching for historical precedents.

Notes

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6. Interview with an F-15 wing weapon's officer who provided the information based on the policy of nonattribution, 13 April 1993.
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8. Montgomery C. Meigs, *Slide Rules and Submarines: American Scientists and Subsurface Warfare in World War II* (Washington, D.C.: National Defense University Press, 1990), 99.
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14. Tactical Air Command Regulation (TACR) 23-46, *Organization and Mission—USAF Tactical Fighter Weapons Center*, Headquarters Tactical Air Command (TAC), Langley AFB, Virginia, 3 July 1990,1.
15. TACR 23-45, *Organization and Mission—USAF Tactical Air Warfare Center*, Headquarters TAC, Langley AFB, Virginia, 26 January 1990,1.
16. Nellis interviews.
17. Ibid.
18. Maj Scott Anderson, USAF, division chief, Multi-Command Manual 3-1, Nellis AFB, Nevada, telephone interview with author, 23 March 1993. Major Anderson related how of 200 TIPs submitted at an average Tactics Review Board, 160 were from operators, whereas the remaining 40 came from the test community.
19. Bruce R. Wolf, deputy historian, Aeronautical Systems Division, interview with author confirming the dates found in numerous sources, 2 October 1992.
20. Nellis interviews.
21. Ibid.
22. Ibid.
23. Ibid.

24. Ibid.
25. Ibid.
26. Holley, 7.
27. James H. Patton, Jr., "Stealth Is a Zero Sum Game: A Submariner's View of the Advanced Tactical Fighter," *Airpower Journal,* Spring 1991, 7.
28. *United States Space Command: Operation Desert Shield and Desert Storm Assessment* (U)," 31 January 1992, 22 and 66. (Secret/Noforn) Information extracted is unclassified.
29. Ibid.
30. Nellis interviews.
31. Maj Gen James E. McInerney, Jr., USAF, Retired, Telephone interview with the author, 21 May 1993. General McInerney's "Big Mac Attack" is often cited by operators familiar with his efforts to shift USAF paradigms from low-level attack to medium altitude attack long before Desert Storm proved its efficacy. As he related to this author, "Low-level ingress is what we do *between* every war."

Chapter 3

Documenting Doctrinal Lag

Altering tactical procedures in the middle of such a desperate struggle was a very serious undertaking.

—Wilhelm Balck

We must strive to develop an employment doctrine in peace that requires the minimum of combat adjustments in war, lest human and materiel costs become unnecessarily high. To requote historian Sir Michael Howard, ". . . it is the task of military science in an age of peace to prevent doctrine from being too badly wrong."[1] What does matter, Howard continues, ". . . is [our] capability to get it right quickly when the moment arrives."[2] While we may very well overcome a future foe due to superior technology, mass, or both, the political imperative for few casualties is not likely to tolerate losses like those the Eighth Air Force endured in World War II (WWII). Had the B-17 been purchased in larger numbers before the US got involved in the war, fewer casualties and greater effectiveness would likely have resulted.

The YB-17 and Refining Doctrine under Fire

The B-17 was developed under circumstances remarkably similar to the new acquisition policy—a small number of well-tested prototypes, strategic warning of a threat, and mass production of the system in time for war. The "Y" in the YB-17 designation "indicated that the planes were undergoing service testing before, if ever, they were to be purchased in larger orders."[3] Although the Army Air Forces (AAF) hoped never to have to "shelve" the technology from the YB-17 prototype, the Flying Fortress experience is very instructive. The AAF'sWWII daylight, *unescorted*, precision bombing campaign with B-17's illustrates the point that knowing how to fight, how to employ a particular system tactically and operationally, is vitally important.

Although the YB-17 prototype first flew in 1935, there were never enough B-17 prototypes to "train like you'll fight," simply because the B-17 wasn't fielded in quantity until war broke out. Due to budget and political constraints, only 13 were bought between 1935 and 1938.[4] As one example of not training like they eventually fought, there is virtually no archival evidence to suggest the 13 B-17 prototypes were used to practice, let alone to refine, the box formation that would be so crucial throughout the war.[5]

Before I continue, let me be clear—I am *not* claiming that better bomber formations would have been decisive by themselves. Of interest to the reader is the effect of fielding very limited numbers of a system in peacetime. The bomber formation example is salient because these "self-defending" formations were key to bomber advocates pre-WWII argument that there was no need for fighter escorts. The limited numbers of YB-17s fielded prior to WWII helped create problems inhibiting the development of sound formations, an exceedingly important portion of the unescorted bomber employment doctrine, foreshadowing some of the Yockey policy's problems. To move on, I first dissect some of the history of these formations and then look for contributory causes of the problems that arose.

Although Haywood Hansell lays great credit at the 2d Bombardment Group's "doorstep" for early development of bomber tactics, his claim does not stand under scrutiny. To start, that work was done with older and slower B-9s. Furthermore, two counterclaims are relevant. The Eighth Air Force's own "Tactical Development, August 1942–May 1945" manual describes a search through 10 different formations, noting that the Javelin formation which Hansell attributes to Hugh Knerr "causing troublesome speed differentials . . . leading to loss of mutual support."[6] Here is the central contribution of prewar formation doctrine being basically unflyable! When the formations moved from four to five groups (moving from approximately 75 to 100 aircraft total) the Javelin ". . . had to be abandoned."[7]

Curtis E. LeMay, a key member of the 2d Bombardment Group, also disputes the notion that B-17 employment doctrine was sorted out and ready for war. On the contrary, LeMay, as commander of the 305th Bomb Squadron, details the problems upon deployment to England:

> what we did have to do was to get together some semblance of a workable formation. I immediately canceled out the type of formation I had planned on using and started to get together something which I thought they could fly. This would call for a lot of modification. . . . Later on [this formation] was used by everybody in the Eighth Air Force throughout the war.[8]

LeMay further highlights the problems caused by not having enough aircraft, ". . . and formation flying, *we've never had enough airplanes to fly formation*. We'll have to fly our first formation in England."[9] Notwithstanding the possibility that he might be overstating his contribution, his LeMay's testimony does corroborate the Eighth Air Force experience. A vital question then is just why didn't we have better employment doctrine for the B-17?

One problem is that everything is rushed prior to getting ready for a war—just trying to assimilate new equipment and people consumed a large portion of the Air Corp's leadership energy.[10] Another was that the assumptions about long-range navigation went astray when the art was not rigorously practiced by military flyers between the wars.[11] I also submit that logistics was a subordinate contributory reason in that even with 13 aircraft rarely were half that many available to fly. Moreover, the much larger contributory reason of "politics" had a great and deleterious effect.

