STRETCHING THE UMBILICAL CORD:

THE THEORY, PRACTICE AND FUTURE OF THE SPLIT AIR OPERATIONS CENTER

BY

MAJOR L. T. WIGHT

A THESIS PRESENTED TO THE FACULTY OF

THE SCHOOL OF ADVANCED AIRPOWER STUDIES

FOR COMPLETION OF GRADUATION REQUIREMENTS

SCHOOL OF ADVANCED AIRPOWER STUDIES

AIR UNIVERSITY

MAXWELL AIR FORCE BASE, ALABAMA

JUNE 1998

Disclaimer

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

Contents

Illustrations

Preface

Major Lee T. “Tip” Wight attended the University of Oklahoma and served as a municipal police officer until being commissioned through Officer Training School in 1986. Graduating from Undergraduate pilot training in 1987, he went on to fly F-16s as an aircraft commander and instructor pilot at Hill AFB, Utah and Kunsan Air Base, Republic of Korea. Following his assignment to the 422d Test and Evaluation Squadron (TES) at Nellis AFB, Nevada, he was selected to attend the USAF Weapons School. After graduation, he returned to the 422d TES and subsequently received the Robbie Risner Award as Outstanding Weapons Officer in the Air Force for 1994. He was thereafter selected to return to the F-16 Weapons School as an instructor and developed the initial courseware for the F-16 Block 50 and Suppression of Enemy Air Defenses mission. Additionally, he served a tour as Chief of Wing Weapons, 4404 Wing (Provisional), Dhahran Air Base, Saudi Arabia. Major Wight is a senior pilot with over 2000 flying hours. He has a bachelor’s degree in Political Science — Law Enforcement Administration from the University of Oklahoma, a master’s degree in Aeronautical Science from Embry-Riddle Aeronautical University, and a master’s degree in National Security and Strategic Studies from the US Naval War College. In July 1998, Major Wight was assigned to Twelfth Air Force as Chief, Theater Strategy Development.

Acknowledgments

I would like to acknowledge several people without whose support and help I would never have gotten off the ground with this study. I want to thank Dr. I. B. Holley for focusing my effort and Major Randy Bright for numerous interviews, advice, and assistance in obtaining access to the people and information I needed to complete this paper. Also, Carl DeFranco at Rome Laboratories and Virginia Albert at Logicon Information Technologies Group deserve accolades for their patience and persistent attempts to electronically transmit information necessary for this undertaking.

I especially want to thank Colonel (now retired) Maris "Buster" McCrabb, Colonel Jim Hartney, Lt Col (Colonel-select) Robert Haseloff, Lt Col Gary Cox, and Lt Col James Welshans for the discussions we had on AOC operations and the Split AOC paradigm. Their experience and insight have been invaluable. I would like to thank Lt Col Couliette and Major Mark Conversino for their unceasing support and patience in reviewing multiple, asynchronous drafts of this study, providing comments, and keeping me on track. Captain Shelley Strong also deserves acclamation for her moral support and timely thesaurus assistance.

Finally, I would like to thank Twelfth Air Force for funding this effort and Colonel Sheekley for having the faith to select me to follow in the extremely large footsteps of Major Randy Bright.

Abstract

This study addresses the question of whether or not the Air Force should continue to develop a Split Air Operations Center (AOC) capability whose components are geographically separated, electronically connected, and codependent for task accomplishment. The author analyzes the dilemma created by the Joint Forces Air Component Commander's (JFACC's) desire to collocate with both his AOC and the Joint Forces Commander (JFC) at a forward location, counterbalanced by the need to reduce deployed footprint for various reasons — the most significant of which is to enhance his deployed force protection posture. The study examines the Split AOC as a potential solution to this dilemma. The paper begins by describing a contemporary, collocated AOC structure, as used by the Combat Air Forces' worldwide-deployable Numbered Air Forces. It then contrasts this contemporary AOC with the Split AOC paradigm. Next, the author surveys available historical experience with various forms of the Split AOC paradigm. This evidence includes exercises such as the GOLDEN SABER series, NATIONAL TRAINING CENTER CONTINGENCY OPERATIONS 93-05, the UNIFIED ENDEAVOR series, JOINT TASK FORCE EXERCISE 97-1, and BLUE FLAG 98-1. As part of the spiral development process supporting the *Vision of Aerospace Command and Control For the 21st Century*, the author subsequently appraises potential future applications of the Split AOC paradigm. This includes the AOC Baseline effort, the Distributed Air Operations Center (DAOC) technologies, Joint

Warrior Interoperability Demonstrations, and the EXPEDITIONARY FORCES EXERCISE 98. The final section of the study focuses on issues that shape the Split AOC debate and notes that several doctrinal gaps currently exist regarding AOC operations. These omissions include the failure to explicitly address split operations, as well as omitting any discussion of where the JFACC and the AOC should be located in relation to the JFC. The study concludes that in its present form, Split AOC operations are neither more efficient, nor less expensive than traditional, collocated AOC processes and that over the near term, technology is insufficient to support the paradigm. However, Air Force development of Split AOC operations should continue as part of a flexible response package to various contingencies, not as the single answer to all future airpower command and control requirements.

Chapter 1

Introduction and Overview

> *A Stone Age chieftain had to devise the optimal organization and find the methods and technical means to command the forces at his disposal. From his day to ours, failure to consider and solve the problem was to court disaster — indeed, to make it impossible for the forces to exist.*
>
> —Martin Van Creveld
> Command in War

> *Air warfare cannot be separated into little packets; it knows no boundaries on land and sea other than those imposed by the radius of action of the aircraft; it is a unity and demands unity of command.*
>
> —Air Marshal Arthur Tedder

> *Air Power's unique characteristics necessitate that it be centrally controlled by airmen.*
>
> —Colonel Phillip S. Meilinger
> 10 Propositions Regarding Air Power

Today's Joint Forces Air Component Commander (JFACC[1]) sits squarely upon the horns of a dilemma. On the one hand, the JFACC wants to both centrally control airpower and be collocated with the Joint Forces Commander (JFC) in order to maximize the synergy of the air and land combat arms. On the other hand, a host of contemporary political, military, and economic pressures drive the JFACC to reduce his forward presence to the maximum extent possible. A solution to this apparently intractable problem may be on the horizon. The Split Air Operations Center (AOC) paradigm may allow the JFACC to enjoy the benefits of forward presence while simultaneously minimizing his exposure.

This analysis will examine the roots of the dilemma, starting with the reasons that today's air commanders desire centralized control over their air assets and prefer to collocate their means for exercising this control — the AOC — with the ground commander. Next, the study will focus on the other aspect of the dilemma by examining the arguments for reducing forward presence. Then, this paper will detail AOC theory, examine how its processes might be split, and review experiences with the Split AOC in practice. Finally, this evaluation will peer into the future of the Split AOC before drawing conclusions and making recommendations on the Split AOC paradigm as a whole.

Necessity for Centralized Control

Thousands of years of human conflict have firmly etched unity of command into the military consciousness. Noted historian and military command and control expert Martin Van Creveld described unity of command as one of the fundamental principles of war.[2] The need for unity of command is written in the blood of failed combat leaders and carried forth in today's authoritative Joint Doctrine.[3] Because of airpower's inherent ability to rapidly mass and disperse, as well as its ability to alternatively affect either tactical battles, theater campaigns, or strategic objectives, unity of command is especially critical for air combat. The Air Force's keystone *Doctrine Document 1* echoes this premise. It emphasizes that "unity of command is important for all forces, but it is vital in employing air and space forces. Air and space power is the product of multiple capabilities, and centralized command and control (C^2) is essential to effectively fuse these capabilities."[4] Although some might argue that centralized C^2 doctrine has become

a dogmatic "millstone,"[5] the American airpower experience — born over the trenches of the Great War's Western Front and matured in the thunder and lightning of DESERT STORM — has continuously revalidated this principle. When airmen have centrally controlled airpower, it has generally achieved its objectives; when they have not — as evidenced during 1942-43 in Northwest Africa, as well as in both Korea and Vietnam — it has failed disastrously.[6]

One such prominent disaster — that inflicted upon the Army Air Forces and U. S. II Corps at Kasserine Pass during the 1943 North African campaign — helped to bring about the codification of the principle of centralized control of airpower, by an airman, in *War Department Field Manual 100-20 (FM 100-20).*[7] Because ground commanders insisted on placing fighter aircraft directly over their individual units, air commanders were unable to effectively mass their resources. As a result of this "penny-parceling of air units for ground support at the whim of the ground commanders" — in addition to confused C^2 arrangements and the lack of all-weather airfields — the Allies never achieved air superiority and friendly forces suffered heavily from enemy air attacks.[8] In addition to proving that unity of command was not a mere shibboleth, the Western Desert experience validated the principle of collocating air and ground commanders. British Field Marshal Sir Bernard Law Montgomery summed this up in his assertion that "to obtain the greatest possible air assistance… commanders of both the air and ground units should not only plan together, but their staffs should work together from the same headquarters."[9] By being together, the air and ground commanders could better coordinate their efforts to insure a unity of purpose. This coordination also enabled

airpower to achieve its maximum flexibility, massing and dispersing as required in response to enemy activity.[10]

Incorporation of the Joint Forces Air Component Commander

Although *FM 100-20* called for centralized control of air assets, mismanagement of airpower in Korea and Vietnam clearly showed that military leadership had not successfully internalized this principle. In Korea, although there was theater level "coordination" of Air Force, Marine, and Navy assets, the Fifth Air Force commander never received tactical control (TACON)[11] of carrier-based aircraft or those designated for "strategic" missions. Due to this lack of control, Fifth Air Force was hampered in its ability to support the Army and Marine Corps land battle.[12] In Vietnam, the principle of centralized control unraveled even further. No unified theater-level command arrangement existed — each service simply controlled its own air forces. The Air Force even split its command lines between Pacific Air Forces (PACAF) and Strategic Air Command (SAC). As a result, each service — or even separate major commands (MAJCOMs) within a single service — fought its own air war, with a telling lack of unity.[13]

Eventually, Congressional pressure, combined with operational employment problems encountered during the Grenada operation, resulted in the Goldwater-Nichols Department of Defense Joint Reorganization Act of 1986. This act reorganized the services' command relationships, spurred the codification of joint doctrine, and led to the adoption of the JFACC concept.[14] Under this notion, the JFACC has centralized control over all air assets that are allocated to the Joint Force Commander (JFC) within a theater

of operations.[15] Notably, this commander should be an airman, but not necessarily a member of the U. S. Air Force (USAF), though the JFACC will normally be "the component commander having the preponderance of air assets."[16] *AFDD 1* echoes this presumption.[17]

Unlike the issue of centralized control, Joint and Air Force doctrine are silent on the matter of the physical location of the JFACC and his staff. Potential JFACCs have traditionally taken Field Marshal Montgomery's prescription to collocate with the land component commander. "I'll be wherever the JFC is" Lieutenant General Frank B. Campbell, former commander of Twelfth Air Force (12AF) stated, while serving as JFACC during the BLUE FLAG (BF) 98-1 command and control exercise.[18] Major General Thomas J. Keck, the current 12AF Vice Commander — who also briefly served as JFACC during BF 98-1 — reiterates these sentiments.[19] Noted C^2 expert, author of several C^2 articles, and former School of Advanced Airpower Studies (SAAS) faculty-member Colonel (retired) Maris McCrabb states that "command decisions should be made where the most accurate and timely information is found, where authority is delegated, and where the span of attention is found."[20] Likewise, Colonel Scott M. Britten, who did extensive research on split command and control operations for his Air War College thesis "Reachback Operations for Improved Air Campaign Planning and Control," argues that the last 'C' in JFACC stands for *commander,* the most duty-bound position in the military. The JFACC must be in touch with the airmen, eat in their mess tents, shake their hands, and thank them for their sacrifices. No video teleconference can ever do these things. Perhaps someday a JFACC will be killed because of being in a

combat zone; so be it. But as long as the last 'C' means commander, the theater is where the JFACC belongs.[21]

Wherever the JFC goes, it appears the JFACC and his staff will — and should — collocate, along with their means for exercising centralized control over air assets, the AOC.

The Traditional Air Operations Center

The Theater Air Control System (TACS)[22] consists of both forward-deployed airborne and ground radar elements that enable the JFACC to execute airspace control and air defense operations. Additionally, there are sub-elements of the TACS that either exercise airborne command and control or interact with ground forces to insure that ground support requests are integrated into the overall air plan. The TACS also includes the Wing Operations Centers (WOCs) of the deployed air units, as well as an Airlift Control Center, Airlift Control Elements and Combat Control Teams.[23] The AOC is the highest controlling (or "senior") element of the TACS. The JFACC uses the AOC to develop an air plan that supports the JFC's guidance, to produce the Air Tasking Order (ATO) — which is the guide for executing the JFACC's plan — and to monitor the ATO's execution. Chapter Two of this study describes how the AOC has grown from a unit similar in size to the ancient Greek army's "headquarters," consisting of "a few senior commanders… technical experts… And… hangers-on… [in which] neither a special nor a general staff section [was] in evidence,"[24] to the over 2,000 specialized personnel who performed AOC tasks during Operation DESERT STORM.[25] Translated

into airlift requirements, 12AF alone would need thirty seven C-141-equivalent sorties to transport its complete AOC structure to a forward location.[26]

In some theaters, established physical structures exist for AOC functions and staff; yet, as Lieutenant General Michael A. Nelson observed in "A Commander's View of Command and Control," "we are in a 'go there' mode now and will be increasingly so in the 21st Century… [thus] lighter… smaller… less fragile and more endurable are what we must aim for."[27] Moreover, unlike Operation DESERT SHIELD, the nature of many conflicts may not allow the time, space, or available lift assets necessary to preposition extensive command structures. Political constraints might restrict the number and size of personnel allowed in theater — such as those we experienced in El Salvador and are currently enduring in Saudi Arabia. Additionally, an area of operations may pose such a high threat that, in order to minimize potential casualties, commanders only permit essential personnel to forward deploy.

Other situations might make it similarly undesirable to transport the entire AOC structure to a forward operating location. During the 1989 Operation JUST CAUSE, for example, planners sought to preserve operational security (OPSEC) by minimizing pre-hostilities moves into theater.[28] Moreover, two major theaters of war (MTW) occurring "nearly simultaneously," would severely strain strategic lift assets and potentially restrict the deployment speed of large C^2 packages. Situations such as these present modern air commanders with a dilemma. How can the JFACC maintain forward presence and yet adequately perform his role without an entire AOC staff physically present? The Split AOC concept may provide an answer.

The Split AOC Concept

Among others, the 12AF staff has expanded on various proposals intended either to increase the TACS' survivability[29] or to tailor it for contingency operations.[30] As a result, 12AF developed and tested the concept of a "Split AOC" during BLUE FLAG 98-1.[31] This paradigm involves AOC elements that are geographically separated, electronically connected, and codependent for task accomplishment.[32] Exactly where the AOC's processes are "split" will depend on the nature of the contingency.[33] Those portions deployed forward, into the area of operations, are known as the AOC-forward (AOC-F), whereas the elements remaining in garrison are known as the AOC-rear (AOC-R).

What the Split AOC is NOT

Before discussing the Split AOC concept in detail, some limitation of this paradigm is necessary. Several popular "buzz words" have been mistakenly linked to the Split AOC concept, confusing the Split AOC's intended role and structure. One such term is "reachback." This term is defined by the *Presentation of USAF Forces* — commonly known as the "*Little Red Book*" — as "a concept for the use of Air Force forces/capabilities not located in the AOR [Area of Responsibility]/JOA [Joint Operations Area]." [34] By definition, the Split AOC will use reachback to access information and processes not available at the forward operating location. However, reachback alone is not sufficient to constitute a Split AOC operation. For example, the DESERT STORM AOC was located in Riyadh, Saudi Arabia, and it frequently accessed essential information for developing its theater air strategy through reachback to the CHECKMATE[35] staff located in Washington, District of Columbia.[36] However, the

entire AOC functional structure was located at Riyadh Air Base. In a similar fashion, during Operation DELIBERATE FORCE in Bosnia, General Michael E. Ryan — the Combined Forces Air Component Commander (CFACC) — located his primary C^2 operation at the Combined AOC (CAOC) in Vicenza, Italy and only relied on his headquarters at Naples, Italy for public affairs functions.[37] Therefore, because their AOC processes were not split, neither DESERT STORM nor DELIBERATE FORCE fit this study's criteria for Split AOC operations.

In a similar manner, the term "distributive operations" is often misconstrued with Split AOC operations. In fact it has a different meaning altogether. Neither *Joint Publication (JP) 1-02, Department of Defense Dictionary of Military and Associated Terms* nor service doctrinal publications define "distributive operations." Systems theory experts, however, define the term as "the ability to disperse multiple, *independent* functional systems about an area to enhance their potential for survival and suffer less overall system degradation in the event of individual component destruction."[38] However, instead of being able to function independently, the components of the Split AOC are *codependent* for task completion. That is, both the forward and rear AOC components are necessary for the AOC to successfully translate the JFC's guidance into air operations tasks.[39] Therefore, this study will not consider distributive operations to be synonymous with the Split AOC concept. However, this study will assess the Split AOC's codependency requirement as a potential weakness, if communications links fail.

Lastly, the issue of Administrative Control (ADCON) versus Combat Command (COCOM) is sometimes misapplied in discussions of the Split AOC concept. Simply put, COCOM is the command authority to accomplish the mission (which may be

operational control [OPCON[40]] or tactical control [TACON]), while ADCON is the "care and feeding" requirement for the deployed force that is the responsibility of the owning service component commander.[41] For USAF forces, ADCON is the responsibility of the Commander, Air Force Forces (COMAFFOR).[42] The JFACC has no inherent responsibility for ADCON, unless he is also functioning as the COMAFFOR and is subsequently "dual-hatted." What this means is that in most situations, the JFACC is responsible for the combat employment of air forces, while the "parent" MAJCOM of the deployed forces is responsible for their organization, training, and equipment.[43]

The AOC is the JFACC's means of exercising COCOM over his assigned or attached forces in the theater of operations. Whereas, depending on the size of the deployed force, ADCON would be performed by staff elements of either the parent MAJCOM or the Numbered Air Force (NAF) from which the assets were drawn.[44] The ADCON support function may be performed by either staff elements in theater, collocated with the AOC, or via "reachback" to the parent unit at a rear location.[45] However, in no way do MAJCOM "rear staff elements" exercise combat command over deployed assets. This is solely the prerogative of the CINC, who may elect to delegate COCOM over air forces to the JFACC.[46]

Therefore, an operation in which the JFACC, also functioning as the COMAFFOR, has his entire AOC[47] forward deployed, but is merely receiving ADCON support from a rear element, is technically not a Split AOC operation. This is the situation in which Ninth Air Force found itself during DESERT STORM. As previously mentioned, Ninth's entire AOC deployed forward, while ADCON was performed by the Tactical Air Command Battle Staff functioning as Central Command Air Forces (CENTAF) Rear

from Langley AFB, Virginia.[48] This arrangement did not restrict the daily command exercised by General Horner (the JFACC) through his AOC, over the deployed forces. To be included in this study as a Split AOC, an AOC must have its COCOM functions geographically separated, not merely its ADCON structure.

Thesis Overview

Having clarified what a Split AOC is not, what this study will do is assess the Split AOC's merits and its potential application to our present and projected future force structure. Specifically, this analysis will focus on the question of "Should the Air Force continue to develop and use a small-scale, deployable Air Operations Center component to assist the JFACC in planning, executing, and controlling combat air operations?"