Many sources document the 2d's logistics support problems during the 1936–39 time frame, and rarely were there more than six aircraft available to fly.[12] When six were available, as they were for the famous Buenos Aires trip, they went essentially as single aircraft to give the crews the maximum amount of training.[13]

Additionally, politics had a subtle but crucial role to play. Because of the B-17's unique status and high visibility, the elite 2d Bombardment Group received only the best of the Air Corps' very experienced crews. The Eighth Air Force was being set up. With copilots having as much as 5,000 hours, the Air Corps allowed the fear that accidents would kill the B-17 program overshadow the fact that in the event of war, far less experienced crews would be flying. A B-17 crewman said, "we knew if a YB[-17] crashed we could probably say goodbye to the nation's bomber program."[14] Given that fighting formations are only as good as your weakest (i.e., most inexperienced) link, this situation is akin to the Nellis tactics developers being accused of forgetting the new lieutenant when developing tactics.[15]

Also, and despite a subsidiary mission to develop tactics for the new aircraft, Edward Jablonski, Jeffrey S. Underwood, and the unit histories point out how a myriad of political and public relations concerns intervened. The B-17s were more often used in public relations stunts like the aforementioned flight to Buenos Aires, Argentina, than for more detailed employment problems.[16] Underwood captures how Henry "Hap" Arnold, Frank M. Andrews, and Oscar Westover all saw the B-17 as a tool to promote airpower and a separate Air Force: "With these 13 YB-17s, the Army Air Corps conducted a publicity campaign to win appropriations for more Flying Fortresses."[17] Underwood further collars the Air Corps attitude with Andrews saying, "I don't think we should pass up this opportunity to sell ourselves to a pretty good cross section of the country."[18]

The post-Munich situation placed the YB-17 in a scenario much like what the new acquisition policy envisions for the future—receiving and acting upon strategic warning of a threat to US vital interests, producing weapons based upon tested prototypes, and employment in combat. Yet, the development of sound employment doctrine—such as formations, navigation, escorts, defensive firepower, and targeting—was hindered by no less than the limited number of prewar prototypes and political imperatives. Although the AAF expected thousand-bomber raids, it had a dozen or less with which to practice. That practice it did get was with crews with thousands of hours experience, rather than the hundreds or tens of hours crews would have when they would go to fight.

The cumulative effect on employment doctrine was damaging. There were too few YB-17s to start with, logistics kept many from flying, and those that could fly were regularly tasked for stunts that had more to do with the creation of an independent Air Force than with sound doctrine. The Air Corps wrongly assumed that finding Buenos Aires after a long flight was the equivalent of finding a target under hostile conditions. Once the rush to build up the tangible parts of the force (trained people, planes, and bases) came, it

overwhelmed all doctrine development. LeMay is, again, illustrative; "I tried to consider the [bombing of the USS] Utah [exercise] and the Rex and the South American trips, but it didn't add up the same way now. . . The situation wasn't the same."[19] In my opinion, these hindrances contributed to the losses, especially the early losses, incurred in the skies over Europe in WW II.

The ultimate test of the self-defending formation reached a climax on 14 October 1943, when, with 60 downed aircraft and 642 casualties on the second Schweinfurt raid, attrition reached 20 percent of the dispatched aircraft and crews.[20] The self-defending formation was not to be, as loss rates this high could not be sustained.

In total, thousands of aircraft and aircrew were lost over the continent. I submit that part of the reason was that too few prewar aircraft, in conjunction with pre-war politics, caused an important "drift" away from reality. I further submit that a larger number of systems in peacetime, proportionate to the expected usage, might have highlighted the formation deficiencies before aviators were placed at risk. They would have learned the difficulty in flying tight formations with large numbers of bombers, the difficulty in finding precision targets, and gained insight into the best type of formation to maximize defensive firepower. It is true, however, they were ultimately successful. The salient question is: Will we have the luxury of time, a casualty-tolerant public, and numerical superiority in the future?

For the sake of argument, let's assume (not to say that it's a good assumption) for a moment that a weapon system can be provided in time for a conflict. Is that enough? The history of weapons system acquisition and deployment and employment doctrine development suggests the answer is a resounding no!

Modern Perspectives

> *I believe that it takes at least two years to make a suitable [pilot]. You may teach a man to stagger around in the air in about three months . . . but to teach him every trick of the trade, to have confidence under all conditions . . .takes at least two years.*
>
> —William "Billy" Mitchell

Mitchell was optimistic! In the days of fabric aircraft and iron men, two years was sufficient. Recent history, however, indicates significant numbers of weapon systems are needed in the hands of operators for at least *30* months before a lethal employment doctrine evolves. It is risky to think otherwise. It is the type of risk politicians took unknowingly with the B-17 in the late 1930s. Any policy that stops development programs after the demonstration/ validation milestone is likely to hinder doctrinal development during peacetime and will increase risk to aviators when the shooting begins.

Examining current Air Force fighters illustrates the time lag between first fielding a system and second getting to what I term "acceptable combat-

lethality" or ACL. This point is at the initial major rewrite of a new system's MCM 3-1, approximately 18 months into operations.[21] A conservative starting point for our "time line to ACL" begins with the first flight of the production aircraft—the time when hardware begins to meet operators on a flight line. (This is doubly optimistic because the Yockey policy assumes first that thoroughly tested prototypes are available to go right into production, and second, that thoroughly tested means ready to produce. One only needs to review the B-1A to B-1B, and the YC-15 to YC-17 programs to see that this is not always the case.) The midpoint is the initial operational capability or IOC, what is considered the absolute earliest a unit constitutes any combat capability at all. *Every one* of my 25 interviews attested that IOC is *not* when you'd prefer to go to combat.[22] IOC dates are too often tied to a date for acquisition and budgeting reasons than for readiness reasons. Thus the desired end point is perceived as about 18 months beyond the IOC. To illustrate, figure 6 catalogs the lag between the initial flights of an aircraft, the IOC date, and the time to ACL:

	F-15A	F-15E	F-16A	F-117A
PROTOTYPE FIRST F LIGHT	JUL 72	DEC 86	JAN 74	DEC 77
PRODUCTION FIRST FLIGHT (PFF)	"	"	AUG 78	JUN 81
PRODUCTION 1ST DELIVERY (PFD)	NOV 74	DEC 88	"	SEP 82
IOC	OCT 75	SEP 89	OCT 80	OCT 83
ACCEPT. COMBAT LETHALITY (ACL)	APR 77	DEC 90*	APR 82	APR 85
PFF to ACL	***43mos***	***48mos***	***47mos***	***46mos***

*5 months of intensive training prior to start of air war in Desert Storm

Figure 6. Modern Doctrinal Lag

As you probably noted, the time between *production* article first flight and ACL for the F-15A, F-15E, F-16A, and F-117A aircraft, respectively, was 43, 48, 47, and 46 months.[23] This is an *average* of 46 months after the aircraft is first flown. (The lag between *prototype* first flight and ACL is at least as long and often longer.) Add to this the years necessary to get the system to the field and you can see the difficulty of this policy. What is especially crucial here is that the Yockey policy seems not to recognize the additional 18 months time required to get to a point when forces are individually ready to fight with a high probability of success and at the least cost.

Discussions with the Air Force's tactics developers highlighted how the first major revision of the MCM 3-1 might serve as the demarcation line for ACL. For example, the F-15E was fielded at IOC with an initial 3-1 based on proven aircraft. This means that the air-to-ground portion of the tactics manual that codifies tactical doctrine was based on F-111 and F-16 tactics, while the air-to-air portion was based on the F-15C. One of the authors of the first F-15E MCM 3-1 revision related to me that fully 75 percent of the document was changed to recognize specific F-15E capabilities.[24] The Air

Combat Command office responsible for all tactics conferences and MCM 3-1 updates agrees that this is standard.[25] Additionally, it's important to keep in mind that the F-15E may very well represent a future "best-case" scenario—the incremental improvement of a previously proven system.

Experienced airmen further corroborate this view. One who has 5,200 hours (3,800 in fighters) believes that 24 months is the *minimum* time to become minimally proficient in a new system (basing his comment on experience in transitioning the F-15A to the F-15C, a subsystem change).[26] I submit that at a minimum, *another* 12 months elapse before enough higher-ranking officers, including those who will serve as air component commanders, will be exposed to the system's operational utility via exercises and deployments. This is the minimum time needed to begin to shift senior officer paradigms. I propose to call this known-combat lethality or KCL.

Thus, what happens *after* a system "hits the ramp" is as important in the debate over this policy as getting to the ramp. We *may* be able to speed up the process, but the lesson remains—even with production models available, lots of time is needed to get to an acceptable level of combat readiness. Note, too, it would take *longer* to have a *wing* operational or to achieve more robust readiness. This is not the end of it. We must also consider the likelihood operators, just as with the diesel to nuclear attack sub experience, will operate new systems like the old systems they replace until they learn to maximize the potential of the new system. My interviews indicated the less time allowed for the transition, the more likely operators will not trust the new systems.[27] One F-16 pilot told me, "Trying to arbitrarily get an aircraft ready twice as fast equates to 'no time to think, no time to study threats'."[28] What good is expensive state-of-the-art technology if the operator is inclined to perform based on habits from old technology?

The bottom line is that the process to develop trained and confident aviators, able to confidently employ their systems to their full potential in conflict, is historically about a three-*year* process. The Yockey policy underestimates *by half* the time required to get ready to fight and win. Figure 7 summarizes the time it takes to get to ACL and KCL.

For another example, even though the B-17 was flown from 1936 to 1939, it wasn't until late 1943 that a war-winning doctrine evolved. We ought not forget the B-17 case. We also should not expect to develop a conflict-winning

EVENT	AVERAGE TIME
PFF to IOC	28 mos
IOC to ACL	18 mos
ACL to KCL	12 mos
Total	**58 months**
Total Beyond IOC	**30 months**

Figure 7. Time Line to Combat Lethal

concept for a shelved prototype during a rush to produce it. Marshal of the Royal Air Force Sir John Slessor pointed towards the danger inherent in "building-to-shelve" when he said, "Even if we had wanted to, we could not have changed our air policy whenever we might have liked, because the aircraft we had and were building were not adaptable to each and every role; and that is a point which will be relevant in any future war."[29] In other words, if we do not develop employment doctrine based on the "dynamic trinity," we risk being so badly wrong in assessing the need that the hardware could be beyond modification.

Notes

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3. Edward Jablonski, *Flying Fortress: The Illustrated Biography of the B-17s and the Men Who Flew Them* (Garden City, N.Y.: Doubleday, 1965), 11.
4. Ibid.
5. General Headquarters Air Force, "Suitability of the B-17 as an Air Force Bombardment Airplane," Langley Field, Virginia, 20 July 1937, 1.
6. "Eighth Air Force Tactical Development: August 1942–May 1945," prepared by the Eighth Air Force and the AAF Evaluation Board (ETO), foreword by Maj Gen W. E. Kepner, 9 July 1945, 12.
7. Ibid.
8. Curtis E. LeMay and MacKinlay Kantor, *Mission With LeMay* (Garden City, N.Y.: Doubleday, 1965), 232 and 234.
9. Ibid., 227. Emphasis added.
10. Lt Gen John J. Burns, USAF, Retired, former director of requirements for Tactical Air Command and Air Staff. Telephone interview with the author, 24 May 1993. General Burns has had experience preparing for three wars: WWII, Korea, and Vietnam. He related to me the magnitude of just securing adequate equipment, facilities, and training while preparing to fight and noted that the existence of a single squadron of SAC F-84s was immensely helpful in preparing for the Korean crisis.
11. Monte D. Wright, *Most Probable Position: A History of Aerial Navigation to 1941* (Lawrence: University Press of Kansas, 1972), 197–201.
12. Maj Peter Faber, professor, School of Advanced Airpower Studies (SAAS), Maxwell AFB, Alabama. Interview with author confirming the notions of Edward Jablonski, Jeffrey S. Underwood, the AFHRA, and others present, 31 March 1993.
13. Jeffrey S. Underwood, *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration, 1933–1941* (College Station: Texas A&M Press, 1991), 46–72.
14. Ibid., 13.
15. Multiple confidential interviews with aviators of the 57th Test Group, Nellis AFB, Nevada, 10–11 February 1993. These are the aviators responsible for tactics development and evaluation for the Air Combat Command (ACC). Interviews were granted on confidential basis. Detailed records are available as necessary. Hereinafter referred to as Nellis interviews.
16. Jablonski, 16–17.
17. Underwood, 46–72 and 84.
18. Ibid., 93.
19. LeMay, 227.
20. William R. Emerson, "Operation POINTBLANK: A Tale of Fighters and Bombers," *The Harmon Memorial Lectures in Military History, 1959–1987* (Washington, D.C.: Office of Air Force History, 1988), 445.