Chapter Two takes the first step toward answering this question by describing traditional AOC theory. The chapter illustrates how official doctrine and the standard operating procedures (SOPs) of the Combat Air Force (CAF) worldwide-deployable NAFs — Eighth Air Force (8AF), Ninth Air Force (9AF), and 12AF — envision the traditional AOC. Since Seventh Air Force (7AF), based in Korea, plans to operate exclusively from fixed, permanent sites, this study will not assess their AOC structure. Thirteenth Air Force's (13AF's) AOC organization, mission, and structure are presently embryonic. During a contingency they would likely be augmented by 12AF,[49] therefore, their present structure will also not be evaluated. Furthermore, Sixteenth Air Force's (16AF's) commander, Lieutenant General Richard Betherum, — based in Naples, Italy — indicated that his headquarters would likely only forward deploy to three fixed, sub-regional operating sites.[50] Therefore, this study will not assess their structure either. The

next section of Chapter Two will focus on potential variants of the traditional AOC concept, to include both functional and physical splits within the AOC, as well as some tailored TACS alternatives.

Chapter Three will examine the Split AOC in contemporary practice. This survey begins with 12AF's experience during the GOLDEN SABER series of "tailored" AOC exercises and its NATIONAL TRAINING CENTER (NTC) CONTINGENCY OPERATIONS (CONOPS) deployment. Next, this treatise examines 8AF's UNIFIED ENDEAVOR exercises, as well as its experience during JOINT TASK FORCE EXERCISE (JTFEX) 97-1, and concludes with a detailed evaluation of 12AF's BLUE FLAG 98-1.

Chapter Four shifts to the future of the AOC. It will discuss ongoing attempts to standardize AOC processes and training, conceptions of Split AOC options to include the Rear Operations Support Center (ROSC) at Langley AFB, Virginia, and some of the technologies demonstrated during the Joint Warrior Interoperability Demonstrations (JWID) for the Distributed Air Operations Center (DAOC). The chapter will then examine how the application of the Split AOC paradigm during the EXPEDITIONARY FORCE EXERCISE (EFX) 98 supports the "spiral development and acquisition process" envisioned by the *Command and Control Roadmap* and the *Vision of Aerospace Command and Control for the 21st Century*. The chapter concludes with an assessment of how all of these concepts are expected to evolve into the technologies and processes that will support the "JFACC After Next."

Finally, Chapter Five describes issues central to the current debate over the Split AOC. It will summarize the various advantages and disadvantages of the competing

concepts and answer the question of whether or not the NAFs should continue to develop the Split AOC. Finally, it will offer some doctrinal recommendations to further the Split AOC's implementation.

Thesis Limits

To date, various split AOC configurations have been demonstrated only once or twice. Furthermore, these tests have not been done in a controlled environment, in accordance with an objective test plan. Therefore, any conclusions drawn from these isolated data points would be premature, at best. Due to this insufficient data base, which makes deriving conclusions imprudent, this study will not attempt to definitively establish what the optimum configuration should be for Split AOC operations. However, it will discuss the advantages and disadvantages of several Split AOC variants. This study will also not try to answer the question of whether or not there *should* be a ROSC or where it should be located, since its ongoing construction renders those issues moot. The study will also not address the issue of who *should* control the ROSC, but it will detail concerns about control of the ROSC that are shared by both Air Combat Command (ACC) and the NAFs.

This study will also not perform a detailed cost-benefit analysis of split versus collocated AOC operations. This is primarily due to the fact that the Split AOC is still largely conceptual and its final configuration is far from agreed upon. Moreover, due to the number of variables involved and the limited data presently available, that type of study is beyond the scope of this project, although it would certainly be a useful subject for future research.

Ultimately, this study discovers several existing doctrinal holes. Yet, for reasons similar to those that currently preclude the cost-benefit analysis, this thesis will limit its recommendations to areas that doctrine should address, instead of attempting to establish definitive doctrinal conclusions. Furthermore, because Split AOC development and testing are ongoing, these suggestions are intended as starting points for a thorough doctrinal investigation as AOC technology matures. Clearly, in whatever form the Split AOC eventually takes, this paradigm offers many challenges to traditional command and control concepts.

Notes

[1] For simplicity of reference, throughout this paper, the terms Joint Forces Air Component Commander (JFACC), Joint Forces Commander (JFC), and Air Operations Center (AOC), unless otherwise noted, should be assumed to apply equally to joint or combined forces. Thus, for the purposes of this study, these terms will be assumed to include functions performed by the Combined Forces Air Component Commander (CFACC), Combined Forces Commander (CFC), and either a Joint AOC (JAOC) or Combined AOC (CAOC). Likewise, unless otherwise noted, JFC will be assumed to be any commander in chief (CINC) of any unified or specified combatant command, exercising COCOM (combat command authority) as specified by Title 10 ["Armed Forces"] *United States Code*, Section 164. In this paper, the term JFC may include Combined Forces Commander (CFC) functions or those of a Joint Task Force Commander (JTF/CC). For further description of JFC and JFACC command authority, see *Joint Publication 0-2, Unified Action Armed Forces (UNAAF)* (Washington, DC: United States Joint Chiefs of Staff, 1992) and Air Force Doctrine Center, *Air Force Doctrine Document (AFDD) 1, Air Force Basic Doctrine* (Maxwell AFB, AL: Air Force Doctrine Center, 1997), p. 13. Hereafter referred to as *AFDD 1*.

[2] Martin Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), p. 1.

[3] See United States Joint Chiefs of Staff, *Joint Publication 3-0*, *Doctrine for Joint Operations* (Washington, DC: United States Joint Chiefs of Staff, 1995), p. II-1.

[4] *AFDD 1*, p. 13.

[5] J. F. C. Fuller quoted in Richard E. Simpkin, *Race to the Swift* (London: Brassey's Defence Publishers, 1985), p. 1.

[6] United States Air Force, *JFACC Primer*, 2d ed., (Washington, DC: Department of the Air Force, 1994), p. 8.

[7] War Department, *Field Manual (FM) 100-20 Command and Employment of Air Power*, (21 July 1943), 3-4.

Notes

[8] David Syrett, "The Tunisian Campaign, 1942-43" in *Case Studies in the Development of Close Air Support*, Benjamin Franklin Cooling, ed. (Washington, DC: Office of Air Force History, 1990), p. 162-170, especially p. 165.

[9] Sir Bernard Law Montgomery quoted in Syrett, p. 172.

[10] Syrett, p. 172-3.

[11] *Joint Publication (JP) 3-0* defines TACON as "the command authority over assigned or attached forces or commands, or military capability or forces made available for tasking that is limited to the detailed and usually local direction and control of movements or maneuvers necessary to accomplish assigned missions or tasks." *JP 3-0, Doctrine for Joint Operations*, (Washington, DC: USCJCS, 1995), p. II-8.

[12] Stephen J. McNamara, Lt Col, USAF, *Air Power's Gordian Knot: Centralized Versus Organic Control* (Maxwell AFB, AL: Air University Press, 1994), p. 89.

[13] Ibid., p. 97.

[14] Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress (Pursuant to Title V of the Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991)* (Washington, DC: Government Printing Office, 1992), p. K-4. *Joint Publications 0-2, 3-0, 3-56, and 3-56.1* all indicate when and how a JFC or JTF/CC would designate an Air Force Component Commander (AFCC) as a JFACC. For the purposes of this paper, when discussing the airman exercising centralized control over apportioned air assets, although it might in actuality be either the JFC himself, a JFACC, an AFCC, or another component commander with the preponderance of air assets to be employed, this paper will refer to that person as the JFACC. See the above listed publications for details on the situational designation of air control authority.

[15] United States Joint Chiefs of Staff, *Joint Publication 3-56.1 Command and Control for Joint Air Operations* (Washington, DC: U. S. Joint Chiefs of Staff, 1994), p. II-2.

[16] Ibid.

[17] *AFDD-1*, p. 67-72.

[18] Frank B. Campbell, Lt Gen, USAF, personal interview, Homestead Air Reserve Station (ARS), FL: BLUE FLAG 98-1 AOC-forward, 17 November 1997.

[19] Thomas J. Keck, Maj Gen, USAF, personal interview, Davis-Monthan AFB, AZ: 12AF Vice Commander (CV), 17 March 1998.

[20] Maris McCrabb, Colonel (retired), USAF, draft briefing, "Command and Control Concept of Operations: Dynamic Battle Management" (Langley AFB, VA: Air and Space Command and Control Agency, 21 January 1998), slide 14.

[21] Scott M. Britten, Colonel (select), USAF, "Reachback Operations for Improved Air Campaign Planning and Control (Draft)," unpublished Air War College thesis (Maxwell AFB, AL: Air War College, April 1997), p. 27.

[22] Excellent descriptions of the TACS are in the Deputy Chief of Staff, Plans and Operations, Headquarters United States Air Force, *JFACC Primer* (Washington, DC: HQ USAF, 1994) and Robert J. Blunden, Jr., *Tailoring the Tactical Air Control System for Contingencies* (Maxwell AFB, AL: Air University Press, 1992), p. 1-17.

[23] Blunden, p. 8-10.

Notes

[24] Martin Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), p. 29.

[25] Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare?* (Annapolis, MD: Naval Institute Press, 1995), p. 126.

[26] Martin Kahao, Lt Col, USAF, "How We Fight," briefing slides, (Davis-Monthan AFB, AZ: 612 CPS/DOXP, 4 February 1998), slide 15.

[27] Michael A. Nelson, Lt Gen, USAF, "A Commander's View of Command and Control" in A. H. Levis and Levis, I. S., eds., *Science of Command and Control: Part II Coping with Change* (Fairfax, VA: AFCEA International Press, 1994), p. 6.

[28] David Tillotson III, Major, USAF, *Restructuring the Air Operations Center: A Defense of Orthodoxy* (Maxwell AFB, AL: Air University Press, 1993), p. 34.

[29] See among others Maurice P. Wexlar, et. al., *Modular Operations Concept Study*, 2 vols., (Griffiss AFB, NY: Rome Air Development Center, 1981), especially p. 418; Dale L. Goodell, *Modular Control Equipment: Concept of Operations for the European Tactical Air Control System* (Maxwell AFB, AL: Air University Press, 1987); Robert D. Russ, "The Eighty Percent Solution," *Air Force Magazine*, January 1991, p. 60-62; E. B. Clark, et. al., *Tactical Air Control System Functional Distribution Options*, 2 vols., (Hanscom AFB, MA: Electronic Systems Division/Air Force Systems Command, 1986); and *21st Century Tactical Command and Control Study (TC^2-21)*, 2 vols., (Hanscom AFB, MA: Electronic Systems Division/Air Force Systems Command, 1985). These concepts were developed primarily in anticipation of a conventional, force-on-force, NATO versus Warsaw Pact battle in Central Europe.

[30] Robert J. Blunden, Jr., *Tailoring the Tactical Air Control System for Contingencies* (Maxwell AFB, AL: Air University Press, 1992).

[31] The employment portion of BLUE FLAG 98-1 occurred between 14-20 November 1998 and included operations conducted between three geographically dispersed bases: the AOC-rear located at Davis-Monthan AFB, AZ; the AOC-forward at Homestead ARS, FL; and the "white force" or controlling section at Hurlburt AFB, FL, as well as Airborne Warning and Control System (AWACS) simulations electronically transmitted from Tinker AFB, OK. Kris Lauritzen, "BLUE FLAG 98-1 EXECUTIVE SUMMARY," message (Hurlburt Field, FL: 505th Command and Control Evaluation Group [CCEG], 26 November 1997).

[32] Randy Bright, Major, USAF, "Split AOC Decision Brief" (Davis-Monthan AFB, AZ: 612 CPS/DOXP, 27 October 1997).

[33] Randy Bright, personal interview, Homestead ARS, FL, 20 November 1997.

[34] The "Little Red Book" is a doctrinal publication written by the commanders of the Combat Air Forces (CAF) which describes how their forces will be presented to the Joint Force Commander (JFC) and employed in various situations. Much of this guidance will be incorporated into *Air Force Doctrine Document 2*. Combat Air Forces, *Presentation of USAF Forces ["Little Red Book"]* (Langley AFB, VA: CAF, 1997), p. 3.

[35] Headquarters, USAF/XOOCD.

[36] Richard T. Reynolds, *Heart of the Storm* (Maxwell AFB, AL: Air University Press, 1995), p. xxx.

Notes

[37] Robert C. Owen, *Balkans Air Campaign Survey*, "Summary," (Maxwell AFB, AL: Air University Press, 1997), p. 15.

[38] RAND Corporation, *Some Remarks on Digital Distributed Communications Networks* (Santa Monica, CA: RAND Corporation, 1967). Emphasis added.

[39] Hereafter I will refer to this requirement as "codependency for task accomplishment" or simply "codependency."

[40] *Joint Publication 3-0* describes OPCON as "inherent in COCOM and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission." *JP 3-0, Doctrine for Joint Operations*, (Washington, DC: USCJCS, 1995), p. II-7.

[41] United States Joint Chiefs of Staff, *Joint Publication 0-2, Unified Action Armed Forces* (Washington, DC: US Joint Chiefs of Staff, 1995), p. xi-xiii.

[42] Combat Air Forces, *Presentation of USAF Forces* ["*Little Red Book*"] (Langley AFB, VA: Combat Air Forces, 1997), p. 4.

[43] Ibid.

[44] Note that if no JFACC is designated or if the JFACC is from another service besides the USAF, the COMAFFOR may retain OPCON and/or TACON over the deployed forces, as well as ADCON. See "*Little Red Book*," p. 4., and *Joint Publication 3-56.1*, p. II-2.

[45] This rear organization, providing the "care and feeding" support is known as the AFFOR-rear. See "*Little Red Book*," p. 8.

[46] The source of concern over this concept is the fear of rear elements usurping the theater commander's command authority, echoing the ineffective micro-management practices of President Johnson during Vietnam and in effect attempting to "run the air war from Washington." Mark Clodfelter has an excellent description of the "Tuesday Lunches" in which President Johnson chose targets in *The Limits of Air Power* (New York: Free Press, 1989), p. 124. For a description of General Horner's reaction to potential direction from Washington, see Reynolds, *Heart of the Storm*, especially p. 129.

[47] A COMAFFOR's AOC becomes a Joint AOC (JAOC) when the COMAFFOR is designated as the JFACC. See "*Little Red Book*," p. 7.

[48] Ibid., p. 8.

[49] Gary Cox, Lt Col, USAF, personal interview, Barksdale AFB, LA: 8AF/CCG, 18 March 1998 and Randy Bright, Major, USAF, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXP, 16 March 1998.

[50] Richard Betherum, Lt Gen, USAF, personal interview, Maxwell AFB, AL: School of Advanced Airpower Studies, 23 February 1998.

Chapter 2

AOC Theory and the Split AOC Paradigm

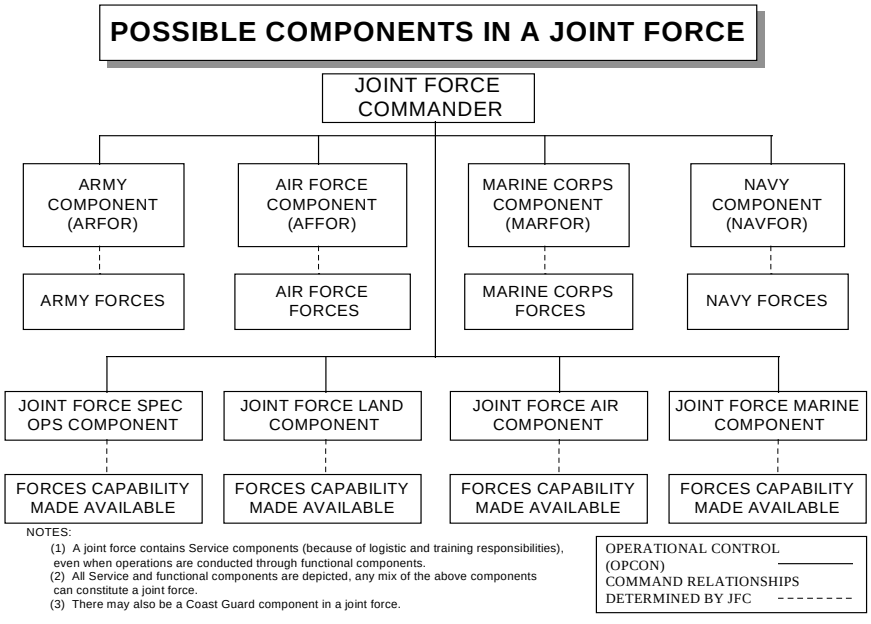
The NAF (Numbered Air Force) is the senior warfighting echelon of the U. S. Air Force.

—Air Force Doctrine Document 1

The AOC is the air and space operations planning and execution focal point for the JTF and is where centralized planning, direction, control, and coordination of air and space operations occurs for which the COMAFFOR/JFACC has OPCON/TACON.

—Presentation of USAF Forces ("Little Red Book")

USAF doctrine specifies NAF personnel as its warfighters. A NAF commander will be designated as the COMAFFOR[1] for air forces allocated to a geographic commander-in-chief (CINC) for combat operations. Figure 1 indicates the possible components and command relationships for joint forces.

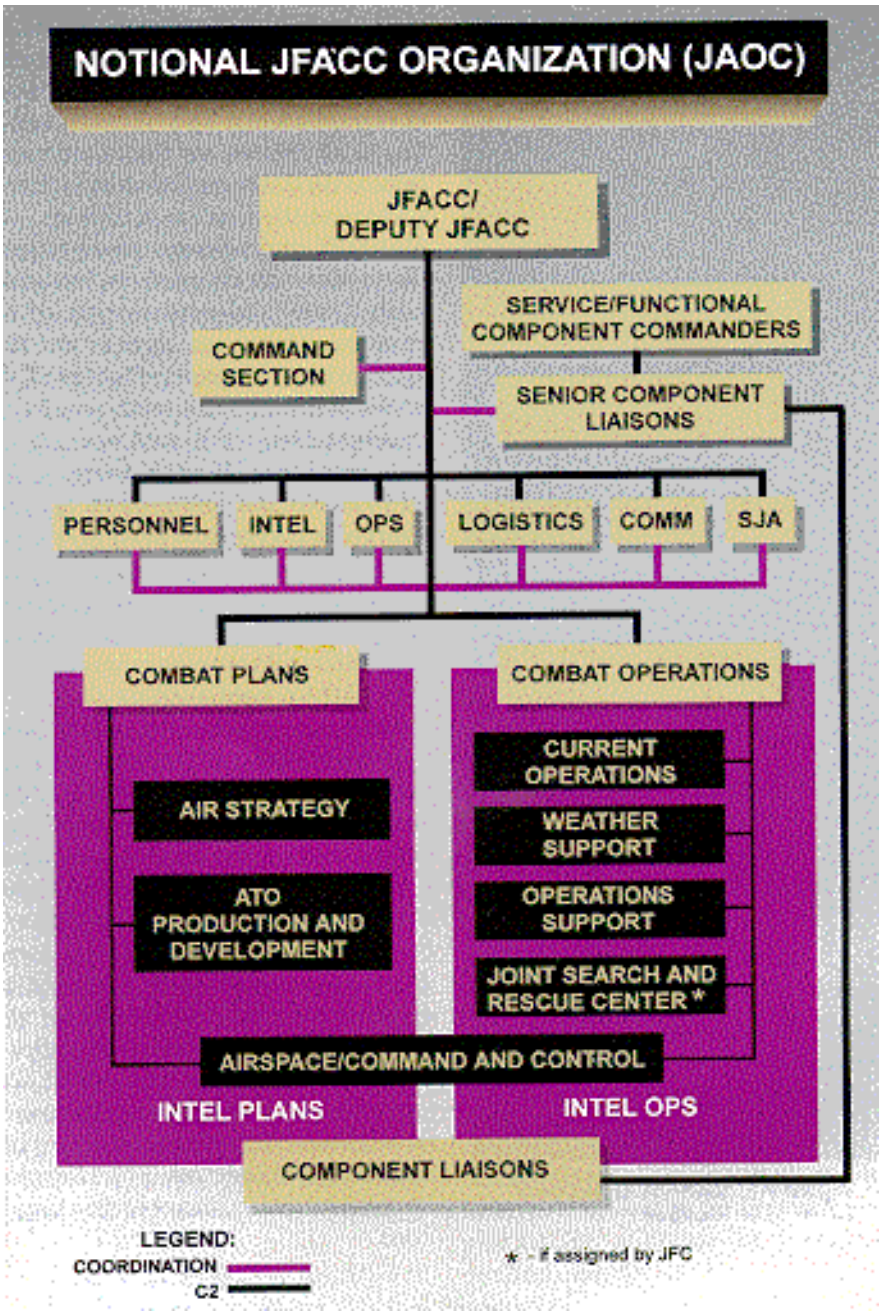


Source: Joint Publication 3-0, Doctrine for Joint Operations, p. II-16.