21. Maj Scott Anderson, USAF, division chief, Air Combat Command, Multi-Command Manual 3-1, Nellis AFB, Nevada, telephone interview with author, 23 March 1993. Major Anderson related how of 200 TIPs submitted at an average Tactics Review Board, 160 were from operators, whereas the remaining 40 came from the test community. Hereafter referred to as Anderson interview.

22. Nellis interviews.

23. Bruce R. Wolf, deputy historian, Aeronautical Systems Center, interview with author confirming the dates found in numerous sources, 2 October 1992.

24. Maj John Wilcox, USAF, member of F-15E "Strike Eagle" branch, 422d Test and Evaluation Squadron, Nellis AFB, Nevada, telephone interview with author, 2 April 1993.

25. Anderson interview.

26. Nellis interviews.

27. Ibid. Multiple (11) confidential interviews with aviators of the 58th Fighter Squadron, Eglin AFB, Florida, 13–14 April 1993. Interviews were granted on confidential basis. Detailed notes are available.

28. Nellis interviews.

29. MRAF Sir John Slessor, "The Past Development of Air Power," *Journal of the Royal United Services Institute for Defence Studies,* 1949, 226.

Chapter 4

Critiquing the Yockey Policy

New weapons when not accompanied by correspondingly new adjustments in doctrine are just so many external accretions.

—Maj Gen I. B. Holley, USAFR

Before concluding, it is important to focus on why this "doctrinal lag" phenomenon is so vital to us today. We have seen the minimum of 30 months beyond IOC **it takes to truly develop a minimally lethal capability for a new system. Theoretically, if one had unlimited time to prepare, the Yockey policy might make sense. I submit it does not because its fundamental assumptions about strategic warning and the predictability of war are highly suspect.**

The Fallacy of Strategic Warning

Deterrence of a global aggressor, heretofore the Soviets, has always relied upon forces in-being. The new reconstitution portion of US national security strategy is different, it expects to deter ". . . based upon a capability to build forces if, and when, they are ever needed."[1] In 1991, then-President Bush accepted that the former Soviet Union would need "at least one to two years or longer to regenerate the capability for a European theater-wide offensive or a global conflict."[2] However, and very ominously, in May 1992 Adm David Jeremiah wrote that the strategy's assumed warning time had grown from a two-year warning to "eight-to-ten years."[3] Is this politics or a good assumption, and how does it impact this issue? There are three major problems with this strategic warning assumption: (1) there is no modern precedent for eight-to-ten year warning; (2) even when there is intelligence, that doesn't mean it will be acted upon in time; and (3) intelligent adversaries will use disinformation to our disadvantage.

Lack of Historical Precedent for 8–10 Year Warning

Very briefly, there is no modern precedent for expecting to have eight years or more of strategic warning. Prior to US involvement in World War I, President Wilson was proclaiming we would stay out of the war right up until we began to send troops.

A clear example is the US reaction to the events leading up to World War II. Although Hitler's actions were threatening, especially with his visible persecution of the Jews, it was not until after Munich in 1938 that Roosevelt acted to authorize a 10,000 aircraft Army Air Force.[4] The fall of France in May 1940 sent tremors throughout the country and not until then did the president authorize 50,000 airplanes.[5] Within three years, the Anglo-American Combined Bomber Offensive would begin. In the Pacific, despite years of military anticipation of an aggressive Japan, little was done to get an Air Force ready. Today, the atrophy of the defense industrial base means the lead times required to rebuild force structure is inherently less flexible and inelastic than ever before—even the F-117A, a model acquisition program, took six years from flying prototype to IOC. Had this policy been in place in 1990, there would have been no F-117As for Desert Storm.

Not Acting on Strategic Warning

Desert Storm illustrates how warning information can be misinterpreted. Not only did the US know Saddam Hussein's Iraq was becoming one of the largest military powers in the world, we aided his efforts. In our desire for a counter-weight to Iran, we did not seem to foresee Hussein's Iraq becoming an adversary. Diplomats sent mixed signals and we simply misjudged Hussein's intent regarding Kuwait—"certainly no one, including [Secretary] Aspin, predicted or expected war with Iraq until just hours before it started."[6]

What will become of "constructive engagement" policies in the future? History insists we can misjudge what the current Chinese or Iranian military buildups truly mean until there is little time to act. Will we underestimate the ability of potential adversaries to develop threatening weapons, much like our forefathers laughed off the Japanese "Zero" or the Russian T-34 tank? Can we afford to do so knowing former-Soviet scientists are all over the globe peddling their expertise and that Su-27s are being exported around the globe?

Disinformation Keys on Bad Assumptions

In *The Arab-Israeli Wars*, Chaim Herzog documents a scenario that ought to have chilling effect on US policymakers. After the 1967 War, the Israelis made a number of assumptions that turned out to be nearly fatal.

Herzog says,

> . . . it was assumed that, having learned the lessons of the 1967 War, the Egyptians would not embark upon a new war until they felt capable of . . . neutralizing the Israeli Air Force. For this they would require squadrons of medium bombers and medium fighter-bombers . . . Israeli Intelligence assumed that there was no real danger until approximately 1975. However, President Sadat came to the conclusion that . . . he could not wait until then.[7]

Herzog then continues to highlight how Arab preparations for war were aided when the Israelis "became captives of a preconceived notion that the Egyptians would not and could not go to war unless certain preconditions had been satisfied."[8] Finally, Herzog goes on to say, the Egyptians aimed their efforts

at these Israeli preconceptions, and ". . . mounted a classic 'misinformation' campaign, which proved to be effective."[9]

In sum, this history is more relevant than ever. As the very quotable Mr Augustine of Martin-Marietta says, "It's a dangerous world. Anyone who doubts that should read some history books. The question is 'how soon,' and my guess is that *it will be sooner than many might otherwise expect*."[10]

We Can't Predict What We'll Need

Another fundamental flaw in the Yockey policy is that it assumes the next war will be largely the same as the last war—the size force needed, the time needed, what worked, what did not, and so on. A manifestation of this is how so much of recent debate has been trapped by Secretary Aspin's "Iraq/Desert Storm equivalent" logic. Sir Michael Howard likens a military during peace to a sailor navigating by dead reckoning, "you have left the terra firma of the last war and are extrapolating from the experiences of that war. The greater the distance from the last war, the greater become the chances of error in this extrapolation."[11] In my judgment, there is real danger that we are already extrapolating too much based on Desert Storm's success; especially that our ". . . military equipment is already more than a match for for any threat . . ." for the foreseeable future.[12] The advantages of today's F-15 are now more training and avionics related rather than aerodynamic and are ". . . not as robust a difference as one might want to count on for the future."[13]

In a fascinating piece entitled, "Clausewitz, Nonlinearity and the Unpredictability of War," author Alan Beyerchen makes a convincing case that the Clausewitzian concepts of friction, chance, and a reactive enemy recognize unpredictability as a hallmark of warfare.[14] Beyerchen quotes *On War* as evidence, "circumstances vary so enormously in war, and are so indefinable, that a vast array of factors has to be appreciated. . . ."[15] If war is nonlinear, as I believe it is, then it is possible that ". . . immeasurably small differences in input can produce substantially different outputs."[16] The difference of some preconflict operational unit experience might be very critical. From another perspective, what may not seem to be critically important—or a small fact kept secret from the US—could have much greater impact than we would predict. For example, the Scud missiles fired by Iraq during the Gulf War, which had a strategic impact far larger than their military value, despite being well-known weapons. Another would be to assume that because the F-15 is superior to the Su-27 now, that we can maintain that state indefinitely. Alistair Horne reminds us not to forget ". . . one of the essential axioms of war; that success seldom succeeds twice."[17] This means that ". . . potentially dangerous errors and disasters take on added dimensions when the task is to prepare for or conduct a war."[18] Without significant numbers and operational units to generate ideas and mistakes in peace, we are more likely to make errors in war.

Although war's inherent unpredictability also impacts our ability to assess warning, let's examine a few examples where, under the new policy, costly mistakes might have been made in war rather than in peace.

It took the Air Force several years to discover a fix for a flaw in the operational flight program of the F-16 Fighting Falcon. In early "A" models when the battery back-up systems failed, the flight controls failed to the maximum deflection position.[19] Several aircraft were lost due to 9G pitchovers after engine losses. The phenomenon was never found in operational testing, where, quite understandably, testers do not shut down all power systems. We cannot predict when the war will come so that these "bugs" will be eliminated before we have to fight. Had this been part of the scenario the Yockey policy envisions, those problems might have been discovered on the first combat sorties. As retired General McInerney explained to me, "A-model aircraft are notorious problem-children."[20] The Yockey policy will ensure we fight with A models.

US Navy Commander John Nichols provides another example relating how the predicted reliability of the AIM-7 Sparrow missile in the Vietnam conflict did not come to pass, ". . . it wasn't reliable in combat, despite optimistic assessment from the [tests at] Pacific Fleet Missile Range in peacetime."[21] The friction of war, documented a thousand times, teaches us that we'll have less time than we thought, that the weapons won't work the first time as we planned, and that the opponent may be smarter and more tenacious than we thought. We must work to avoid a repeat of these mistakes—mistakes the Yockey policy sets us up for.

One other topic worthy of refutation is the notion that longer periods of testing the limited numbers of prototypes can make up for the operational experience of larger numbers of a system. Notwithstanding earlier comments, some think that these limited numbers can be used to gain experience at exercises like Red Flag. Don't forget that a typical "Flag" exercise requires relatively large numbers of systems, on the order of 40 F-16s, 20 A-10s, and 20 F-15s.[22]

Under closer scrutiny, the Yockey policy looks like a house built on the shifting sands of assumptions. It assumes we'll have an eight-to-ten-year warning, that we'll have "perfect" intelligence, that we'll act upon that warning, that we'll have prototyped the right system to be produced, that it will be produced in time, that our preconflict vision of the system's mission will hold, that pilots newly introduced to the system will be able to learn its strengths and weaknesses quickly, that we'll fight it intelligently, and that the trend of American tactics defeating Soviet-bloc tactics will hold. This seems entirely too risky for conservative military minds to accept, yet this is the policy.

Both the assumption that there will be eight to ten years of warning and the assumption that what we can predict when and what we'll need to produce are inherently troublesome. We need systems that have had the time to build, through smart processes and trial and error, a robust, lethal, and

war-winning doctrine before we have to fight; rather than to rely on quick learning when the bullets start to fly.

Summarizing the Policy Critique

> *If we fight tomorrow's war, we must do it with tomorrow's weapons, tactics and techniques—but we must prepare for it today.*
>
> *—Maj Gen Edward Timberlake, USAF, Retired*

All in all, the Yockey policy's reliance on strategic warning for its structural underpinnings is inherently fraught with danger and ignores several aspects of our history. First, and momentarily neglecting the reality that strategic warning is often ambiguous, it is likely politicians will not act even upon clear and ominous warning. They will try to avert provoking the conflict they wish to avoid with the reasoning, "preemptive bellicosity, instead of putting out the fires, fans them."[23] They will hope to avoid conflict, or at least not be the one who starts it, by not preparing for it. Thus, we may never get the technology off the shelf. Second, when they do act, it will often be with far less time than eight to ten years. Last, we overrate our ability to predict what countries will do, develop, or exploit and when they'll do it. History suggests we are often egocentric regarding other culture's abilities. More directly dangerous, during peacetime we tend to slash the intelligence budgets needed to stay abreast of these developments.

Additionally, warfare is an inherently unpredictable, or nonlinear phenomenon. The Yockey policy relies on an assumption that the next conflicts will produce threats of approximately the same scope and kind as past wars. These are risky and ahistoric assumptions. As one commentator noted, "Probably the single biggest pitfall of prognostication is the assumption that current trends will extend indefinitely into the future."[24]

However, I believe there are some ways to explore the "full range of dynamic responses" at an affordable price.

Notes

1. *James John Tritten, Our New National Security Strategy: America Promises to Come Back* (Westport, Conn.: Praeger, 1992), xi.
2. Department of Defense, *Annual Report to the President and the Congress* (Washington, D.C.: Government Printing Office, January 1991), 3; *1991 Military Forces in Transition*, September 1991, 12–13, and 17.
3. Adm David E. Jeremiah, "Beyond the Cold War," US Naval Institute *Proceedings*, May 1992, 55.
4. Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907–1960*, vol. 1 (Maxwell AFB, Ala.: Air University Press, December 1989), 90–91.

5. Ibid., 101.

6. L. Edgar Prina, "Clinton/Aspin vs. The Reality of Unreality," *Sea Power,* March 1993, 21.

7. Chaim Herzog, *The Arab-Israeli Wars: War and Peace in the Middle East* (New York: Random House, 1982), 227.

8. Ibid., 227–30.

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11. Michael Howard, "Military Science in an Age of Peace," *Journal of the Royal United Services Institute for Defence Studies*, March 1974, 4.