Figure 1. Possible Components in a Joint Force.

AOC Organization

If designated as a Joint Forces Air Component Commander (JFACC)[2] by a CINC or Joint Forces Commander (JFC), the COMAFFOR becomes responsible for the "planning, coordination, allocation, and tasking of joint air operations based on the JFC's concept of operations and air apportionment decision."[3] The COMAFFOR/JFACC will exercise these responsibilities through the Air Operations Center (AOC).[4] Regardless of its actual configuration in a particular scenario, in general, the AOC will perform combat plans and combat operations functions, while integrating intelligence and other service and component liaison officers (LNOs) into both processes. Presently there is no consensus among the "seventeen agencies worldwide that purport to be AOCs"[5] as to the standard configuration or processes the AOC should perform. However, joint doctrine offers a description of a notional AOC structure, illustrated in Figure 2.



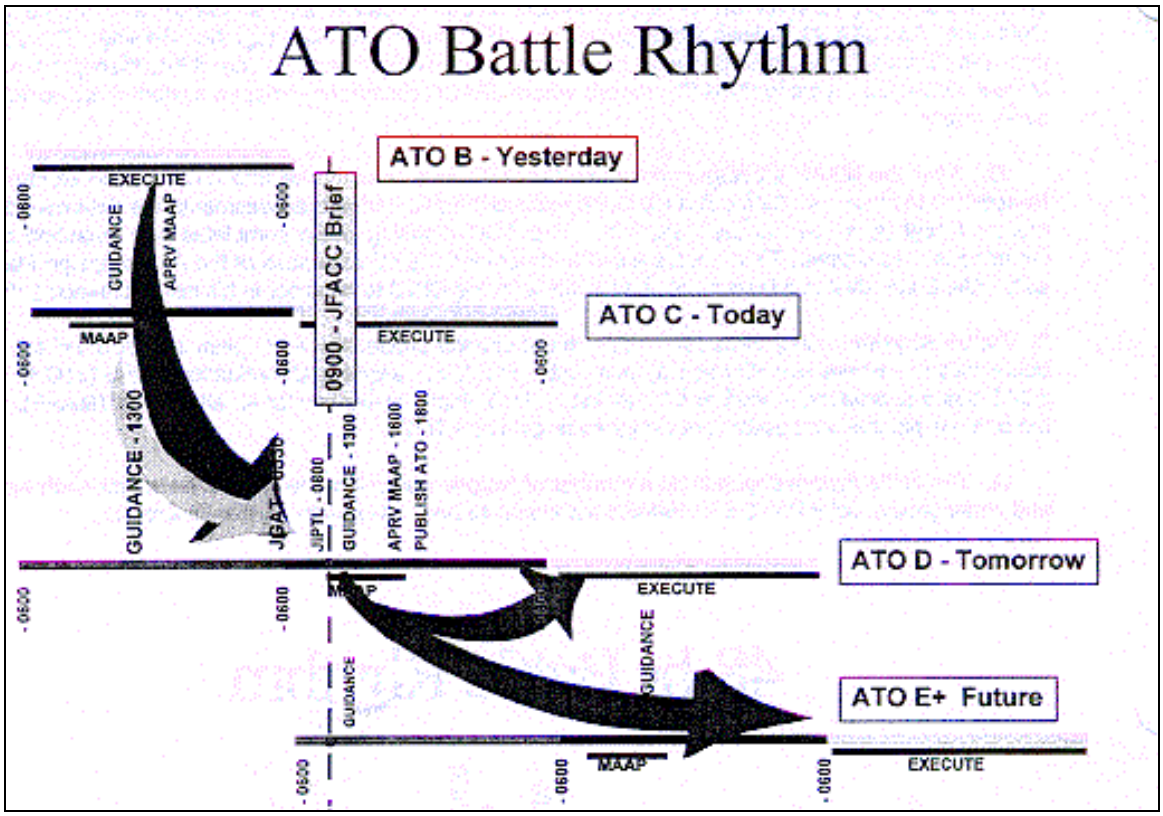
Source: JP 3-56.1, Command and Control of Joint Air Operations, p. II-6.

Figure 2. Notional AOC Organization

Simply put, the AOC structure contains components that control both "today's" and "tomorrow's war." The office of Combat Operations within the AOC is responsible for monitoring "today's war" through the daily execution of each Air Tasking Order (ATO).[6]

It is through the ATO structure that the JFACC controls combat operations. Ideally, every sortie flown within the Area of Operations (AOO) will be included on the ATO. This document — which for a large operation may be hundreds of pages in length — is used to indicate mission taskings, targets, ordnance, times, rules of engagement (ROE), and any special operating instructions (SPINS). Combat Operations "closely follows the action of current joint air operations, shifting missions from their scheduled times or targets and making other adjustments as the situation requires."[7]

Meanwhile, Combat Plans prepares for "tomorrow's war" through its strategy cell and the Air Tasking Order (ATO) production and development section — both of which interface with the Intelligence Plans section and various LNOs. These LNOs are representatives from other service components and tasked wings, and generally include experts in all major weapons systems and air force functions. They provide the specialized coordination and expertise necessary to translate the JFC's guidance into executable tasks, as specified in the ATO. The ATO follows an approximately forty-eight hour development cycle and covers a period of twenty-four hours. Each ATO is executed sequentially while others are being prepared or their results assessed, forming a "battle rhythm"[8] as shown in Figure 3.



Source: 12AF Air Force Forces SOPs, p. 20.

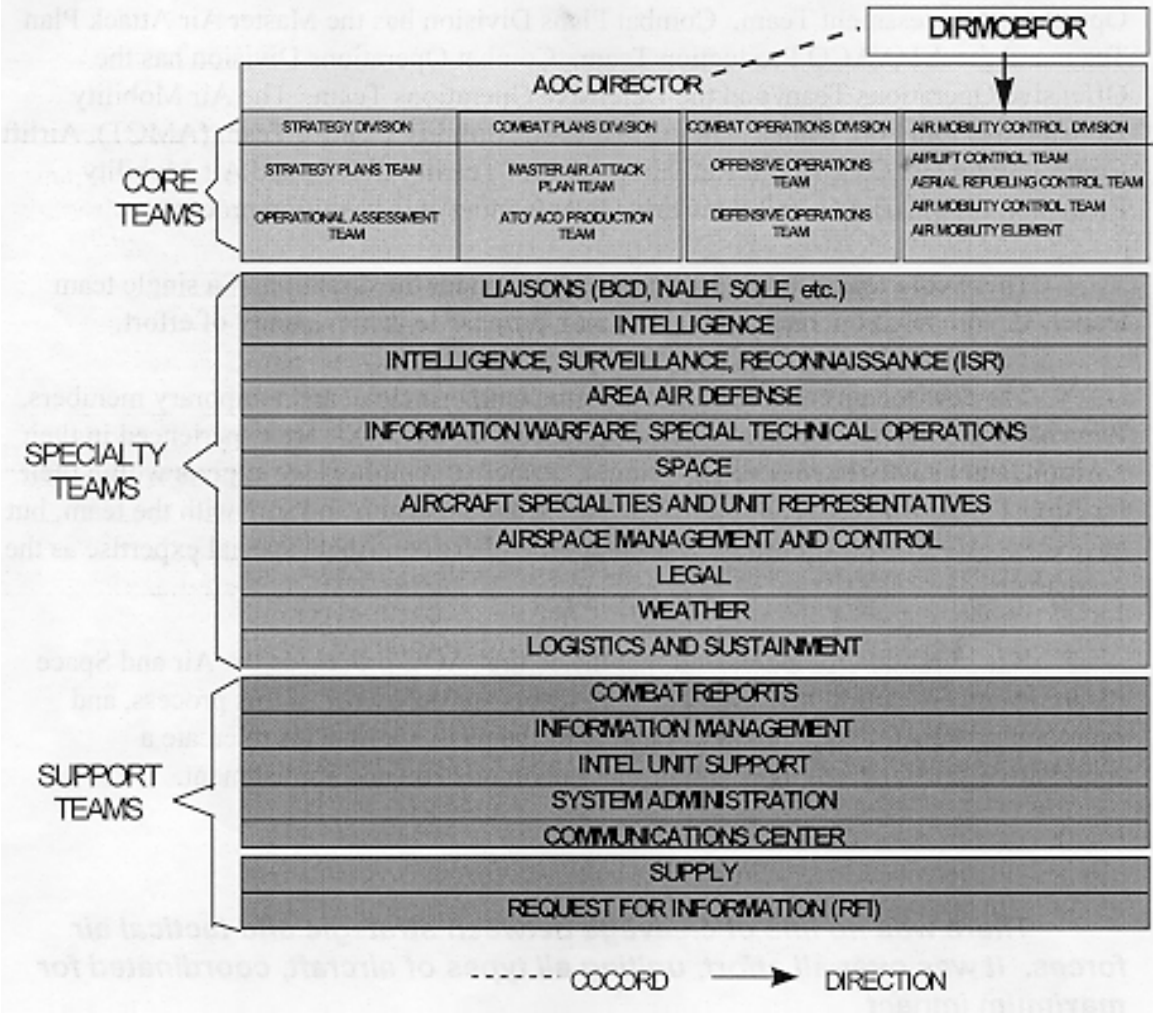
Figure 3. ATO Battle Rhythm

Heavily integrated into both Combat Operations and Combat Plans functions is the intelligence cell. Intelligence personnel, in conjunction with operational analysts, must conduct battle damage assessment (BDA) in order to determine the effects of recently flown missions. In turn, this enables the JFACC to assess progress toward achieving theater air objectives. This assessment will also shape subsequent ATO cycles, as the JFACC assesses the need to retarget certain objectives or indicates those that can be eliminated from the target list.

The JFC may also designate the JFACC as the Airspace Control Authority (ACA) and the Area Air Defense Commander (AADC). As the ACA, the JFACC is responsible for structuring a system to both deconflict and identify all air traffic within the Joint

Operations Area (JOA). If the JFC designates the JFACC as the AADC, the JFACC will integrate all forms of air defense (both air-to-air and surface-to-air) to protect all friendly forces operating in the JOA. This mission requires detailed coordination among the LNOs to insure unity of effort, avoid mutual interference, facilitate timely threat identification, and prevent fratricide.[9] If the JFACC is so designated, the AOC's structure will contain the staff necessary to develop, coordinate, and publish airspace control procedures, as well as to operate the airspace control system within the Area of Responsibility (AOR) or JOA.[10]

Current Air Force doctrine does not modify the AOC's structure or functions from that described in Joint Doctrine. However, the USAF Combat Air Forces' (CAF[11]) *"Little Red Book"* reorganizes the AOC structure into four divisions, comprised of core, specialty, and support teams.



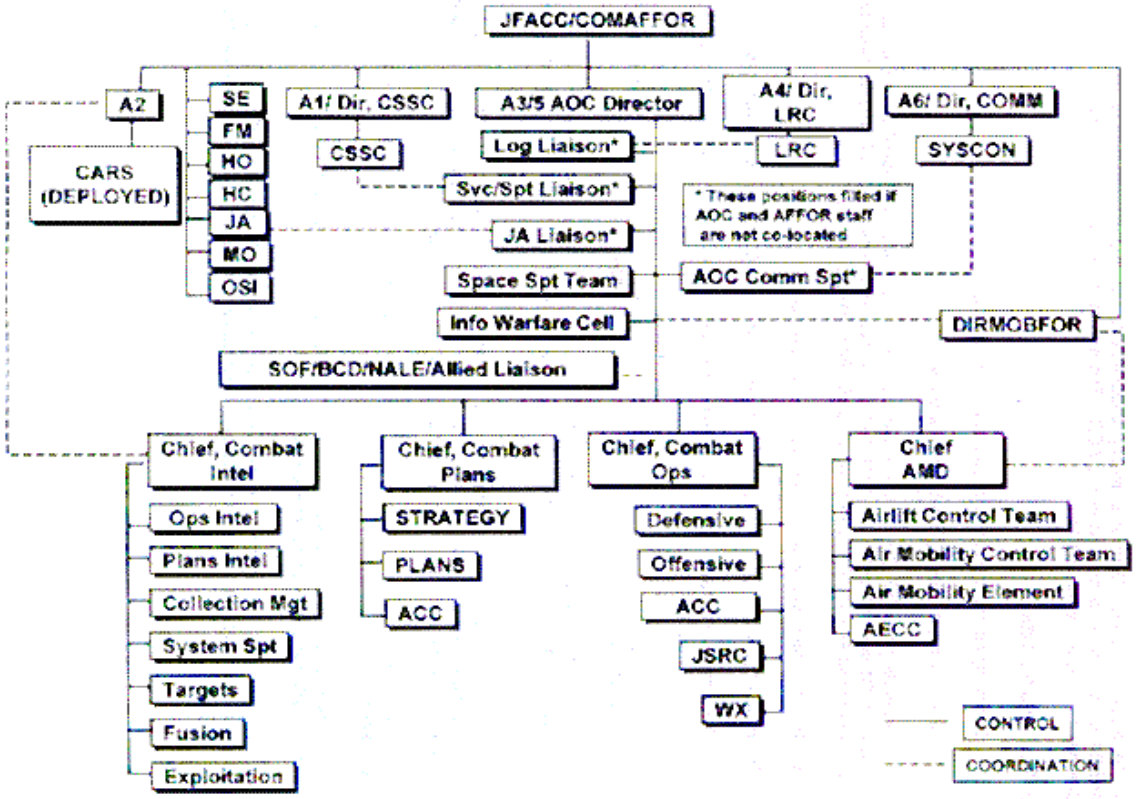
Source: "Little Red Book," p. 26.

Figure 4. Combat Air Forces AOC Organization

As shown in Figure 4, the four divisions, all operating under the supervision of the AOC director, consist of the Strategy Division, Combat Plans Division, Combat Operations Division, and Air Mobility Control Division. Each division contains two core teams, except for the Air Mobility Control Division, which has four. The divisions' functions are analogous to those previously specified in joint doctrine. The most significant difference between CAF and joint AOC structure is that the CAF Strategy Division has a separate operational assessment team to judge attack effects in relation to operational and strategic objectives. Additionally, airlift, air refueling, and air mobility

operations are grouped separately from the liaison elements. Other changes emphasize specific roles by creating specialized cells — such as separating offensive and defensive operations or identifying area air defense as its own team.[12]

The core teams are manned by permanent, principal, and temporary members. Permanent members — usually drawn from members permanently assigned to the NAFs — have no other AOC responsibilities and generally have specific training for their roles. Principal members are functional experts and remain with their particular "cell," but may have other AOC responsibilities, whereas temporary members are assigned to augment particular cells based on their previous experience and any special expertise.[13] Both principal and temporary members are usually members on temporary duty (TDY) from other organizations. In addition, it is likely that each cell will be augmented by personnel both from within the NAF and from outside agencies depending on the nature of the contingency and the level of support required.[14]



Source: 12AF Air Force Forces AOC SOPs, p. 8.

Figure 5. 12AF Air Force Forces AOC Organization

Because the JFACC tailors the AOC to suit his particular needs, each AOC has a unique structure,[15] although it will contain the functions recommended by Joint doctrine. Figure 5 above illustrates 12AF's AOC organization. 12AF's modification to the CAF model realigns the Guidance, Apportionment, and Targeting (GAT) function under the Strategy cell. They also place theater airlift control under Combat Operations, instead of under the Director Mobility Forces (DIRMOBFOR) and the Air Material Division (AMD). This realignment is done to insure that the JFACC's airpower strategy is continuous throughout the GAT process and so that the JFACC can exercise direct control over theater airlift.

On the other hand, according to 8AF's Chief of Strategy, Lt Col Gary Cox, 8AF is "for all practical purposes in alignment with *AFDD 2* and the '*LRB*'." They do not alter the AMD or DIRMOBFOR functions, but similar to 12AF, they move the GAT function under the purview of the Strategy Cell.[16]

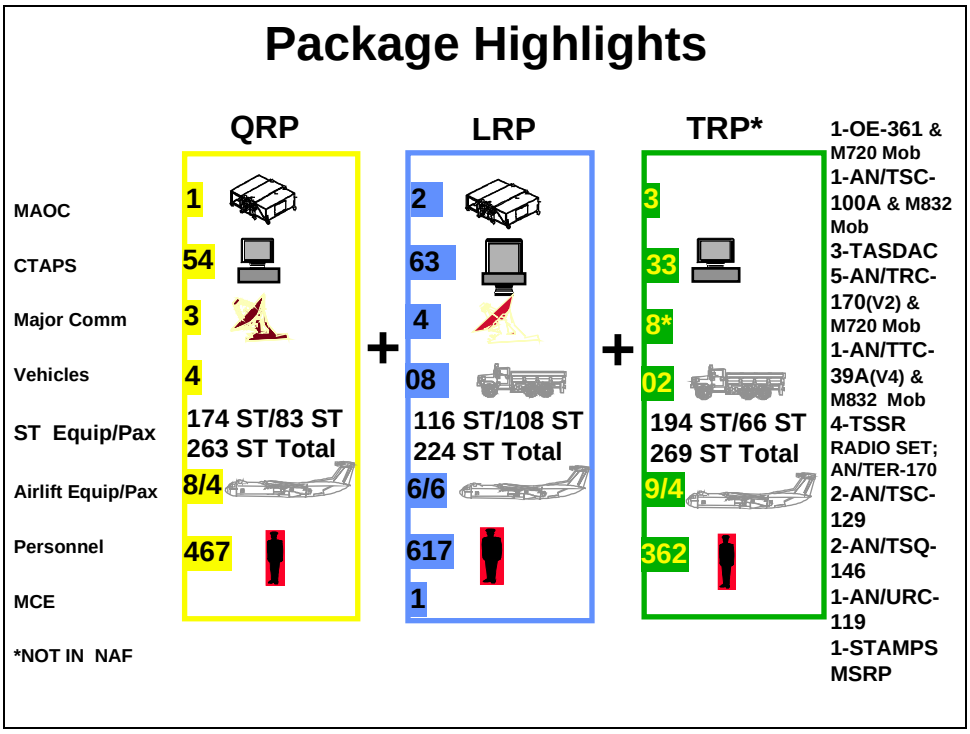
Meanwhile, 9AF uses only three divisions in its AOC structure: Combat Operations, Combat Plans, and the Airlift Control Cell. Consistent with 12AF and 8AF, however, the GAT function is supervised by Strategy team members, who are organizationally aligned under Combat Plans.[17]

AOC "Footprint"

When mobilized and deployed, the sum total of any AOC's personnel and equipment on the ground is known as its "footprint." The exact composition of an individual AOC is the JFACC's prerogative and will be tailored to each situation, based on the mission and type of forces the NAF presents to the JFC.[18] 12AF has three tailored AOC packages, with the AOC's size corresponding to the anticipated number of daily air missions that will be flown (see Figure 6). The first option — known as the Quick Response Package (QRP) — is tailored to support an estimated 300-500 missions per day, and consists of roughly 467 personnel[19] and 263 total short tons[20] (ST) of equipment. This would require approximately twelve C-141-equivalent sorties.[21]

The second tailored AOC option is the Limited Response Package (LRP), which is able to support some 1000-2000 missions per day. In addition to the personnel and equipment necessary for the QRP, the LRP would require approximately another 617 personnel, 224 ST of equipment and twelve more C-141-equivalent sorties, for a total of

twenty-four. If the AOC was required to support over 2000 sorties per day (such as flown during Operation DESERT STORM)[22] another 362 personnel, 269 ST of equipment and another thirteen C-141 equivalent sorties would be required. The footprint of a fully deployed AOC, able to support a Major Theater of War (MTW), would consist of over 1,500 personnel and 750 short tons of equipment. This massive array alone would require the equivalent of thirty-seven C-141 sorties to arrive in theater,[23] but might even expand further depending on the nature and expected duration of the conflict. As an example of the size to which an AOC can grow, by the end of the war the CENTAF staff deployed to support the JFACC during Operation DESERT STORM expanded to include over 2,000 personnel.[24] The AOC's "footprint" becomes significant not only in terms of potential threat exposure, but also (and perhaps more significantly[25]) in terms of the mobility requirements for transporting the AOC's personnel and equipment into the theater of operations. If the footprint is larger, A JFC will be required to prioritize equipment for shipment, which may mean choosing between C^2 equipment and ammunition or food.