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13. David A. Bond, "Clouded Threats, Lost Urgency Blur Debate on Defense Cuts," *Aviation Week and Space Technology,* 16 March 1992, 27.

14. Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security*, Winter 1992/1993, 59–90.

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16. Beyerchen, 65.

17. Alistair Horne, *The Price of Glory, Verdun 1916* (New York: Penguin, 1962), 321.

18. Beyerchen, 89.

19. Air University interviews (F-16 pilot and Fighter Weapons School instructor) with author.

20. Maj Gen James E. McInerney, Jr., USAF, Retired, former deputy chief of staff for Programs and Analysis on the Air Staff. Telephone interview with author, 21 May 1993. General McInerney has extensive combat experience from Korea and Vietnam.

21. John B. Nichols and Barrett Tillman, *On Yankee Station: The Naval Air War over Vietnam* (Annapolis: Naval Institute Press, 1987), 76.

22. Joris Janssen Lok, "Training and Simulation: Filling the Missing Link," *Jane's Defence Weekly*, 13 April 1991, 608.

23. Garry Wills, "Critical Inquiry in Clausewitz," *Critical Inquiry* 9, December 1982, 285.

24. Richard LaCayo, "Future Schlock," *Time,* Fall 1992, 90.

Chapter 5

Potential Solutions

. . .doctrinal payoff is directly proportional to the degree to which steps have been taken to test novel weapons or tactics.

—Maj Gen I. B. Holley, USAFR

A thesis that documents what has happened in the past may be informative but has limited utility in helping us cope with the future. Since it's likely we'll see continuing pressure to cut defense spending, I offer two solutions to this vexing cost-benefit problem. Within this context of scarce funding, we can adopt two innovative approaches designed to give us the real-world experience needed to prepare a lethal and war-winning doctrine in peacetime. The first is to capitalize on the use of interactive simulation to help develop employment doctrine throughout the life cycle of new systems. The second is by building what I term "prototypical" units.

Interactive Simulation for Employment Doctrine

I fly airplanes for a living, and I don't want to give up flight time for 'sim' time. But, having seen the capability of interactive computing, I think it's absolutely essential we do this.

—Navy pilot quoted on "Simulation Insights" videotape

While we use the integrated product development (IPD) concept to field the hardware as "smartly" as possible, we need an employment doctrine equivalent. The IPD process forces teaming of many disciplines early in the design phase of a program. This approach reduces costly errors while they can still be fixed relatively easily. Nonetheless, from a tactics, techniques, and procedures perspective, the real development of employment doctrine is not initiated until well after the system is flying. In other words, we seem to not focus on employment until we near *fielding*. The operational concepts needed to justify and sell programs are relatively vague capability statements. It would be valuable to place earlier focus on tactical and operational doctrine development, building on the past practice of simulation efforts and involving MAJCOM staffs, tactics developers, operators, testers, and contractors. The Air Force is starting to "buy in" to this notion with the modest Tactical Air Command and Control Simulation Facility (TACCSF) at Kirtland AFB, New

Mexico, and with the small Man-in-the-Loop Air-to-Air System Performance Evaluation Model (MIL-AASPEM) at Eglin AFB, Florida. (MIL-AASPEM is a low-cost, interactive simulation that excels at 2 v. 6-type air-to-air engagements and is currently used to evaluate AIM-120 upgrades). We can also benefit from using interactive simulation as a building-block complement to current tactics development and evaluation (TD&E) processes. These efforts will lead to a much-needed ability to modify requirements before the configuration is fixed and may save the government large sums of precious procurement and operations and maintenance (O&M) dollars.

We can use both the US Navy and Army as examples of capitalizing on low-cost technology to develop tactics for current systems and to provide a basis for future weapon system decisions. Our sister services seem less inhibited by new simulation technologies than we do.

The US Navy opened their Weapons and Tactics Analysis Center (known as WEPTAC) at China Lake, California, in 1982.[1] WEPTAC is a "multi-station, player-in-the-loop war gaming facility," located at the Naval Air Warfare Center.[2] In the WEPTAC overview briefing, the very first mission listed is "Develop/Evaluate Fleet Tactics."[3] When the Navy considered going to an all F/A-18 air wing on its smaller carriers, they sent the air wing to WEPTAC to assess the impact.[4] In addition to individual and small group tactics, WEPTAC provides a tool for assessing operational doctrine in that it can work with up to 200 different assets.[5] Future plans range from relatively minor processor upgrades to speed up the simulation, to integrating WEPTAC with fleet systems while they are at sea.[6] While WEPTAC provides the capability to perform operational effectiveness assessments for future, as well as for existing weapon systems, the US Army provides an equally good, if not better case with its Aviation Test Bed.

The Army's Aviation Test Bed at Fort Rucker, Alabama, was instrumental in the decision to stop the procurement of ADATS, the Air Defense and Anti-Tank System. The Test Bed facility consists of simulator stations for eight helicopters, eight armored vehicles, two close air support (CAS) aircraft, up to six air defense/artillery batteries, a command post, and a "God's Eye view" master station. Using relatively low-cost, distributed simulation techniques, the Army set about to test tactics that could be used to best fight the ADATS. After extensive trials and numerous tactics, the Army discovered that the ADATS system would not be able to meet its primary requirement—to shoot down enemy helicopters. [7] "Before a single weld was laid and for the sum of $7 million we were able to tell what it took the Army $7 billion on the Sgt York gun system [that did not benefit from such a simulation effort]—that the system didn't meet the need." [8] Apache helicopter crews from Fort Rucker used the facility for 10 days prior to deploying to Desert Storm to perfect some of their tactics, too.[9]

Army programs go far beyond this one site. The Army's Deputy Assistant Secretary for Research and Technology recently stated the Army will use distributed interactive simulation (DIS) to: (1) determine weapon effectiveness *during design*, (2) develop tactics, techniques, and procedures prior to

the first prototype, and among others, (3) *re-fight* battles.[10] The Army has gone so far as to begin developing six "battle labs," roughly representing all the major branches of that service. The Army's Close Combat Tactics Trainer (CCTT) system will interactively connect battle labs at Forts Knox, Sill, Rucker, Leavenworth, Monroe, Gordon, and Benning.[11] CCTT will "allow armor and mechanized units at different locations to conduct tactical maneuver training in a combined arms, computer-simulated battlefield environment. CCTT will include nearly 500 simulators and work stations . . . and will allow running of a REFORGER-size exercise through networked simulators."[12] Gen Frederick M. Franks, commanding general of the Army's Training and Doctrine Command, commented on the Sir Michael Howard quote introduced earlier. General Franks said, "What we need to do . . . is to continue to experiment in order for us to get [doctrine] nearly right."[13] These battle labs are one way the Army is using technology to help it deal with the present and the future.

I have managed two Air Force simulator programs and feel justified claiming the superiority of Air Force simulators individually. However, it is surprising and disappointing to discover the Air Force trails the other services in networking simulations. The USAF seems especially reluctant to utilize similar systems for tactics development, both because simulators have historically been used by Congress to threaten flying hour programs and because the fidelity of these networks has been of lower quality than USAF operators are used to. While we have used some large-scale simulations in the past, we ought to lead the way for networking those simulators we already have.

Imagine the benefits. Instead of deploying to Red Flag and learning some relatively simple lessons about the first few sorties, an interactive network could help aviators learn these lower-order lessons at home—saving the subtle lessons for the exercise. Since a Red Flag or Maple Flag is a rare (and expensive) opportunity, interactive simulation might help us learn better lessons, rather than preempt the need for the lesson.

The point is simply that technology exists to begin the development of employment tactics and concepts earlier in the acquisition process and throughout a systems life. This does not mean that simulators can replace flying hours, flight demonstrators, or tactics/test airframes. They cannot. "Continuous G-load, 3D situational awareness, speed and the stress of flying *cannot* be realistically represented in full scenario combat trainers."[14] Notwithstanding this, the Air Force could do a much better job of networking existing weapon systems trainers (WSTs) and buying some MIL-AASPEM simulators to provide more than qualification and continuation training. We stand to benefit from aiming computing power at tactics development, from "requirement to retirement"—especially if the budgets continue to drive the numbers of systems procured down. This capability would be especially useful in the prototypical units operating a new system.

Prototypical Units

The large quantity of conflicting and uncertain doctrine contrasted sharply with the small quantity of practical experience. When this experience was widened in exercises and maneuvers to test out particular doctrines it was discovered that there had been too little preparation and too much theory. The practical capabilities . . . had been prone to much exaggeration.

—R. J. Overy

To complement earlier employment doctrine emphasis and to develop the practical experience Overy refers to, we must change our idea of what a prototype weapon system is. Instead of one or two items, we'll need to build an absolute minimum of one basic operational *unit*, at least squadron size for the USAF, over and above those needed for operational test and evaluation (OT&E) and TD&E. This is a method the Soviets have long used in preparing their systems for operational fielding.[15] Using our own fighter community as an example, we would need approximately 12 aircraft for OT&E and tactics development (Nellis would get 6, Edwards 4, and Eglin 2—all standard complements), and another 24 for a squadron, thus 36 "prototypes." Clearly, the question of exactly how many requires detailed study and will be related to the employment concept. Logically, since operational requirements will vary, the size of the "prototypical unit" should also vary. For example, with only 20 B-2s being fielded, this approach would not blindly advocate 36 B-2 "prototypes."

These units must be considered permanent for the life of a system. The peace-time job of the operators manning these units would be to develop and continually refine both operational and tactical employment concepts and doctrine. They must use Holley's process of systematically searching for both similar and dissimilar experiences to foster the most robust doctrinal lessons.[16]

Additionally, because employment doctrine is so dependent on the threats, terrain, and weather within theaters, the squadron-sized unit advocated above, might hypothetically organize into four flights covering geographic responsibilities. One flight would develop tactics and operations for Europe and its war plans, another for the Persian Gulf/Mid-East region, one for Korea and the last for "South of the Equator." Perhaps each flight would deploy by themselves (say, one flight of four) the first year, with a plan to deploy the squadron to each region over the next two years. We can further foster tactical doctrine if these units rotate average "line dog" operators through them regularly, say every two years, to avoid the YB-17 experience. Rigid adherence to a hiring "experience formula," say, 1/3 each of "recruits" under 500 hours, 500–1,500 hours, and more than 1,500 hours, will help ensure wide applicability of the developed operations and tactics. This type of exposure is crucial for developing doctrine, even if periods of longer operational testing emerge for the new acquisition policy. Equally important, this "prototypical unit" must deploy to "Flag" exercises

to gain simulated-combat, deployment, and support experience. Finally, this unit must have a MIL-AASPEM type, interactive simulation capability to experiment with and generate new employment ideas and concepts.

Historical Perspective

During my research I discovered that the concept of prototypical units was not entirely unique. The Luftwaffe archives revealed the German Air Force had a rating of "evaluation pilot," distinct from that of "test pilot."[17] During World War II, the German Luftwaffe essentially created this type of unit to avoid fielding "immature," problematic equipment. The Germans recognized the tendency of testing to create sterile solutions and purposefully equipped entire frontline units with prototypes. They were tasked to create employment doctrine and they served to prevent flawed equipment from causing unnecessary losses. Dr. James Corum related that the Luftwaffe did have a general process of initial testing of a system by test pilots, preproduction models being fielded and sent to operational units to be evaluated, and collection of the data to refine the design as necessary.[18] Some notable examples include Fighter Wing 26 and the FW-190 on the Western Front and the Hs-129 in the East.[19]

I believe these examples, among several, highlight how crucial it is to have some time to iron out the undiscovered problems operational usage brings to light. Remember, these aircraft were preproduction models that had already gone through testing. To their credit, the Luftwaffe built a system of active exposure to "average" operators to identify and correct these problems. Although the longer periods of operational testing "rollover plus" envisions might catch more of the problems, they cannot be trusted to replicate the conditions that operational units produce. So, production "in time for the next war" must account for the time it first takes to develop a robust employment doctrine.

Before leaving the topic of potential solutions, there is one issue this paper has not addressed and which requires further research—the need for subsystem equipment upgrades. With the demise of the Soviet Union there is no clear threat. That historical threat was available to help justify the need for regular upgrades throughout the life span of a system. Now, absent that threat, there will be increased pressure to avoid the expense of the subsystem upgrades, as well as for the major system upgrades like a new airframe. This is also salient because a new radar in a fighter aircraft drives new tactics and doctrine nearly as much as a new airframe does and relates closely to the other recommendations made here.[20]

Notes

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3. Ibid., 11.
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13. "Battle Labs," 16.
14. Joris Janssen Lok, "Training and Simulation: Filling the Missing Link," *Jane's Defence Weekly*, 13 April 1991, 606.
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17. Dr James S. Corum, German military expert who spent several weeks during the summer of 1992 translating German military archives in Berlin, interview with author, Maxwell AFB, Alabama, 5 October 1992.
18. Corum interview, 2 April 1993.
19. Donald Caldwell, *JG 26: Top Guns of the Luftwaffe* (New York: Orion, 1991), 98–99 and William Green, *Warplanes of the Third Reich* (New York: Galahad Books, 1970), 391–94.
20. Nellis interviews.