Source: Lt Col Martin Kahao, "How We Fight," 12AF/DOXO briefing, 4 February 1998.

Figure 6. 12AF Mobilized AOC Package Options

8AF presently uses the same nomenclature and approximate structure for its tailored response packages as does 12AF. 9AF, on the other hand, adds a fourth package — an "Intermediate Response Package [IRP]" which falls roughly between the QRP and LRP in size and function.[26]

Need for Reduced Forward Presence

Given the amount of AOC equipment required to support a contingency operation — in the context of recent terrorist attacks on deployed U. S. forces — efforts have been underway to reduce the deployed size of the AOC and its staff. Reducing the forward C^2 footprint is not a new objective. Planners considered split operations as early as 1979 in response to the threat posed by the former Soviet Union's doctrine of attacking C^2

operations.[27] Numerous Air Force-sponsored studies suggested ways to reduce the TACS' forward footprint; however, it was the terrorist blast at Dhahran Air Base, Saudi Arabia in June 1996[28] that stimulated 12AF and Air Combat Command (ACC) planners to consider split AOC operations as one means of reducing vulnerability.[29]

Besides vulnerability to enemy or terrorist attack, there are a host of other incentives to reduce the AOC's forward footprint. These motives fall into three basic categories: political, economic, and military. In terms of political influences, there are both domestic and foreign considerations that shape the size of a deployed AOC. U. S. involvement in El Salvador illustrates how domestic political considerations can limit the amount of forward-deployed personnel. With the searing memory of an open-ended involvement in Vietnam still painfully fresh, Congress enacted a law in 1982 that limited the total number of U. S. military personnel permanently stationed in El Salvador to fifty-five. This law resulted in an Air Force contingent of only five people.[30] Although U. S. personnel acted only as advisors to the El Salvadoran Air Force, who performed their own C^2 operations,[31] a similar restriction on a future U. S. deployment would clearly preclude using the traditional Theater Air Control System (TACS).

Foreign political considerations can similarly restrict the size of the deployed U. S. force. Although a nation may desire U. S. military assistance, its culture may be such that a large U. S. presence can backfire and create internal difficulties for the host nation's leadership. This may either be due to a "culture clash"[32] or by appearing to de-legitimize the government the U. S. is ostensibly there to support.[33] In either case, these foreign political considerations may force military leaders to deploy forward only the minimum essential number of personnel.

For reasons of both efficiency and security, reducing forward presence also makes sense from a military perspective. As the previous section shows, deploying just one element of the TACS — the AOC — can consume a tremendous amount of airlift. Even with U. S. forces involved in only one MTW, airlift resources are at a premium.[34] Should two contingencies occur "nearly simultaneously," the strain on available airlift resources would likely prove unbearable. Moreover, without increasing the number of military personnel assigned to C^2 functions — which given post-Cold War downsizing, appears unlikely in the near term — a large number of personnel deployed forward reduces the flexibility to respond to additional contingencies. Presently, we have a large portion of our qualified AOC personnel continuously deployed to support ongoing operations in Bosnia, Iraq, and Korea who would be difficult to redeploy to other theaters, without compromising current operations.[35] Thomas Keaney and Eliot Cohen noted in their summary of the *Gulf War Airpower Survey — Revolution in Warfare?* — that even during DESERT STORM, "the Air Force depleted command and control units in the U. S. and Europe to the point where it exhausted effective tactical air command and control reserves."[36] A smaller forward footprint, combined with personnel savings generated either by improvements in AOC procedures or technology, might help alleviate future shortages.

A reduced footprint may also be militarily desirable to enhance operations security (OPSEC). Large deployments of equipment and personnel to a forward location can telegraph the fact that "something is up." A small contingent arriving in theater can be more readily camouflaged and its personnel more easily controlled, reducing the risk of information "leaks" or enemy observations of increased activity. A clear case of this was

Operation JUST CAUSE, where, largely for reasons of security, 12AF elected to create an AOC out of elements of its already forward deployed assets and personnel.[37] Thus, other than the JFACC, no additional personnel were deployed to the theater to man the AOC.[38]

Finally, force protection is enhanced by a reduced forward presence. As noted earlier, combat planners suggested numerous initiatives to downsize and disperse the forward presence of TACS elements out of concern for their vulnerability to attack in a high threat environment.[39] A Tactical Air Command (TAC) proposal to create a Modular TACS system offered advantages not only in improved transportability and reduced deployment times, but also a significant survivability enhancement on the expected battlefield of Central Europe.[40] As presciently noted in the 1985 publication *21st Century Tactical Command and Control Study* (TC^2-21),

> the expected 1995 TAF C^2 capability will still be characterized by manpower-intensive, partially automated systems with 'thin' communications connectivity subject to single-point failures… [t]actical commanders will continue to rely on centralized C^2 and sensor correlation 'nerve centers' which will be visible to the enemy (physically and electronically) and relatively easy to destroy or neutralize.[41]

Despite the demise of the Soviet Union, the terrorist attacks on our deployed forces in Riyadh (1995) and Dhahran (1996), Saudi Arabia, illustrate enduring military vulnerabilities. Thus, while a smaller deployed force improves efficiency by reducing lift requirements, it also reduces its physical vulnerability. A smaller "footprint" may also be easier for security forces to protect. Moreover, because a smaller C^2 facility requires fewer security personnel to protect it, correspondingly fewer total personnel have to be placed "in harms way." Hence, overall exposure may be reduced.[42]

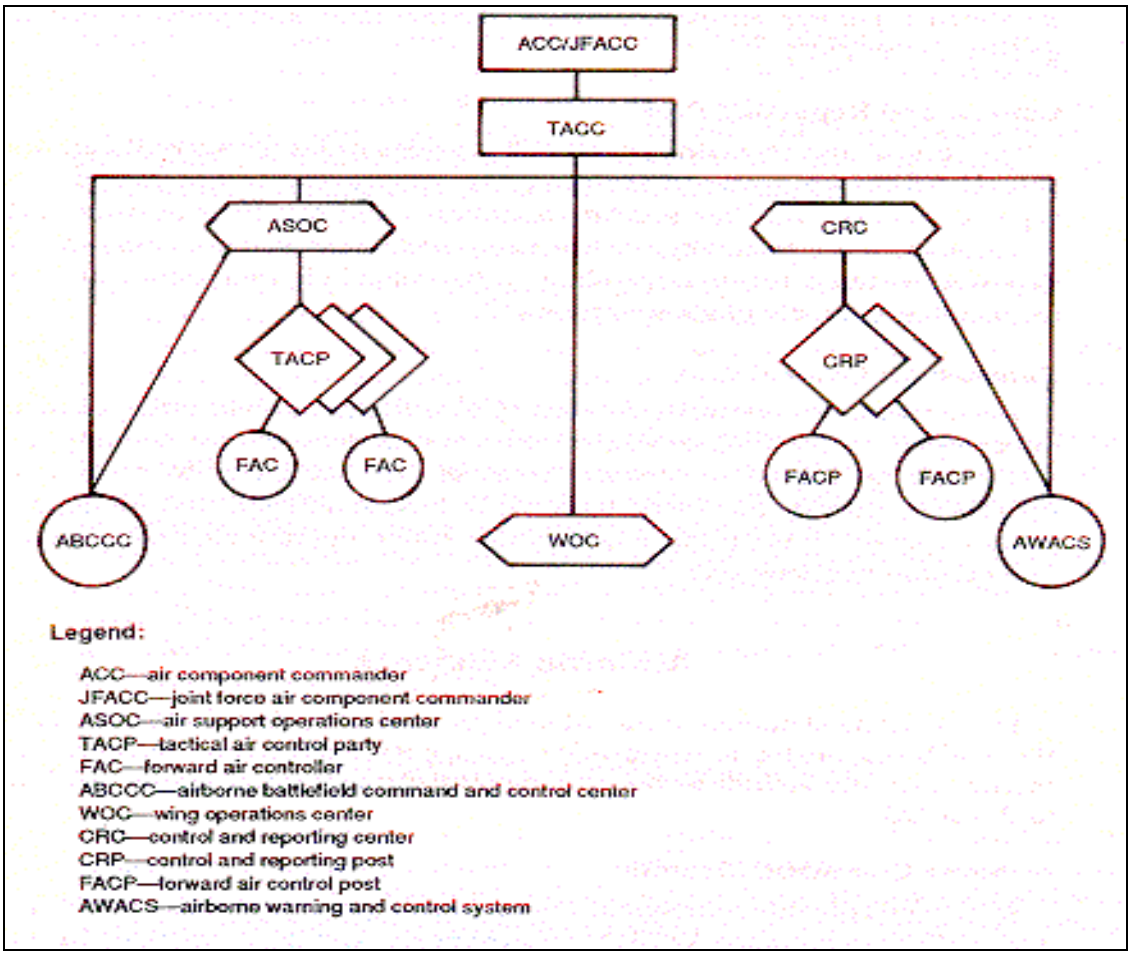
The Split AOC Paradigm

Several proposals offered suggestions for reducing this deployed footprint. In general, however, the recommendations all contain three common premises: elements of the AOC are geographically separated, electronically connected, and codependent on each other for task accomplishment. One of these proposals, initiated in the early 1980s, was the Modular Tactical Air Control Center (MTACC) concept. This was primarily designed for levels of tactical air control subordinate to the AOC, specifically the Forward Air Control Posts (FACP) and Control and Reporting Elements (CRE). These are the lowest levels of the TACS, primarily intended to offer a forward element — frequently among the forward line of (friendly) troops (FLOT) — that can provide battlefield radar surveillance and facilitate local air defense operations. Inputs from these forward elements are fused by Control and Reporting Centers (CRCs) — located between the FACPs/CREs and the AOC — and ultimately passed to the AOC.[43] Figure 7 displays the relationship of the various elements of the TACS.[44]

> The MTACC offers a smaller in-country presence, reduced airlift support, and a minimized vulnerability to a single enemy strike. However, it does not possess sufficient capability to control air operations for an entire theater. Nonetheless, the MTACC Concept of Operations (CONOPS) offered the intellectual precursor for the Split AOC operation.

According to a 1990 Tactical Air Command (TAC) study,

> guidance and the current [air] situation could be relayed from the deployed site to the home station TACC [Tactical Air Control Center][45] where detailed planning, operations, and intelligence would be worked. The ATO, detailed operations, and finished intelligence could then be passed back to the deployed TACC.[46]



Source: Robert J. Blunden, Jr., *Tailoring the Tactical Air Control System for Contingencies* (Maxwell AFB, AL: Air University Press, 1992), p. 9.

Figure 7. Theater Air Control System

Lt Col Robert Blunden, Jr. is an operational C^2 expert who, among his other operational experiences, participated in Operation JUST CAUSE. In his 1992 thesis, *Tailoring the Tactical Air Control System for Contingencies*, Blunden expanded upon the MTACC CONOPS and, based on his experience with deployed C^2 operations, proposed a split Tactical Air Control Center. According to Blunden,

> this concept allows the ACC [Air Component Commander]/JFACC to deploy a relatively small control organization that could provide guidance and the current situation to the home-station elements, where detailed planning, operations, and intelligence activities would be conducted. Air tasking order support and detailed operations and intelligence information

> could then be passed back to the deployed unit for the commander's decision.[47]

Colonel Scott Britten — an Air War College student who also has an operational C^2 background — expanded on Blunden's concept by elaborating on the technical potential and feasibility of splitting AOC operations between a stateside "garrison" and a forward location. Although Britten's paper focuses primarily on a software program used by AOC personnel to generate the ATO — the Computer Aided Force Management System (CAFMS) and its potential successors — he clearly described the Split AOC concept, along with a detailed discussion of several potential advantages and disadvantages inherent in split operations.[48]

Twelfth Air Force (12AF) includes both Blunden's and Britten's concepts within its Split AOC concept. Under the 12AF model, in order to collocate with the JFC — who will usually be forward with the deployed troops — the JFACC and a portion of the AOC staff will form what Blunden's study described as the "relatively small control organization that could provide guidance and the current situation to the home station."[49] 12AF calls this small control organization the "AOC-forward" (AOC-F) and its companion element which remains at the NAF headquarters, the "AOC-rear" (AOC-R).[50] The exact number and function of the personnel comprising the AOC-forward will be situationally dependent, based on the contingencies' particular political, economic, and military considerations. Blunden, in his chapter entitled "Principles for Tailoring," offers some guidelines for the JFACC to use in appropriately sizing his C^2 structure.[51] Briefly, these include understanding the objective of the operation, analyzing the scope of the contingency, determining command, control, and communications functions, analyzing

the operating environment, maintaining security, selecting the most capable resources for deployment and providing maximum support, then reviewing the assembled product for suitability, feasibility, acceptability, simplicity, and flexibility.[52]

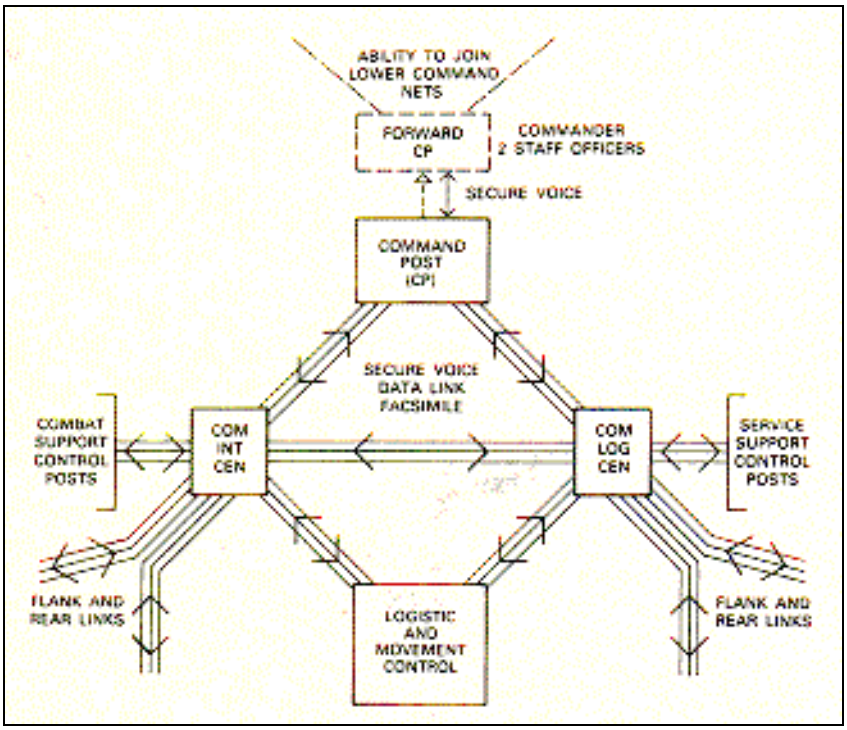
Current 12AF AOC Standing Operating Procedures (SOPs) are under revision to include the Split AOC concept; thus, no definitive guidance exists within 12AF as to exactly what will deploy forward or remain in the rear. However, a current draft of the Strategy Cell SOP states:

> Should the JFACC/COMAFFOR decide to co-locate part of the AOC with the JFC at another location, expect a large portion of the Strategy Plans Team to deploy forward. One or two members of the Strategy Plans Team will remain back with the AOC rear to ensure understanding and connectivity with the remainder of the Strategy Division. Tailor the manning requirements based on the crisis and the JFACC's vision.[53]

As indicated above, each situation will be unique. Future experimentation may eventually prescribe an optimal configuration for most split operations. Yet, despite the currently indeterminate nature of exactly what AOC functions will be located where, the apparent key to resolving the JFACC's dilemma between forward location and footprint concerns is to have a small staff that can effectively support the JFACC's exercise of command — collocated with the JFC and electronically linked to the remainder of the AOC elements at a rear location — where the detailed operational assessment and ATO production will occur.

Notably, proposals to split command and control operations are not limited solely to air forces. Current U. S. Army doctrine includes a discussion of "Split-Based Operations." Under this concept, "split-based operations provide versatile, deployable, and expandable unit configurations to support the deployed force. Technologies now

being developed enable the separation of forward and rearward functions."[54] Figure 8 illustrates an Army concept of split operations. *Field Manual 71-100* goes on to note that "split-based operations require robust long-haul, high volume communications. Without such support, they will rarely be feasible."[55]



Source: Richard E. Simpkin, *Race to the Swift* (London: Brassey's, 1985), p. 262.

Figure 8. U. S. Army Split Operational Command Post Schematic.

Regardless of their source of origin, all of the above proposals attempt to reduce forward presence by geographically separating, and electronically linking, codependent command and control elements. This is the starting point for evaluating historical experience with split operations. Moreover, the change in the international security environment from one of Cold War "Standoff at the Fulda Gap" to the "New World Order" starring the U. S. as the "sheriff" of a world-wide coalition "posse," combined with shrinking defense expenditures, reduced forward basing, and an increased emphasis

on force protection, has driven the U. S. to an "expeditionary" mindset. Concomitantly, when the JFC deploys forward, for the reasons previously listed, the JFACC wants to be there, along with his AOC. However, as detailed, there may be times when this is impractical. As a result, some form of split operations might solve the dilemma between a reduced forward footprint and the JFACCs ability to effectively control air operations.

As the next chapter will examine in detail, the NAFs are moving forward on ways to resolve this issue, beginning with a series of 12AF and U. S. Army III Corps GOLDEN SABER exercises that experimented with "distributed operations" between TACS elements under field conditions. Chapter Three also discusses a 12AF attempt to use a JFACC forward with the JAOC remaining in the rear during NATIONAL TRAINING CENTER CONTINGENCY OPERATIONS (NTC CONOPS) 93-05. The chapter also includes Eighth Air Forces' tests of various forms of the Split AOC during UNIFIED ENDEAVOR exercises and even a JFACC-afloat, with a geographically separated AFFOR AOC, during JOINT TASK FORCE EXERCISE (JTFEX) 97-1. Finally, Chapter Three concludes with a detailed examination of 12AF's recent BLUE FLAG 98-1 exercise, that featured a complex Split AOC model.

Notes

[1] Commander, Air Force Forces, see "*Little Red Book*," p.15.

[2] See *JP 3-56.*1, p. II-2 for JFACC designation procedures. Note that this paper will *not* discuss the relative merits of using or not using a JFACC for joint/combined operations, but will merely address the application of the Split AOC concept in a situation where either a JFACC is designated or USAF assets are the only ones present, requiring the COMAFFOR to perform OPCON/TACON functions in addition to ADCON. See "*Little Red Book*" p. 16 for a more complete description of this situation.

[3] *JP 3-56.1*, p. II-2.

[4] In the case of joint operations, the AOC would be designated as a JAOC, or CAOC for combined operations; however, for simplicity, the author will use the generic term "AOC" throughout this paper to include JAOC/CAOC functions, unless specifically indicated otherwise.

Notes

[5] Mark Lindsley, director of the AOC Baseline effort (described in Chapter Four), telephone interview, Hurlburt Field, FL: Air and Space Command and Control Agency (ASC2A)/Command and Control Technical Innovation Center (C2TIC), 13 January 1998.

[6] *JP 3-56.1*, p. II-7.

[7] Ibid.

[8] It is appropriate to note at this point that the services do not necessarily agree on the function or purpose of the ATO; however, a discussion of the ATO's appropriateness is beyond the scope of this paper. For a detailed description of the ATO development process and a notional "forty-eight hour battle rhythm" see United States Air Force Twelfth Air Force, *Twelfth Air Force (12AF) Air Force Forces (AFFOR) Air Operations Center (AOC) Standard Operating Procedures (SOPs)* (Davis-Monthan AFB, AZ: 12AF, 1997), p. 15-20.

[9] Ibid., p. II-5.

[10] Ibid., p. II-4.

[11] United States Air Forces in Europe (USAFE), Pacific Air Forces (PACAF), Air Combat Command (ACC), Air Force Space Command (SPACECOM), Air Education and Training Command (AETC) and Air Mobility Command (AMC).

[12] For a complete description of the function of each cell, see the "*Little Red Book*" p. 27-33.

[13] "*Little Red Book*," p. 27.

[14] Frequent NAF augmentees to the AOC are USAF/XOCD personnel, commonly known as "CHECKMATE," who lend expertise to the Strategy and Operational Assessment cells and serve as liaisons with national intelligence databases and the Joint Warfighting Analysis Center (JWAC). Also, depending on the size of the contingency, tasked wings may also provide augmentees for many sections of the AOC.

[15] Chapter Four details the "Future AOC Baseline," which is an attempt to standardize the configuration of each AOC. Results are expected in the 2000 timeframe; however, presently there is no consensus on exact AOC structure or function. Indeed, 12AF has a published AOC SOP — which served as the "industry standard," with 8AF having an approximately "70% solution" on paper, while 9AF references USCENTAF instruction 10-105 (8 February 1996) for their AOC structure and function. Jim Welshans, Lt Col, USAF, telephone interview, Barksdale AFB, LA: 8AF/A-3,5; Jim Hartney, Colonel, USAF, personal interview, Shaw AFB, SC: USCENTAF A-3, 20 March 1998, and Rocky Blackwell, Future AOC Baseline Project Manager, telephone interview, Hurlburt Field, FL: ASC2A/C2TIC, 23 February 1998.

[16] Gary Cox, 8 AF/CCG, personal interview, Barksdale AFB, LA, 18 March 1998.

[17] U. S. Central Command Air Forces (USCENTAF) Instruction 10-105 (Shaw AFB, SC: Headquarters, USCENTAF, 8 February 1996), p. 10.

[18] "*Little Red Book*," p. 24.

[19] For a complete listing of the personnel by Air Force Specialty Codes, see "12AF Initial Draft 7FVX1 UTC: Generic AOC Baseline," electronic copy provided by Lt Col Martin Kahao, Davis-Monthan AFB, AZ: 12AF/DOXO, 17 March 1998. Copy on file at SAAS, Maxwell AFB, AL.

Notes

[20] A short ton is "a unit of weight of 2,000 pounds." *Field Manual 55-15, Transportation Reference Data* (Washington, DC: Headquarters, Department of the Army, 1968), p. 5-94.

[21] These numbers are all approximate, as each package will be tailored for the individual situation. Moreover, C-141 equivalent sorties are a rough approximation based on the ability to handle approximately 16 equipment pallets and 20 ST per sortie. Source is briefing by Lt Col Martin Kahao, "How We Fight" (Davis-Monthan AFB, AZ: 12 AF/DOXP, 4 February 1998), slides 15-18.

[22] 2,759 sorties were flown on the first day (17 January 1991) of Operation DESERT STORM. See Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare?* (Annapolis, MD: Naval Institute Press, 1995), p. 11 and Table 20: "Total Sorties by U. S. Service/Allied Country by Mission Type," on p. 260.

[23] Kahao, "How We Fight," slide 15.

[24] Keaney and Cohen, *"Revolution in Warfare?"*, p. 126.

[25] Lt Col Gary Cox feels that the mobility requirements are the most significant implication of the size of an AOC's footprint. Personal interview, Barksdale AFB, LA: 8AF/CCG, 18 March 1998.

[26] Lt Col (Col. select) Robert Haseloff, personal interview, Shaw AFB, SC: 9AF/A3, 20 March 1998.

[27] See Wexlar, et. al., *Modular Operations Concept Study* (1981); Goodell, *Modular Control Equipment: CONOPS for the European TACS* (1987); Clark, et. al., *TC^2-21* (1985); TAC Concept of Operations, "Modular Tactical Air Control Center" (1990), among others.

[28] This high-profile terrorist bombing was the second attack in less than a year on U. S. forces deployed to Saudi Arabia. The truck bomb, estimated at 5,000 pounds, was so large that it defeated existing passive security measures at the Khobar Towers compound where a majority of U. S. and other foreign personnel lived. It killed nineteen U. S. military members and wounded hundreds more. The political impact of the bombing eventually caused U. S. forces to relocate to Al Karj AB, Saudi Arabia. Senior military leaders selected Al Karj AB for its remote location and better defensibility, as well as to minimize the impact of U. S. personnel on the Muslim culture of Saudi Arabian nationals. *Los Angeles Times*, "Saudi Arabia to let U. S. move 4,000 of its troops," in *The Seattle Times*, on-line edition, August 1, 1996, <http://www.seattletimes.com>.

[29] Colonel Maris McCrabb, telephone interview with author at Maxwell AFB, AL, 26 January 1998.

[30] James S. Corum, "The Air War in El Salvador," unpublished monograph (Maxwell AFB, AL: School of Advanced Airpower Studies, 1997), p. 7.

[31] During 1982-1985, the El Salvadoran Air Force (ESAF) flew only approximately 100 total sorties per month. Additionally, their air-to-ground C^2 structure consisted of army units desiring air support using a radio to call back to their command post, where soldiers placed the radio over a telephone handset, which was connected to the ESAF commander. In turn, the ESAF commander either made a radio call to Air Traffic Control tower personnel — who relayed the request for support to aircraft via radio, or placed a phone call to the aircrew quarters himself. In many cases, ESAF aircrew

members generated their own air support requests by making a visual observation of enemy activity from their observation aircraft, then returning to base and flying a second sortie in an attack aircraft (usually A-37s) against the targets they had detected earlier. No consolidated command center existed until 1986, when a "Joint Intelligence Operations Center" assumed some of the functions U. S. military personnel conduct from an AOC. James S. Corum, personal interview, Maxwell AFB, AL: SAAS, 17 April 1998.

[32] An example is the desire of Moslem heads of state to minimize the size of deployed Western forces in Saudi Arabia, Kuwait, and Bahrain. A good description of the friction created from the culture clash is described in Matt Labash, "The Scapegoat: How the Secretary of Defense Ended the Career of an Exemplary Air Force General," *The Weekly Standard,* November 24, 1997, p. 20-29.

[33] See Max G. Manwaring and John T. Fishel, "Insurgency and Counter-Insurgency: Toward a New Analytical Approach," SAAS Reprint from *Small Wars and Insurgencies* (London: Frank Cass, 1992), p. 285 and Andrew Krepinevich, *The Army in Vietnam*, (Baltimore, MD: Johns Hopkins Press, 1986).

[34] During DESERT STORM, the demand for airlift forced President Bush to authorize the activation of the Civil Reserve Air Fleet for the first time in history. *Gulf War Airpower Survey, Volume III, Logistics and Support*, (Washington, DC, 1993), p. 108.

[35] James Welshans, personal interview, 8AF/A3-5, Barksdale AFB, LA, 18 March 1998.

[36] Keaney and Cohen, *Revolution in Warfare?,* p. 181.

[37] *24th Composite Wing After-Action Report* (U), undated, Deputy Commander for Operations, p. 2. (Secret/No Foreign Nationals [NOFORN]) Information extracted is unclassified, cited in David Tillotson III, *Restructuring the Air Operations Center: A Defense of Orthodoxy* (Maxwell AFB, AL: Air University Press, 1993), p. 33-4.

[38] Ibid.

[39] One codification of this requirement is detailed in Science Applications International Corporation, *21st Century Tactical Command and Control Study (TC^2-21)*, 2 vols., (Washington, DC: Defense Advanced Research Projects Agency, 1985), especially p. i.

[40] Maurice P. Wexlar, et. al., *Modular Operations Center Concept Study* (Griffiss AFB, NY: Rome Air Development Center, 1981), p. 418.

[41] *TC^2-21*, p. II-2.

[42] Obviously, reducing forward presence by centralizing operations also creates a single-point vulnerability, a tradeoff that will be discussed in Chapter Five.

[43] Robert J. Blunden, Jr., *Tailoring the Tactical Air Control System for Contingencies* (Maxwell Air Force Base, AL: Air University Press, 1992), p. 9.

[44] Although its components and acronym remain the same, the system is now known as the "Theater" Air Control System (TACS). See *JFACC Primer*, p. 26.

[45] At the time, the AOC was known as the Tactical Air Control Center (TACC), thus all references to what is known today as the AOC, are listed as the TACC. I will use AOC interchangeably with TACC, as the structure and functions are identical.

Notes

[46] Tactical Air Command (TAC)/DOY, "TAC Concept of Operations, Modular Tactical Air Control Center," (Langley AFB, VA: Headquarters TAC/DOY, 1990), p. 5.

[47] Blunden, p. 51-2.

[48] See Scott M. Britten, "Reachback Operations for Improved Air Campaign Planning and Control (Draft)." Unpublished Air War College Thesis. Maxwell AFB, AL: Air War College, 1997, especially Chapters 2-4.

[49] Blunden, p. 51.

[50] Randy Bright, "Strategy Division Annex to *12AF Air Force Forces AOC SOPs* (Draft)" (Davis-Monthan AFB, AZ: 612 CPS/DOXP, 13 January 1998), p. 6.

[51] See Ibid., Chapter 3, pp. 33-45.

[52] Blunden, p. 34.

[53] Bright, "Strategy Division Annex (Draft)," p. 6.

[54] *U. S. Army Field Manual 71-100, Division Operations* (Washington, DC: Headquarters, Department of the Army, 1996), p. 3-14, 15.

[55] Ibid., p. 15. Note that both this document and *FM 100-15, Corps Operations* (Washington, DC: Headquarters, Department of the Army, 1998), especially chapters three and four and appendixes C and D, include detailed doctrine on the role and function of both forward and rear elements. Although similar in many respects to the Split AOC, this study will strictly focus on Air Force experience with the Split AOC, due to the Army command post's significantly different size and function.

Chapter 3

Split AOC Operations in Practice

The first reaction many warfighters expressed when introduced to the reachback operations concept was "you'd better have good comm links!"

—Colonel Scott Britten
Reachback Operations for Improved
Air Campaign Planning and Control

Upon arrival at the new site, our aging TSQ-93 equipment displayed "queertron" effects. Voltage readings were erratic and inconsistent. Plugging in the coffee pot allowed everything else to work — but everything adamantly died after the perk cycle was complete.

—712th Air Support Operations Center
GOLDEN SABER IX After Action Report

Everyone knew there would be serious problems and there were. So, why were we surprised? The "head and brain" of the JAOC were separated from the "body" at Barksdale — which flailed for two days. This was expected but other implications were not.

—General Stephen B. Croker
Former 8AF Commander on UNIFIED ENDEAVOR 95

Info distribution is paramount in execution. We saved the enemy the trouble of disrupting our communications…. we did it to ourselves.

—USSOUTHAF/A-1
BLUE FLAG 98-1

GOLDEN SABER

This exercise series begins the chronological synopsis of USAF Split AOC experience. The following exercises include examples of various types of split and distributed operations attempted by Combat Air Force (CAF) units since 1979. Twelfth Air Force (12AF) and the U. S. Army III Corps conducted the GOLDEN SABER

exercises from 1979 to 1988[1] and primarily focused on deployable Theater Air Control System (TACS) elements subordinate to the AOC itself — Air Support Operations Centers (ASOCs) and Forward Air Control Parties (FACPs) — supporting army maneuvers. However, the GOLDEN SABER experience is a forerunner of the distributed operations concept and likewise foretells many of the difficulties encountered with subsequent Split AOC operations. This experience is especially pertinent to the realm of the Split AOC's "center of gravity" — communications.

Description. The GOLDEN SABER series of exercises were multi-echelon, free-play, corps-level command post exercises designed to simulate the European Theater of Operations in a general war scenario against USSR-led, Warsaw Pact forces and familiarize participants with North Atlantic Treaty Organization (NATO) command and control procedures.[2] Additionally, a major objective of several of the exercises was to practice integrating an Army division already committed to battle with its associated TACS elements.[3] These ground-oriented exercises, conducted by U. S. III Corps at Fort Hood, Texas, included both joint and NATO combined forces.[4] Although GOLDEN SABER did not specifically exercise the Split AOC model, the distributed operations among subordinate elements of the TACS — the Tactical Air Control Center (TACC) — now known as the AOC — ASOC, Control and Reporting Elements (CREs), and Forward Air Control Parties (FACPs) — did rely on communications links for effective operation. The difficulties that these TACS elements encountered provides counsel to future planners of split operations.

Observations. Most of the GOLDEN SABER after-action findings have a negative slant. In other words, if a process worked, there is often little mention of it in the after-

action assessment. Therefore, the GOLDEN SABER after-action reports tend to document only problems. Many factors that may have worked successfully are not mentioned at all. This study will conservatively assume that if a process was not mentioned, it functioned sufficiently well for participants to consider it effective. However, this study will focus on those items that were repeatedly mentioned as problems — most notably communications.

After-action reports mention communication difficulties on at least six out of the ten selected GOLDEN SABER exercises. Historical accounts of the 602D TAIRCW's participation in the first GOLDEN SABER attributes some of its communications problems to poor weather.

> The unpleasant weather provided a realistic test of the units *[sic]* ability to operate a DASC [deployed air support center] under unfavorable conditions. The excessive rain, cold win[d], and mud were hard on personnel and equipment.[5]

A GOLDEN SABER III after action report is more damning:

> the information flow of more specificly *[sic]*, the lack of it severly *[sic]* degraded the combat effectiveness of this TACP. It is imperative that the senior TACS element in the corps develop a method of passing on required information in a timely manner to incoming FACP's *[sic]*.[6]

In this case, it appears that a majority of the communications problems were procedural, vice mechanical, in that required communications codes and authenticators were not passed from the ASOC to the incoming TACPs during the course of the simulated battle. As a result, the TACPs were unable to accomplish their missions.[7]

Units involved in GOLDEN SABER V also experienced procedural communications problems similar to those encountered during GOLDEN SABER III. Furthermore, this exercise encountered a limitation in the number of available frequencies for its close air

support (CAS) aircraft. This restriction, in turn, left them vulnerable to simulated enemy jamming that affected the aircrew's ability to perform the CAS mission.[8]

602D TAIRCW Units participating in GOLDEN SABER VI solved many of the communications problems that harried the earlier exercises, but unfortunately, they encountered a new problem. According to the unit history, "the problems involving communications cables, HF [high frequency] frequencies, and TRC-97 [radar] sites that had plagued previous exercises, had been successfully resolved…."[9] However, an unexpectedly heavy volume of land-line telephone traffic severely degraded the TACC's switchboard line access, sparking a future requirement for a dedicated hotline between the ASOC and TACC.[10]

Telephone problems were magnified during GOLDEN SABER IX, but were only one of many communications difficulties that moved an after-action writer to describe them as "the worst observed since GOLDEN SABER III."[11] During this exercise, the US Army's telephone communications system failed completely:

> The AN/TTC-39 [Army field telephone system] was overloaded almost immediately after being put into service, and speculation was that either too many telephone lines had been run through each of the switches, or that there was a computer software problem. As a result of the TTC-39 problems, the only means for contacting personnel in the field was through the 602 TAIRCW's microwave system.[12]

Fortuitously, this exercise was the first in which the 602D TAIRCW deployed a backup microwave communications system. This GOLDEN SABER IX operational test validated backing up land-line communications systems with microwave radios and established a future requirement for this system. Current Split AOC concepts do, in fact, rely heavily on satellite communications to augment land-line networks.

GOLDEN SABER IX participants also experienced numerous other communications difficulties. ASOC personnel found that after the telephone failure, the resulting saturation of voice radio frequencies proved unsuitable for "discussing problems and resolving situations, or pursuing lengthy allocation information."[13] Moreover, the ASOC lost HF radio contact with the TACC due to antenna problems,[14] and following its field "leap" (airborne insertion) ASOC personnel encountered the numerous electrical problems they later described as "queertrons."[15] Additionally, the TACC experienced communications cable problems. The cable provided by the Army proved incompatible and unreliable. This forced the Air Force to install "1500 feet of their own 26-pair cable to enable 12 channels to be used. Unfortunately, some (three) of these channels were bad. This hampered the effectiveness of communications."[16] The 712th ASOC after action report went on to note that "US Army cabling is never as reliable as our own. During those exercises in which we do exercise AF communications circuits, AF units must plan to bring and use their own cables."[17]

Equipment incompatibility between services is an issue that will need a considerable amount of attention in the future, as a reduced force structure necessitates increased joint operation. Therefore, these incompatibilities must be resolved in order to ensure the success of future split operations, which will inevitably depend on Joint (and likely Coalition) equipment to function.