Chapter 6

Conclusion

A soldier who is familiar with his weapon can only achieve a maximum effect with it when he believes in the way it is tactically employed.

—General Adolf Galland
The First and the Last

Headlines like, “Is Clinton Cutting Twice As Much From Defense?” indicate defense cuts growing from the campaign’s $60 billion pledge to $122.6 billion.[1] With cuts this large there is likely to be increased pressure to forego producing new weapons. In my opinion, this would be a short-sighted mistake. This paper has tried to highlight the interaction of time and numbers in developing a lethal employment doctrine during peacetime; one that is capable of winning at the lowest cost in wartime. The argument hangs on I. B. Holley’s assertion that a concept is only a hypothesis and can never become a doctrine until sufficient evidence accumulates to suggest the desired result is *likely* to occur.[2] Sufficient numbers, at least unit size in my argument, are needed to supply the evidence to move hypotheses to doctrines capable of conflict-winning at acceptably low costs.

On the “dark side” of the issue, we have seen that the Yockey policy spawned industrial base concerns, relies on historically unreliable strategic warning, and mistakenly assumes that testing can completely supplant operational usage. Additionally, I have highlighted how important employment doctrine is regarding the way forces actually fight and how that a well-developed doctrine can lead to lower combat losses. The YB-17 example helped show how logistics, numbers, and public scrutiny can derail attempts to develop tactics and employment doctrine—leading directly to higher losses in the early phases of combat. Updating the history with the cases of how late generation fighters matured illustrated that the problem has not gone away and, in some aspects, may be worse.

The positive perspective is that the Air Force has shown some ability for visionary thinking, particularly regarding simulation. In this vein, two new and innovative ways can be implemented to improve the way employment doctrine is developed in this era of shrinking defense budgets.

First, we can push a requirement to develop employment doctrine earlier into the development process and throughout a system’s life. We can capitalize on US Army and US Navy experience in this arena. With the help of interactive simulation technologies, both the Navy and Army are using networked simulators to develop tactics for current systems and to acquire

more suitable future systems. Adopting these simulation techniques expands upon and complements existing efforts and increases the odds we'll have combat-lethal employment doctrine when we need it.

Second, the concept of prototypical units was presented. These units will broaden operator exposure to the much smaller "buys" while rigorously increasing the likelihood someone will recognize the ultimate potential of a system. This is important because, "the more people you have flying, the more employment innovations you'll get—that's a given. . . ."[3] Enough "end items" are needed to equip operational test and tactics development and evaluation (TD&E) units and, at a minimum, an additional, squadron-sized unit. This approach preserves the historical employment doctrine development process in microcosm, without being so costly as to hinder long-term militarily effectiveness. While more expensive than what efficiency-minded bureaucrats would prefer, it is far less expensive than the unnecessary losses in life, resources, or unmet political objectives we might sustain in a future conflict. The F-117 program serves as a benchmark that this type of small production run can be profitable for all involved.

The US Armed Services have long histories of encouraging and utilizing technology for their respective uses. On the other hand, they rarely discuss the ways to acquire the experience from which doctrine springs. Experience comes only from analyzing two sources: combat or peacetime training. Since we cannot rely upon the opportunity to experience the former, we must strive systematically to maximize combat-transferable experience from the latter. If we do not, we stand to pay for that experience in blood. Billy Mitchell's far-sighted advice ought to be heeded today, ". . . money could not buy knowledge of aviation; the fault had been not so much in the spending of the appropriation, but in laying a sound foundation."[4] Our best hope for laying a foundation that can cope with the changing defense environment is innovative thinking that *balances* budget efficiency with the need to maintain combat effectiveness. When American lives and treasure are at stake, it seems wise to err on the side of prudence.

To close, we must not forget the hard-earned lessons of the past and become smug. Desert Storm was, in some ways, too successful. Mackubin Owens warns in *Strategic Review*, "There is always the chance that success in battle will lead to doctrinal complacency. Such complacency may have two results: an intellectual stagnation that allows one's potential adversaries to gain the initiative; or . . . leading to the misapplication of force."[5] Even if we assume the industrial base will remain able to supply the systems we need when we need them, policy must recognize the additional time needed to develop combat-capable doctrine. The issue is vitally important. Lest we find ourselves reliving the apocryphal story of medieval knights being handed M-16 rifles for battle, and then proceeding to use them as swords! As I. B. Holley, Jr., has observed,

> . . . closer study of military history shows that new and more effective weapons have generally been adopted only slowly . . . [I]t is probably not too much to suggest that the survival of entire cultures may hinge upon an ability to perfect superior weap-

ons and exploit them fully. Survival itself, then appears to depend on speed in both the development and the utilization of weapons.[6]

Before one concludes that Holley is being too dramatic, we must remember that in this century alone Germany and Japan were destroyed (or at least renovated) by war, France overrun, and Britain nearly defeated.

If we move with imaginative thinking and forceful implementation now, when the threats are less imminent, we can build an affordable system designed to produce the practical, real-world experience Overy mentioned. If we do so we will live up to the inspired foresight of an airpower forefather:

The task of each generation is to interpret accumulated experience and to adapt it to new conditions.

—Alexander P. de Seversky
Victory through Air Power

Notes

1. "Is Clinton Cutting Twice As Much From Defense?" *Aviation Week and Space Technology*, 22 March 1993, 64.
2. Maj Gen I. B. Holley, Jr., USAFR, Retired, "Concepts, Doctrines, and Principles: Are You Sure You Understand These Terms?" *Air University Review*, July 1984, 91.
3. AU interviews (F-117 pilot) with author.
4. William Mitchell, *Winged Defense: The Developments and Possibilities of Modern Air Power Economic and Military* (New York: Putnam, 1925), 28.
5. Mackubin Thomas Owens, "Review Essay: Lessons of the Gulf War," *Strategic Review*, Winter 1992, 53.
6. I. B. Holley, Jr., *Ideas and Weapons* (Hamden, Conn.: Archon Books, 1953), 175.

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