The litany of communications problems at GOLDEN SABER IX extended to the lack of trained maintenance personnel. As a result, the 712th ASOC's after-action report stated that

> ASOC tech control required 2-8 hours to solve problems and restore circuits. I[f] TACC *[sic]* had a tech control many of the problems encountered on the circuits could have been corrected in much less time. ASOC tech controllers were unable to correct problems in timely fashion *[sic]* and circuit outages were excessive.[18]

GOLDEN SABER X demonstrated the ability of deployed TACC personnel to solve some of GOLDEN SABER IX's cable problems with fiber optics. By deploying well-trained maintenance technicians, exercise planners precluded a repeat of the previous exercises' maintenance difficulties. However, like it predecessors, GOLDEN SABER X experienced its share of unanticipated communications problems. The 602D TAIRCW history notes,

> Throughout the entire exercise, the direct lines from the AOC to the simulation center were inoperative, while the teletype lines between the two locations worked for only one day. The ASOC totally depended upon the Army's communications for uplinks to the ATOCs…. Finally, the malfunctioning or saturation of the dial line (phone) communications network to the ASIC [Air Support Intelligence Center], severely affected air reconnaissance operations.[19]

Assessment. Although its remote sites were only separated by a few kilometers[20] and deployed within the confines of a stateside U. S. Army military reservation, GOLDEN SABER exercises experienced the full spectrum of communications problems. One might speculate that these difficulties would increase by an order of magnitude as widely separated TACS elements are deployed to austere, foreign operating locations. The troubles ran the gamut from procedural problems induced by the "fog of war," through a plethora of hardware problems in phone cables, "queertrons" in electrical lines, and displaced radio antennas, to planning problems that resulted in a failure to deploy adequate maintenance technicians able to correct this "Pandora's Box" of severed communications links. In many of the GOLDEN SABER exercises, these

communications failures were significant enough to inhibit the effectiveness of the simulated combat operations for periods of varying duration. However, with time, participants were eventually able to correct or "work around" these problems through alternate means of communication.

The experience gained through GOLDEN SABER indicates that in split operations — or any activity that is communications-dependent — communications links are a "center of gravity" which an astute enemy may attack. Moreover, even in the absence of enemy action, "Murphy's Law" may strike the unprepared operation and render it helplessly uncommunicative. Based on the observations contained in the above after-action reports, planners of future geographically-separated, communications-dependent, operations must anticipate communications difficulties. Redundant communications links can minimize the impact of a single failure. This was illustrated during GOLDEN SABER IX and X, when failures in the Army phone system were circumvented by Air Force microwave communications. Similarly, Air Force phone line failures were obviated by Army satellite uplinks. Adequate stocks of known "high failure items" — such as communications cables — should be available, as should competent maintenance technicians.

Finally, given what appears to be — based on the GOLDEN SABER experience — the almost inevitable nature of communications failures, to the maximum extent practical, components or processes that will be "show stoppers" if communications links fail, should have their functions at least minimally duplicated at all operating sites. In this manner, if communications are severed, operations can continue while repair efforts are underway. For example, if AOC processes can not continue without Strategy Cell

personnel, then — in a Split AOC operation — Strategy Cell members should be represented at both forward and rear locations. Although AOC operations would certainly be degraded if communications were completely severed between forward and rear, if this and the function of other critical cells is duplicated, some planning and execution could occur until communications links are restored.

Modular Tactical Air Control Center (MTACC) Evaluation of Computer Assisted Force Management System (CAFMS)

This evaluation was an early test of the "reachback" and distributed operations concepts that are central to both the Split AOC paradigm and future distributed technologies. These future distributed operations models include, among others, the Distributed Air Operations Center (DAOC) and the "JFACC After Next."

Description. During the timeframe of the initial GOLDEN SABER exercises, the 602D Tactical Air Command and Control Squadron (TACCS) conducted at least two tests of "reachback" and distributed operations. These were done in support of the Modular Tactical Air Control Center (MTACC) evaluation, which attempted to reduce the footprint of TACS elements in order to survive the expected Central European battlefield.[21] The first of these was conducted 4-18 January 1982 at Langley AFB, Virginia. Its objective was to assess the requirements for training and operational procedures to deploy and employ the remote Computer Assisted Force Management (CAFMS) Terminals, which are used by AOC personnel to produce the Air Tasking Order (ATO) at Wing Operations Centers (WOCs).[22] For this test, remote computer and encryption equipment was sent to Seymour-Johnson, Myrtle Beach and Homestead AFBs and linked to the main computer at Langley AFB, Virginia.[23] The second test of this

concept was performed during GALLANT EAGLE 82, where four CAFMS remote terminals were deployed to Nellis AFB, Nevada and linked to the main terminal at Bergstrom AFB, Texas.[24]

Observations. The second remote CAFMS test experienced hardware problems that impaired its effectiveness. Although the initial test of the system from Langley AFB, Virginia to the three field locations was apparently without significant incident, the operational exercise of this system during GALLANT EAGLE 82 experienced phone line problems similar to those of GOLDEN SABER IX. Apparently, "the lines procured from Bell Telephone to link the CAFMS main computer at Bergstrom AFB to the four remote terminals at Nellis were not conditioned, causing intermittant *[sic]* operation of CAFMS prior to the start of [GALLANT EAGLE]."[25] However, assistance from Bell Telephone enabled line quality to be "improved sufficiently to use three of the four lines for three remote terminals, but the lines were not adequate for crypto [secure] operations."[26] Hardware problems not only interrupted communications to one of the four remote sites, it also precluded secure operation of the entire system, an unacceptable state in actual combat.

Assessment. Like the GOLDEN SABER examples, this evaluation illustrates the potential for hardware failures in land-line communications connections. Furthermore, even with technical assistance from qualified contract specialists, the system was only capable of operations in a degraded mode. This is significant because many future distributed operations concepts depend on commercial land-line communications, maintained by civilian contractors. This experience also suggests that for future operations, a more robust communications suite — including the option of connecting the

system over secure satellite communications links — might obviate the land-line problem.

National Training Center Contingency Operations (NTC Conops) *93-05*

This exercise is notable in that it illustrates a Split AOC configuration where the JFACC is not collocated with the AOC. Additionally, in this case, the JFACC only had a small liaison team forward. This exercise additionally showed how severely communications limitations can affect split operations.

Description. NATIONAL TRAINING CENTER CONTINGENCY OPERATIONS 93-05 (NTC CONOPS 93-05) was a U. S. Army Exercise intended to train III Corps staff in contingency Joint Task Force (JTF) planning and execution. The operation was conducted 1-9 February 1993 at the National Training Center (NTC), Fort Irwin, California.[27] During this exercise, 12AF provided a U. S. Air Force JFACC, General Pat Gamble,[28] who was collocated with the JTF commander at NTC. Although approximately fifteen liaison officers from 12AF supported the JFACC at NTC, the rest of his staff remained in the JAOC at Davis-Monthan AFB, Arizona. This marked the first time in 12AF history that a JFACC had not been collocated with the Joint AOC (JAOC).[29]

Observations. Although the III Corps commander, Lieutenant General Pete Taylor, judged NTC CONOPS 93-05 to be an overall success,[30] the JFACC and the JAOC experienced significant communications bottlenecks. This caused the JFACC to remark that he felt more like a "glorified liaison officer [LNO] than a JFACC."[31] One exercise participant, Lt Col Robert O'Brien, stated that the communications bottlenecks were due

to the fact that the JFACC deployed without a full communications suite which would normally accompany a deployed JAOC. In this case, the communications system consisted of only eight STU-IIIs [secure telephones] and a couple of fax machines.[32] Because of the inadequate communications, neither forward nor rear component could tell what the other was doing. As a result, for most of the exercise, JAOC personnel resorted to shuttling LNOs back and forth in order to exchange information between the separated AOC elements.[33]

Assessment. Another exercise participant, Lt Colonel Craig Dreier, reached a guarded conclusion about the split operation. He observed that "it will work, but it's not as good as it could be. It works better if you can collocate."[34] It also appears that the JFACC's self-assessment as a "glorified LNO" was because of his inability to communicate effectively with the JAOC. As a result, the JTF commander knew more about the air operation than did the JFACC.[35] Moreover, Major General Thomas Keck, 12AF Vice Commander, stated that he felt that the forward staff was too small to be effective and was in turn overshadowed by the Army presence. Due to their comparatively small forward presence, General Keck believed that Air Force inputs did not receive the appropriate level of attention from the JFC.[36]

Based on the above difficulties, General Keck and others assessed the AOC configuration at NTC CONOPS as ineffective.[37] Additionally, they asserted that a primary reason for its unsuitability was the small number of personnel located forward.[38] However, due to the communications limitations that hamstrung the JFACC and his LNOs at NTC CONOPS 93-05, it is difficult to assess exactly why the forward element was ineffective. While the relative size of a deployed AOC's staff may relate to the

ability of the JFACC to influence the JTF commander, this exercise provides insufficient evidence to evaluate that proposition. The most significant lesson that one can draw is that in order to be effective, deployed AOC personnel, regardless of their number, should have a robust communications suite. This should include Video-Teleconferencing Circuits, (VTC) as well as multiple radio, telephone, and computer communications links.

Unified Endeavor 95

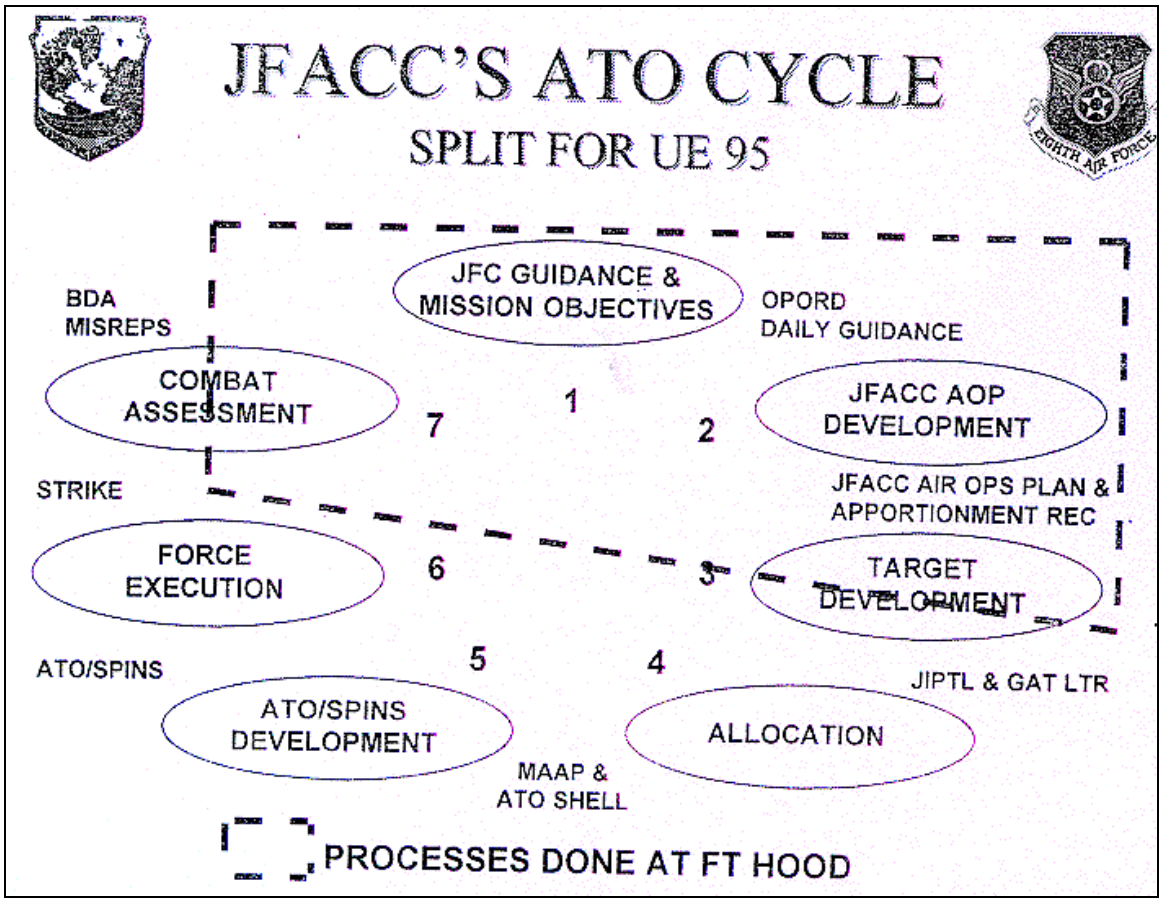
Despite later claims that BLUE FLAG 98-1 was the first split-AOC exercise, UNIFIED ENDEAVOR (UE) 95 appears to have actually been the first documented, truly functionally-split AOC exercise. In UE 95, Eighth Air Force (8AF) elected to position the JFACC forward, collocated with the JFC. Additionally, 8AF positioned the strategy, intelligence, and combat assessment functions forward. Meanwhile, the preponderance of personnel for both Combat Plans and Combat Operations remained in the rear.[39]

Description. UE 95 was the second in a series of United States Atlantic Command's (USACOM's) JTF training exercises. UE 95 featured joint operations in a general war scenario with an emphasis on Theater Ballistic Missile Defense, integrating USAF and Marine air assets with Navy forces and U. S. Army III Corps forces located at Fort Hood, Texas. JAOC C^2 functions were split between the JFACC and a JAOC-forward (JAOC-F), collocated with the JFC commander at Fort Hood, Texas and the JAOC-rear (JAOC-R) at Barksdale AFB, Louisiana.[40] An Air Force captain served as the deputy JFACC in the JAOC-R.[41] The JAOC-F produced the Operations Orders (OPORD), issued JFACC guidance, developed the JFACC Air Operations Plan and apportionment recommendation, completed the assessment of battle damage (BDA), and formulated

mission reports (MISREP) in addition to performing other miscellaneous Combat Assessment functions. Target development was split between forward and rear. A majority of the targeteers were forward in the Guidance, Apportionment, and Targeting (GAT) cell — who produced the Joint, Integrated, Prioritized, Target Listing (JIPTL) and GAT letters. Allocation, development of the Master Air Attack Plan (MAAP), production of the ATO and Special Instructions (SPINS) occurred in the JAOC-R, as did the monitoring of execution through Combat Operations.[42]

Observations. Participants at UE 95 experienced difficulties with information flow between the split AOC elements, problems accessing intelligence data, hardware failures, and manning problems. Additionally, problems associated with a twenty-four hour battle rhythm, the lack of a truly joint planning process, and minimal interaction between personnel at forward and rear locations all appeared to be exacerbated by split operations.

Specifically, participants encountered serious problems with the intelligence information flow induced by both the split operations and the failure to collocate the Joint Information Center (JIC) with the JFC's Joint Operations Center (JOC). As a result, "the JFACC became an intell *[sic]* source when he compiled better intell *[sic]* than his intell *[sic]* staff.



Source: Lt Gen Stephen B. Croker, "UNIFIED ENDEAVOR 95 JFACC Lessons Learned," (U) Briefing slides in Harold P. Myers, *History of the Eighth Air Force 1 January to 31 December 1995* (U) [*8AF History, 1995*] Barksdale AFB, LA: 8AF/HO 13 February 1997 [SECRET], Supporting Document 176, slide 8. Information extracted is unclassified.

Figure 9. UE 95 Split ATO Cycle Processes

Lack of full access to IDBS (Intelligence Data Base System) was a real constraint. They could not access/manipulate any data because that would corrupt the data base (only the host terminal could manipulate the data base) and the host was at N. Fort Hood, Barksdale was a remote."[43]

Furthermore, General Croker noted that "all involved in the air war agreed that the JAOC [JAOC-R] and to a lesser extent the JFACC forward [JFACC and JAOC-F], were 'in the dark' for the first three days of the war."[44] This was largely a result of intelligence

personnel's inability to provide relevant information to the JFACC and the JAOC.[45] General Croker attributed this failure to hardware malfunctions (that took three days to resolve), an apparent lack of operator training on intelligence systems, operator inability to manipulate data bases from remote locations, and poor interface with the JIC/J2 (intelligence) personnel.

This poor working relationship between JAOC intelligence personnel and JIC/J2 personnel further detracted from the ability of the small forward intelligence cell to accomplish their mission. JAOC-F intelligence cell members spent the majority of their energy attempting to obtain information, instead of being able to analyze it and assist other members of the JFACC's staff. Additionally, JAOC-R targeteering/weaponeering was significantly degraded due to the fact that most of the qualified targeteers were located in the JAOC-F, but a majority of the actual weaponeering ended up being done by two overworked personnel in the JAOC-R.[46]

In addition to the host of internal training and exercise problems, General Stephen Croker also made three other observations relevant to future split AOC operations. The first was that the transfer of essential information between split elements was compounded by around-the-clock operations employing different shifts. In one case, the JGAT document was produced at the forward location, during the day. The only product received by ATO planners at night, in the rear, was the JIPTL/Joint Targeting Letter (JTL), which lacked targeting guidance, priorities, and apportionment recommendations. As a result, General Croker observed:

> Due to work hours the JGAT [Joint GAT product] was not available during the night when the ATO was produced. Without a coherent strategy "document" — MAAP or Daily Apportionment Plan, the planners

> simply plotted the targets and fragged aircraft. Planners did not question if this was the best joint use of air assets. The planners thought it wasn't their role since the GAT had all the strategists. However, though the JGAT had "all the strategists" they failed to provide a coherent air strategy for the planners to follow. Bottom line: the planners had no Commander's Intent with enough detail to assist their efforts.[47]

The General's second observation was the lack of a truly "joint" approach to planning (which occurred in spite of a U. S. Navy officer serving as Chief of ATO Plans at night). UE 95 missions were composed almost entirely of aircraft from a single service. Although JAOC personnel perceived that they had insufficient air assets to complete their taskings, an entire Carrier Air Wing and Marine Air to Ground Task Force (MAGTF) were not used to the full extent of their capabilities.[48] In part, this — and some of the intelligence integration problems — were attributable to the physical layout of the JAOC-R. The JAOC-R operations floor itself was organized by aircraft type and there was a physical separation between intelligence and operations personnel. According to General Croker, "this led to little joint integration and coordination with Navy and Marine LNOs which were physically segregated from USAF LNOs."[49] General Croker also noted that reorganizing the layout by mission (such as Air Interdiction, Defensive Counter Air, etc.) might help alleviate this problem.[50]

The third observation of relevance to future split operations was that of limited interaction between forward and rear participants. As the UE 95 lessons-learned briefing notes:

> Lack of staff situation updates and "strategy sessions" definitely hurt JAOC cohesion. Such meetings were planned to follow VTC with Gen Croker. That VTC turned into an hour and a half session (twice a day) leaving no time for the JAOC staff to meet. Additionally, the VTCs were largely a one way transfer of info and Gen Croker's guidance was only received at the 0-6 level of the JAOC. The 0-6s thought everyone else was

> watching the VTC in an outer room but since the staff was not tasked to watch/listen they went back to work after they did their part of the brief. A VTC remote in current ops and plans could have solved this problem, but *since a split JFACC is unlikely in the future it won't be an ongoing problem.*[51]

This communications bottleneck was due to the fact that only one VTC was available for a one and a half hour time period, twice a day. All other communications between forward and rear had to be accomplished either over secure phone or via a classified facsimile (fax) machine.

Due to the significant problems encountered at UE 95, General Stephen B. Croker, 8AF Commander, decided that his AOC operation would not be divided again in the future.[52] Additionally, in his overall after-action assessment, he prefaced all assessments with the statement that "split JFACC operations, initial operational intelligence problems, and (arguably) unrealistic OPFOR [adversary operations forces] red air tactics, deployment, and operational, [maintenance] generation, and munitions capabilities taint any observations or critiques."[53]

Assessment. Participants at UE 95 ran headlong into the "seams" created by geographically separating an organization whose parts are codependent for task accomplishment. These problems included both technical difficulties and organizational troubles. The technical problem of information transfer was compounded by an inadequate communications architecture. As a result, a significant amount of personal interaction was lost in the limited communications available to forward and rear participants, while needed information was frequently not transferred between the separated locations. Due to the JAOC-R floor layout which aggravated existing

organizational "stovepipes," information was frequently not even shared among collocated elements.

UE 95 participants also discovered the organizational problem (that BLUE FLAG 98-1 personnel would later encounter) of determining which elements and personnel to put forward or rear. This exercise showed that removing strategy and combat assessment functions completely from the rear was inefficient at best, and completely unsatisfactory at worst. According to General Croker, the poor articulation of air strategy caused the application of air power to degenerate into an "on-call everything."[54] In turn, the deficiency in articulation impaired the ability of planners to coordinate, task, and fly exercise forces in a coherent air campaign strategy.[55] This less than optimal employment of airpower is largely attributable to seams created by the Split AOC operation. It also illustrates the potential for disaster if these problems are not resolved in future exercises.

Moreover, although testing the durability of communications links between operating locations was not an exercise objective, UE 95 did expose the vulnerability of communications links between forward and rear elements, when both Combat Operations and Combat Plans are located in the rear. Had either enemy activity or equipment malfunctions severed communications between forward and rear, there would have been no way for the JFACC to exercise command and control over the units executing operations. Thus, the JFACC could not make any ATO changes, redirect any missions, or attack any "time critical targets." In fact, the JFACC would have had no way to monitor the results of air operations (other than perhaps by receiving second-hand information from the JFC). As noted later in the analysis of BLUE FLAG 98-1, it was this concern

that influenced 12AF planners to place Combat Operations forward, while leaving the Combat Plans functions in the rear.

Joint Task Force Exercise (JTFEX) 97-1

Joint Task Force Exercise (JTFEX) 97-1 demonstrated another variant of split-AOC operations. It featured a JFACC afloat (aboard the *USS Mount Whitney*) conducting "reachback" operations with the Air Force Forces (AFFOR) staff and AOC located at Barksdale AFB, Louisiana. Therefore, this exercise was not a true demonstration of the Split AOC paradigm, although it did illustrate problems associated with geographically separated operations and problems that plague the "reachback" concept associated with a functionally-split AOC. Additionally, this exercise provided the first test of all-satellite communications links.

Description. JTFEX 97-1 was a four-phase exercise integrating U. S. Navy (USN) and USAF air forces in support of a Smaller Scale Contingency (SSC) operation. The JFACC was a naval officer aboard the command and control ship, the *USS Mount Whitney*. The 8AF Vice Commander, General D. Streater, served as the AFFOR component commander and was collocated with his AOC at Barksdale AFB, Louisiana. This AOC was responsible for ATO production for the entire air operation and was linked via satellite communications to the *USS Mount Whitney* and the Carrier Air Wing aboard the *USS Theodore Roosevelt*.[56] These satellites supported both secure telephone systems, a secure naval bulletin board system for computer access and data transfer (via the Secure Internet Protocol Router Network [SIPRNET]),[57] the Contingency Theater Automated Planning System (CTAPS), and one VTC circuit (between the JFACC and the

Commander, Air Force Forces [COMAFFOR]). Furthermore, exercise communications personnel established communications links among four land-based wing operations centers (Dyess AFB, Texas, Seymour-Johnson AFB, North Carolina, Langley AFB, Virginia, and Patauxant River Naval Air Station, Maryland), in addition to the naval vessels underway.[58]

For the USAF, Phase I consisted of deploying a composite wing into the simulated "theater" and preparing an AOC for deployment. Phase II consisted of supporting JFACC-directed air operations as a show of force. Phase III of the exercise was the support of combat operations. Phase IV was scheduled to be a transfer of authority from the JFACC afloat to a land-based AOC; however, the exercise objectives were achieved prior to this last phase and the exercise terminated without this transfer of authority occurring.[59]

Observations. The JTF Commander, Vice Admiral Vernon E. Clark and the COMAFFOR, General D. Streater, were overwhelmingly positive in their after-action assessments of the exercise.[60] Communication technicians involved, however, had a different perception. These technicians experienced problems in bringing all exercise players into a common network, difficulties with CTAPS operations (both technical and training deficiencies), and significant trouble with satellite communications and secure radio operations in the vault facility housing the AOC.

Difficulties in establishing a common network among operating sites were due to the fact that the addresses for Air Force CTAPS remote terminals were not promulgated through the SIPRNET prior to the start of the exercise.[61] Therefore, the remote terminals could not reach the CTAPS database aboard the *USS Theodore Roosevelt*. Incredibly,

this problem took Air Force system administrators and Navy system engineers several days to correct.[62] As a result of these database and network problems, CTAPS could not be used to build ATOs for the first eleven ATO cycles.[63] The ATOs were produced using a combination of Microsoft Word© and Microsoft Excel© programs, which were then copied to the CTAPS and transmitted. However, this method only met with varying degrees of success. At least one of the ATOs was unreadable and had to be reproduced and then retransmitted.[64] Post-exercise assessment concluded that the impact of these communications difficulties on the exercise as a whole was minimal. However, this was only because of the small number of missions flown. Had the ATO been significantly larger, participants believed that this system would have proved unworkable.[65]

Compounding communications network problems were difficulties establishing secure phone service to the JTF commander and JFACC aboard the *USS Mount Whitney*. Due to a lack of WSC-6 Ground Mobile Forces (GMF) satellite access, the JTF staff was limited to a suite of sixteen of what the Navy euphemistically calls POTS (Plain Old Telephone System) lines. This system depended on commercial satellite access, which suffered from considerable delays and severe bandwidth limitations. As a result, geographically separated exercise participants could successfully initiate only one out of four calls via the STU III secure telephone system. Even when successful, the voice quality was reported as poor.[66] This limited access predictably caused further communications difficulties:

> The SYSCON [Systems Control] was located at Barksdale AFB, LA, and the JCCC [Joint Communications Control Center] was located aboard the Mount Whitney *[sic]*. the *[sic]* SYSCON found it impossible to call the JCCC at times, as the line was often busy or unavailable due to the limited number of phone circuits between the Mount Whitney *[sic]* and shore.

> The secondary means of reporting was the AUTODIN message system. Sending and receiving message traffic at Barksdale was labor intensive, requiring SYSCON personnel to compose, then hand carry messages between their location and the comm center (a 10 minute walk, one way). As a result the quality and timeliness of reporting suffered.[67]

The lack of available circuits also affected land-based planners' ability to use another alternate means of ATO delivery — the Navy Secure Bulletin Board (which also depended on satellite communications). If the ATO could be placed on this computer bulletin board, units could download it by accessing it with a modem-equipped personal computer, using a STU III secure telephone. However, users could successfully connect only approximately fifty percent of the time, due to either failure of the Navy computers to automatically answer, busy lines, or STU III telephones that were unable to achieve a secure connection.[68]

In addition to the plethora of other communications difficulties, there were continuing reception problems with the Ultra High Frequency (UHF) tactical satellite (TACSAT) radio remote connections in the AOC vault at Barksdale AFB, Louisiana. Communications specialists eventually traced these problems to faulty circuitry in a support console through which the radio connections were routed.[69] Another equipment difficulty was that dial-up remotes — which repair personnel would have to access in the event of a radio failure — were located in a secure, alarmed facility. In turn, this required that repair personnel locate security personnel authorized to escort them inside the secure area before proceeding with repairs. As a result, during failures, access to these remotes on occasion took up to an hour and a half. Additionally, the radio equipment itself was obsolescent and frequently malfunctioned.[70] Compounding these difficulties was the fact that communications customer support personnel were either unavailable during non-duty

hours, or when available, were inadequately trained — in one case taking over six hours to resolve a malfunction of a satellite communications terminal.[71]

Assessment. One could safely say that communications between deployed locations for JTFEX 97-1 was a nightmare. AOC operations did not completely grind to a halt only due to the fact that a relatively low number of sorties were flown during the initial phases of the exercise and the discovery of ingenious "work-arounds" remedied hardware problems. The AOC's inability to communicate with Navy ships almost reduced the AOC staff to having to fly the ATO out to the ships, as occurred during Operation DESERT STORM.[72]

This experience reemphasizes that communications are a critical vulnerability when performing split or distributed operations. It also illustrates the danger of relying on only one medium for communication. Communications from shore to ships underway were limited to satellite communications and then this access was severely restricted, due to artificial exercise constraints, in addition to the host of real-world training and hardware problems. Therefore, single point failures totally interrupted information transfer for several hours at a time. Certainly, provided they are aware of it, agile adversaries might be able to exploit a window of opportunity such as this. As will be noted below, during planning for later exercises such as BLUE FLAG 98-1 and the EXPEDITIONARY FORCE EXERCISE (EFX), communications planners placed additional emphasis on developing robust, multi-medium networks. However, JTFEX 97-1 clearly illustrates what can happen when long-haul, land-line communications are unavailable — forcing dependence on satellites.

One might argue that the limitation of military satellite access was artificial, since in a "real" contingency, priority would be given to the JTF operation. However, certain areas of the world do not have continuous satellite coverage and the possibility exists that satellite ground stations might be either attacked directly or their links jammed (or potentially even the satellites themselves attacked, depending on adversary capabilities). Furthermore, as this exercise shows (as well as the experiences documented during many of the GOLDEN SABER exercises) if it is mechanical, it may break. Thus, this scenario may not be as artificial as it might first appear.

Unified Endeavor 97-1

Unified Endeavor (UE) 97-1 illustrated a different variant of split operations — this time the JFACC was located in a JAOC-rear, with a small JFACC liaison team forward. Given 8AF's negative experience with split operations in UE 95 that General Croker had called "a mistake not to be repeated,"[73] when the JTF commander requested the JFACC collocate at the Joint Training and Analysis Center (JTASC) with him along with a small portion of the JFACC's staff, General Streater — the JFACC — elected instead to form the JAOC at Barksdale AFB, Louisiana, and operate from there. As his representatives, he sent forward to the JTASC in Virginia a "robust JFACC liaison team" in an attempt to avoid some of the earlier difficulties.[74]

Description. The execution phase of UE 97-1 occurred from 8-17 December 1997, with a joint force in support of a general war scenario requiring forcible entry, airborne, amphibious, and air assaults. The JTF commander was from the 18th Airborne Corps and was located in the JTASC at Suffolk, Virginia. The 8AF Vice Commander (CV),

General D. Streater was dual-hatted as the JFACC and COMAFFOR. Communications channels were established over existing land-lines between Suffolk, Virginia, and Barksdale AFB, Louisiana. The land-line supported SIPRNET protocol, VTC, as well as secure voice and data transfers. Additionally, as had been done during later GOLDEN SABER exercises, tactical SATCOM relays were emplaced as a backup to the land-line communications.

Observations. After-action reports indicate that internal AOC functions were relatively smooth (at least substantially improved in relation to previous exercises, such as UE 95 and JTFEX 97-1). As one might expect with such a robust communications suite, the *History of the Eighth Air Force, 1 January to 31 December 1996* indicates that "the AOC organization operated efficiently and effectively in the small working area, while communication and connectivity worked adequately throughout the exercise."[75] One notable finding included in an internal AOC after-action report (which reappeared during BLUE FLAG 98-1) was the requirement to identify and use additional administrative support personnel to build briefings and assist with general information management functions, as well as the need for additional Information Warfare personnel.[76]

For a change, this exercise was relatively free from hardware malfunctions affecting communications. The only major problems were configuration difficulties with Constant Source (an intelligence data system) and trouble connecting SIPRNET over tactical SATCOM.[77]

Despite the relatively successful internal operation of the JAOC, there were serious defects in the JFACC's ability to assure the effective application of airpower. The

official history describes Eighth's experience at UE 97-1 as "difficult at best."[78] Many of the problems between the JTF Commander (JTF/CC) and the JFACC appear to have been personality driven; moreover, there seem to have been major flaws in the scenario and exercise controls that inadequately simulated airpower's capabilities.[79] However, there was a significant disconnect between the JFACC's JIPTL and the JTF/CC's guidance.[80] As a result, the JFACC was never able to gain air superiority and friendly forces suffered significant attrition. Lt Col James Welshans — the UE 97-1 AOC director — observed that during UE 97-1, JTF/CC guidance "turned airpower 'on and off' like a faucet to support ground force objectives."[81]

Assessment. Despite the relatively solid performance of the communications hardware, UE 97-1 again demonstrated that some type of hardware failure is almost inevitable. However, due to the abundance of available communications means, these failures were comparatively minor in nature and did not impact the exercise or the leadership's decision-making ability.

Perhaps a more significant lesson was the impact of the JFACC's failure to collocate with the JTF commander. Although some Army personnel may have influenced the JTF/CC about the "proper" use of airpower regardless of the JFACC's location, this tendency may have been exacerbated by the physical distance between the JFACC and the JTF/CC. Communication between the two only occurred twice daily over the VTC, supplemented by occasional phone calls. The distance and limited interaction inhibited the development of a close personal relationship, as it did the informal information exchanges that frequently occur among physically collocated personnel. In fact, it was this experience that prompted one participant to note that the JFACC needs to be

wherever the JTF/CC is, in order to ensure that airpower is not mismanaged.[82] Other 8AF participants concurred with this assessment.[83] Furthermore, this type of experience led the 12AF/CV, General Thomas Keck to conclude that not only does the JFACC need to be forward and collocated with the JFC, but so does his staff, to insure that Air Force viewpoints are not overwhelmed by a large Army contingent advising the JFC.[84]

Unified Endeavor 98-1

8AF attempted to solve UE 97-1's JFACC collocation problem during UE 98-1. This Unified Endeavor exercise also provides another example of Split AOC operations largely similar to the type tried by 12AF during NTC CONOPS 93-05 — a JFACC forward, assisted by a small liaison staff with the remainder of the JAOC rear. However, this exercise additionally made an attempt at splitting AOC processes, by attempting to perform Combat Operations functions forward with the Combined Forces Air Component Commander (CFACC). During Unified Endeavor (UE) 98-1, the CFACC and a small staff of approximately twenty personnel were located in the "CAOC-Forward" and attempted to "simulate" the function of Combat Operations, while they exercised liaison functions with the remainder of the CAOC staff that operated from the rear location. This exercise uniquely featured the use of a dedicated "intranet" to exchange information between the geographically separated sites, which included United Kingdom (U. K.) military forces.

Description. UE 98-1 was the fifth in a series of United States Atlantic Command's (USACOM's) JTF training exercises. Its execution phase occurred 29 October through 4 November 1997, featuring (surprise!) a Southwest Asia scenario. The exercise centered

around operations conducted at the USACOM JTASC in Suffolk, Virginia, and distributed among component training sites geographically separated both within the Continental United States (CONUS) as well as overseas, in the United Kingdom. The supporting components included Joint Force Headquarters, United Kingdom (including U. K. Air Forces), as well as U. S. Army, Navy, Marine, Air Force (8AF), and Special Operations units.[85]

The CFACC and a small portion of his staff were collocated with the Commander, Joint Task Force (CJTF) at the JTASC, while the rest of his staff remained at Barksdale AFB, Louisiana. A deputy CFACC, a U. K. brigadier general, exercised control over the CAOC-rear (CAOC-R) element.[86] Due to space limitations at the JTASC,[87] the forward element consisted of the CFACC and approximately twenty staff members. These staff members made up the CFACC's strategy team and "simulated" a forward Combat Operations division composed of personnel from Combat Operations, Intelligence, and Communications by exchanging information electronically with the remainder of the Combat Operations division at Barksdale AFB, Louisiana.

Communications between the JTASC (CAOC-forward) and Barksdale AFB, Louisiana (CAOC-rear) were enabled by a single VTC, secure telephones, facsimile machines, and a secure computer network (SIPRNET) which featured a novel UE 98-1 intranet homepage.[88] This intranet allowed users to quickly post, transfer, and access information between the distributed sites, which spanned ten time zones.[89] This time difference required twenty-four hour operations and necessitated two shifts at both the CAOC-forward and rear.

Observations. Concerning C^2 arrangements, the official UE 98-1 after-action message simply states,

> The CFACC commander's ability to interface directly with the CJTF ensured that the CJTF guidance and priorities were quickly translated into actions on the ATO. The use of VTC capabilities allowed the CFACC commander to effectively stay in touch with his staff at Barksdale. The CFACC noted at ENDEX [end of exercise] that the only thing he would do differently would be to bring his AOC Current Operations Staff with him next time to facilitate closer interaction with the AOC.[90]

This message also highlighted the effectiveness of the JTF homepage for information dissemination among the geographically and temporally-separated sites. Likewise, CINCACOM judged the defensive information warfare efforts to be successful;[91] however, no dedicated attacks were made on the system. Simulated adversary forces only evaluated information protection efforts from an operational security (OPSEC) standpoint.[92]

8AF staff personnel who participated in the exercise offered a more critical assessment. Because of the "artificial" exercise manning limitations forward, Lt Col Gary Cox, UE 98-1 Strategy Cell Director, stated that with the exception of the strategy cell, the other officers forward effectively became LNOs. For all practical purposes, AOC operations occurred in the rear. In an electronic response to the 8AF/CV's request for a UE 98-1 Training Review, Lt Col Cox observed that "certainly our split configuration with Combat OPS in the rear was inefficient for the current fight."[93] He went on to note that he believed the reason that JTASC personnel wanted the CFACC forward was to have more "control" of air operations.[94] Lt Col Cox also added that he believed all of Combat Operations ought to be located forward, if Split AOC operations were required in the future.[95]

In comparing UE 98-1 with previous 8AF UE exercises (UE 95 and 97-1), Lt Col Cox did feel that collocation of the CFACC with the CJTF was advantageous from a planning perspective. He observed that:

> No longer were we dependent on a single LNO to represent our interests at the JTF. Influence worked both ways. For example, I had no problem in directing the tasks and missions assigned to the JFACC in the JPG [Joint Planning Group]. Further I supported much of my joint planning work with the strategy and CONOPS work by the Strat Cell.… I also believe the Strat Cell was much further along and had a better grasp of CJTF intent than normal. Additionally, the JFACC's presence and support during the JTCBs [Joint Targeting Coordination Boards] helped keep the CJTF appraised of our operations, and the J3 Fires at the "macro" review level and out of micro-managing the JFACC missions.[96]

In another message to the 8AF Commander, Lt Col Cox noted that "we realized at least one great advantage from having the JFACC forward — a strong team and voice on the JTF staff. There is no doubt that the LNO team was far superior to having only two or three individuals forward to deal with the myriad of issues, actions, and questions for 24 hr *[sic]* JFACC ops."[97]

Lt Col James Welshans ran Combat Operations-Rear during UE 98-1 and offered a few other observations. He noted that more VTCs would have improved overall communications between forward and rear; however, 8AF received the exercise notification with such short notice (one week prior to the exercise) that they could only procure one VTC.[98] Furthermore, the limitation on bandwidth time (also due to lack of necessary lead-time for contracting personnel to secure commercial services) severely compressed the battle rhythm. Because of the requirement to brief the CFACC at a certain time, additional time was necessary to prepare and transmit the briefings. Lt Col Welshans described this as "information management hell" with clerical support personnel run ragged.[99] He went on to state that the biggest impediment to efficiency was the downloading and printing of briefings. Lt Col Welshans felt that efficient Split AOC operations would require, as a minimum, a twenty-four hour, dedicated VTC link and a

telephone hotline to the CFACC, as well as a better way to produce CFACC briefings. He also noted that the smooth functioning of the AOC-rear was due in part to the strong personality of the deputy CFACC — the proper selection of which would be crucial to the success of future Split AOC operations.[100] Additionally, Lt Col Welshans noted that while the secure intranet architecture was effective, it lacked a feedback mechanism so that the sender knew the intended recipient of the briefing had in fact received it.[101]

Assessment. After-action reports from this exercise appear to validate the superiority of having the CFACC forward and collocated with the JTF/CC. However, they also highlight the inefficiencies Split AOC operations induce by creating seams in the AOC process. Of particular interest is the fact that emphasis on preparing briefings becomes the biggest impediment to efficient operations — effectively driving the battle rhythm. On the whole, 8AF after-action reports indicate that Split AOC operations are possible, but require a significantly enhanced communications architecture. Finally, if a future contingency requires Split AOC operations, these reports recommend locating the entire Combat Operations and Strategy cells forward. As discussed below, 12AF largely followed this guidance during BLUE FLAG 98-1.

Blue Flag 98-1

Blue Flag (BF) 98-1 offers a more detailed look at a Split AOC operation with separated planning and control processes. During BF 98-1, the JFACC, Combat Operations Division, and a group of component and weapon system-expert LNOs were forward, along with a portion of the Strategy Division, Air Materiel Division (AMD), and Intelligence Divisions. Combat Plans, the ATO production team, and the remainder of

Strategy, AMD, and Intelligence were located in the AOC-rear. As noted earlier, UE 95 was the first functionally Split AOC exercise. However, the significant difference between BF 98-1 and UE 95 was how AOC processes were split. Additionally, BF 98-1 had a significantly more robust communications architecture than did either UE 95 or UE 97-1.

BF 98-1 may serve as a template for future Split AOC operations not only because it was an example of a "true" Split AOC operation — where AOC processes were divided between forward and rear — but also because it demonstrated many of the technologies and concepts that will be incorporated into the Expeditionary Forces Exercise (EFX), the Distributed Air Operations Center (DAOC), and the "JFACC After Next" program.

Description. Erroneously billing this exercise as "the first Split AOC operation,"[102] 12AF nevertheless conducted the execution phase of BF 98-1 from 13 to 20 November 1997, with over 1600 personnel exercising in support of a Caribbean/South American scenario.[103] BF 98-1 strenuously tested the Split AOC paradigm with training operations divided among four geographically separate operating locations. The forward AOC elements (AOC-F) — consisting of the JFACC, Combat Operations, and roughly half of the Strategy, AMD, and Intelligence cells, along with a group of weapons system and component LNOs — deployed to the simulated area of hostilities and operated out of Homestead Air Reserve Station (ARS), Florida. The rear AOC (AOC-R) elements — consisting of Combat Plans, Combat Assessment, and the other half of the split cells and LNOs (including AF/XOCD "CHECKMATE" augmentees) — remained at 12AF Headquarters, Davis-Monthan AFB, Arizona. The exercise was controlled from Hurlburt Field, Florida, where Special Operations Forces (SOF) and U. S. Army land components

also participated. First Air Force personnel were included electronically in the exercise via a "Regional AOC" from their location at Tyndall AFB, Florida. Also, Airborne Warning and Control System (AWACS) personnel electronically transmitted a simulated air picture from Tinker AFB, Oklahoma.[104]

Observations. The plethora of after-action reports on BF 98-1 seems to group observations into three basic categories: people, processes, and technology. Additionally, this assessment will include a critical fourth category — cost.

People. People issues encountered during BF 98-1 revolve around manning and synchronization of effort. Compared to 12AF's Theater Response Package (TRP) manning of approximately 1500 personnel, split AOC operations successfully reduced the forward footprint to approximately 445 exercise participants. Yet, overall manning requirements *increased* by approximately thirty-one percent.[105] Specifically, areas such as communications and administrative support required augmentation due to the added requirement to create and transmit numerous briefings. Moreover, the necessity to provide additional communications technicians, general administrative, services, and security support were also over and above that required for a conventional AOC.[106]

Repeating the Unified Endeavor experience, another manning issue that reappeared at BF 98-1 was the difficulty in determining which personnel to put where. Some cells, such as the Strategy and Intelligence cells, split their personnel between forward and rear, but unfortunately discovered that the personnel ended up in the wrong place to perform their jobs. Highly-trained "CHECKMATE" strategy augmentees in the rear were essentially wasted on administrative tasks such as building briefings, since key strategy development occurred forward.[107] The Intelligence cell elected to put its most capable

people forward, but then suffered from organization and production problems in the rear element.[108]

Despite the increase in overall manning, the cells were often only "one deep" in critical skill areas. Then, because supporting split operations forced the cells to divide their personnel, they ended up being undermanned at each location. Each cell leadership position was often filled by only one person. As a result, those individuals worked fourteen to eighteen hour shifts that would clearly be unsustainable (or sustained only with severely degraded effectiveness) over an extended period of operations.[109] Moreover, due to this "one deep" manning level, the flow of information degraded between certain cells when critical members were forced to take restroom breaks or paused to eat lunch.[110] The Battlefield Coordination Division (BCD) and Air Mobility Division (AMD) encountered similar problems.[111]

BF 98-1 participants also discovered that synchronization of effort between the forward and rear elements was a particularly nettlesome problem. This was compounded by the fact that exercise participants were split by three time zones and worked only one twelve hour shift instead of manning an "around the clock" AOC. Because of this, information either "got lost during the night" awaiting answers from the other element[112] or when personnel forward called for support from the rear, "no one was home."[113] Compounding the time zone problem was the lack of a "combat pucker factor" at rear locations.[114] This translated to a noticeable lack of a sense of urgency among AOC-R personnel "until about five minutes before brief time."[115] Indeed, the operations of the two cells were described by the Air and Space Command and Control Agency/Command

and Control Technical Innovation Center (ASC2A/C2TIC) "Quick Look" as "two out of phase sine waves of tempo and sense of urgency."[116]

Process issues that impacted BF 98-1 centered around the issues of synchronization of effort, forward to rear information flow, traditional JFACC briefing processes, and inefficiencies induced by seams in the AOC process, created by splitting its cells between forward and rear.

Unity of effort was difficult to achieve between forward and rear elements for several reasons. Information flow to the rear elements was inadequate to keep lower level participants aware of the "why" behind certain directives.[117] As General Campbell noted, "senior officers lashed up fairly well while the captains and majors prosecuting operations had little contact forward to rear and back."[118] As an example of this problem, the USAF Battlestaff Training School's (BTS) collection of "Observations, Deficiencies, and Interviews" (ODIs) following the exercise indicated that "JFC/JFACC guidance was not readily available to all cells" and that "one cell did not receive this information at all for the first one and a half days of the exercise."[119]

According to one ODI, "the normal interpersonal feedback was lacking and not easily communicated by VTC, telephone, or computer screen. There was a definitely discernible lower tempo and sense of urgency rearward…."[120] Other ODIs for BF 98-1 recorded that "many at AOC Rear felt that the real action was taking place at AOC Forward *[sic]* and they had little insight into how the exercise was going. Some complained that they didn't know important information that impacted their own function until it was overcome by events."[121] This report went on to note that "training for the 'remote' war is unfamiliar and disconcerting to the exercise participants. This is

especially true for combat veterans and experienced war gamers… [but,] [i]t should be noted that the newer, less experienced personnel appear to have adapted to the new process."[122]

The lack of feedback manifested itself when planners assumed that the previous ATO's targets had been struck, even though in several cases planned missions had been diverted to other targets in response to time-critical taskings. This prevented the planners from putting the "dropped targets" on the next day's ATO, since they assumed the target had already been struck.[123] Likewise, due to insufficient feedback on the results of their missions, electronic warfare (EW) and Information Warfare (IW) representatives were unable to determine the status of targets that their forces attacked on previous ATOs.[124]

The split operation also severely reduced the amount of time allocated for traditional JFACC briefing processes. Some of this may have been due to the fact that for test purposes, a normal forty-eight hour battle rhythm was intentionally compressed to a record thirty-three hours.[125] Moreover, after-action reports indicated that "additional time required to prepare briefing slides for transmittal to AOC forward *[sic]* location took away from actual process *[sic]* that was used to get info to put in briefing *[sic]*."[126] Indeed, at one point during the exercise, General Campbell stopped the Master Air Attack Plan (MAAP) VTC briefing because remote locations had not yet received slides prepared by the AOC-F. Although this may have been partially due to a compressed battle rhythm and IW security requirements that made the transfer of classified data laborious,[127] USAF BTS personnel noted:

> The issue of needing more time to prepare briefings is symptomatic of a different problem — that of increased dependency on high tech briefing graphics. The point of a briefing is to get information to the right people.

> There is, however, a reluctance to appear before the General with anything less than PowerPoint©-generated slides of such clarity and detail that the briefer is relieved of having to really remember very much about the subject.[128]

Another factor that contributed to inefficiencies at BF 98-1 was the tendency of the various cells who had split their functions between forward and rear to "self-replicate" miniature versions of their severed components. The Strategy cell created a "mini-plans" cell forward,[129] as did the BCD[130] and the AMD.[131] Because of the seams created by their division, the forward elements at times duplicated the efforts of rear cells. Although there is some benefit to geographically separated cells overlapping functions,[132] in this case, the duplication of effort added to the overtasking already felt by personnel performing key duties. As previously discussed, these "one deep" cells were undermanned from the start of the exercise, due to the increased personnel requirements of split operations.[133]

Technology. Many of the process limitations characterized above were due to the current limits of technology. In order to understand its limitations and describe a model that may be typical of future distributed operations, the following section will briefly describe the physical communications architecture created for BLUE FLAG 98-1.

Setting up the communications architecture for BF 98-1 required transporting 130 short tons (ST) of communications equipment to the AOC-forward.[134] This equipment included computer terminals, line of sight (LOS) radios, satellite radios, VTCs, shelters, and communications support vehicles, in addition to a host of multiplexers, secure telephones, and other miscellaneous equipment.[135] This all boiled down to three different media over which the AOC-F could communicate with the AOC-R: land-line (consisting of telephone communications circuits, fax, computer network, and VTC circuits), LOS

radio (voice and data link), and satellite radio (Ultra-High Frequency Tactical Satellite [UHF TACSAT] and Super High Frequency Satellite [SHF]). BF 98-1 communications specialists routed the land-line communications through two commercial T-1 cables[136] and for additional information security purposes, installed "firewalls"[137] where the commercial network connected to the military communications circuits. These circuits were all certified for classification levels up to SECRET. Separate systems with higher classification levels were available and similarly used the existing land-line system.[138]

A significant finding from BF 98-1 is that the defensive information warfare measures taken by exercise communications personnel proved extremely successful. According to one of the designers of the system, it would have taken a simultaneous attack on five separate networks to sever connectivity between the distributed elements.[139] In fact, the system proved so robust that despite a determined offensive information warfare effort waged by the 609th Information Warfare Squadron personnel (playing the role of adversary forces), no successful penetrations were achieved. In order to test the system's ability to recover from an actual attack, defensive IW personnel had to intentionally take protective systems off-line and allow attacks to occur.[140]

Several factors temper this success, however. First, as observed by General Thomas Keck, the planners had over three months to prepare,[141] and the "red" (simulated adversary) IW forces were prohibited from actually "frying" any equipment or actively jamming satellite downlinks.[142] Secondly, the multiple VTC links were made possible by leasing commercial bandwidth and using existing high-volume, long-haul communications lines. These lines would likely be unavailable during an actual conflict; especially in an undeveloped country. If damage or lack of land-line availability required

communicators to rely exclusively on satellites, communications flow would likely be degraded — as JTFEX 97-1 experience conclusively showed. Satellite availability would be subject to national priorities and existing areas of coverage. Even if the satellites were available and covered the area of operations, it is still unlikely that sufficient bandwidth would be available. This limitation would force deployed personnel to prioritize information exchanges and overall data transfer rates would be slower.[143] Finally, although the "firewalls" successfully prevented hostile IW intrusions, it also restricted some exercise participants from being able to use "reachback" functions with outside agencies.[144] While this could be procedurally corrected for future deployments, tradeoffs will always be required between security and flexibility.

These technical caveats aside, the ASC2A "Quicklook" notes that communications were "adequate to plan, execute, and communicate during BF 98-1, but many seemingly correctable deficiencies were identified which affected the efficiencies of the people and processes within the JFACC staff."[145] The simultaneously most-loved and most-hated technological element was the VTC. One participant bluntly stated "VTC briefings are a pain in the ***, but also a lifeline from rear to forward."[146] Despite its twenty-four hour availability, VTC picture transmission was still unable to capture many of the non-verbal communications between participants. VTC use required users to develop briefing protocol procedures, something akin to two-way radio communications, as the VTC could only support one conversation at a time.[147] The system periodically "hiccuped" during the exercise, temporarily interrupting briefings until technicians restored the connection. Participants also stated that the VTC needed both better and additional microphones and cameras, as well as a capability to use a "white board" with the system and some type of

pointer.[148] As previously noted, the limited number of VTCs available (although BF 98-1's use of four VTCs was more than in any previous exercise and probably the most that any real-world bandwidth could currently support)[149] — arranged in a "Hollywood Squares" manner featuring multiple split-screen images — provided senior decisionmakers with sufficient information; however, it was at the expense of those at the worker level.[150] Likewise, despite the relatively robust communications network, participants encountered bottlenecks attempting to transmit classified information. Not enough TOP SECRET lines were available — which limited many briefings to the SECRET level.[151] Additionally, current display limitations left some participants complaining of a lack of situational awareness.[152]

***Costs*.** Total BF 98-1 exercise costs were approximately $274,000.00. Of this, about $174,000.00 were for Air Force personnel expenditures, including *per diem* reimbursement. The remainder was expended on equipment, transportation, maintenance, supplies, and commercial rental fees. Commercial communications bandwidth rentals cost approximately $5,200.00 for the duration of the employment phase of the exercise.[153] The figures do not include expenditures for aviation fuel or munitions, as all aircraft and missions were notional. Moreover, the personnel expenses only included those deployed to the AOC-F. Comptrollers did not include any calculation of man-hours in these figures for 12AF personnel who remained at Davis-Monthan AFB, Arizona, nor does it include the cost of those who participated in BF 98-1, but were funded by other agencies.

Assessment. As General Thomas Keck noted, BF 98-1 "was a partial success."[154] More than anything, it proved that Split AOC operations are possible. However, it also

pointed out that current technology is insufficient to support this paradigm. Some of the communications bottlenecks may be relieved if promised technology matures (as will be discussed in Chapter Four) or by changing existing AOC processes to reduce communications requirements. One innovative idea proposed by participants was to incorporate secure cellular phones to reduce classified communications logjams.[155]

Despite the robust nature of BF 98-1 communications links, these links remain the Split AOC's "center of gravity." Certainly, measures like those taken at BF 98-1 will enhance communications operability, but either aggressive enemy activity or physical limitations may ultimately degrade operations.

The pattern of asynchronous operations — "the out of phase sine waves" — that split operations create merits serious attention. It appears that a strong Deputy JFACC is needed at the rear location. He can ensure that the proper "sense of urgency" is conveyed and make certain that all participants are aware of their role in the ongoing operation. During an actual contingency, twenty-four hour operations would solve some of the coordination problems, but it will concomitantly increase overall manning requirements.

The AOC's operating efficiency appeared to be degraded at BF 98-1, as compared to a traditional AOC. Whether it was from the lack of personal interaction, the compressed battle rhythm, the communications bottlenecks, or from the duplication of effort between forward and rear, many participants found that their job took longer, was more difficult to accomplish, and often produced a less than optimum product.[156]

Based on this information, split operations do not appear to be more efficient than those of a collocated AOC, nor do they reduce manning requirements. Although a Split AOC does reduce the forward footprint, due to the increased personnel requirements, the necessity to transport and use additional communications equipment, in addition to the

requirement to rent commercial bandwidth, BF 98-1 experience suggests that the Split AOC paradigm is not cheaper than collocated operations, either. Limited to current technology, planners considering the Split AOC option might be better advised to attempt to collocate the JFACC and his entire AOC with the JFC whenever possible. As Colonel Hugh Smith, 12AF Director of Operations (DO) noted, "in a contingency operation where 40-50,000 U. S. troops are already deployed, what's another 1100 or so for an AOC?"[157] [158]Yet, depending on the situation, the Split AOC's advantages may outweigh its drawbacks. Additionally, future technology promises to improve the efficiency of Split AOC processes. It is this potential that the study addresses in Chapter Four.

Notes

[1] It remains unclear exactly why U. S. Army III Corps and 12AF terminated the GOLDEN SABER exercises. According to the III Corps historian, although no specific reason was documented in III Corps histories, the most likely reasons were a shift in training emphasis brought on by the rapidly approaching end of the Cold War and a change in III Corps leadership with a corresponding shift in training focus. Dr. Charles Moore, U. S. Army III Corps Historian, telephone interview, Fort Hood, TX, 16 April 1998. 12AF histories also give no reason for the exercise series' termination. However, the 12AF Historian, Dr. Patrick Murray, suggested that in addition to the factors cited above for III Corps, 12AF's area of responsibility changed in 1987. As a result, the impetus to exercise with III Corps may have been reduced and in turn, may have contributed to III Corps' decision to cancel the exercise series. For a full description of all of the GOLDEN SABER exercises, see 602D TAIRCW Histories, 1 Jan 1979 through 31 December 1988.

[2] John C. Sullivan, *History of the 602D Tactical Air Control Wing, 12th Air Force, Tactical Air Command, Bergstrom AFB, Texas, 1 January-30 June 1979* [SECRET] (Bergstrom AFB, TX: Office of History, 602D Tactical Air Control Wing, 3 August 1979), p. 74. Information extracted is unclassified.

[3] Allen A. Jones, Fighter Liaison Officer, Detachment 3, 602D Tactical Air Control Wing "Golden Saber III After Action Report," Fort Carson Colorado, 23 February 1981 in *History of the 602d Tactical Air Control Wing (U,) 1 April-30 September 1982* (Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1982 [SECRET]. Information extracted is unclassified.

[4] Office of History, 836th Air Division, *History of the 602d Tactical Air Control Wing (U) 1 April-30 September 1982* (Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1982) [SECRET], p. 35. Information extracted is unclassified.

[5] *602D TAIRCW History*, 1 January-30 June 1979, p. 73-4.

Notes

[6] Detachment 3, 602D TAIRCW "GOLDEN SABER III After Action Report," 23 February 1981, p. 1 in *602D TAIRCW History, January-March 1981*.

[7] Ibid., p. 2.

[8] *602D TAIRCW History January-March 1982*, undated draft, "Det. 1 After Action Report for Golden Saber V."

[9] *602D TAIRCW History 1 April-30 September 1982*, p. 35.

[10] Message [unclassified], Det. 1 602 TAIRCW [Fort Hood, TX, Commander] to 602 TAIRCW [Bergstrom AFB, TX, Director of Operations] 8 June 1982 in *602D TAIRCW History 1 April-30 September 1982* [SECRET]. Information extracted is unclassified.

[11] 712th Air Support Operations Center [ASOC] "After Action Report, GOLDEN SABER IX, Atch 2," in *602D TAIRCW History 1 October 1983-31 March 1984* [SECRET]. Information extracted is unclassified.

[12] *602D TAIRCW History 1 October 1983-31 March 1984*, p. 114.

[13] 712th ASOC "After Action, Atch 2."

[14] Ibid., Atch 12.

[15] Ibid., Atch 15.

[16] Ibid., Atch 20.

[17] Ibid.

[18] Ibid., Atch 21.

[19] *602D TAIRCW History 1 April - 30 September 1984*, p. 69-70.

[20] All of the GOLDEN SABER deployed TACS elements were contained within the Fort Hood, TX, Military Reservation. For an example of a typical exercise layout, see *602D TAIRCW History 1 October 1983 - 31 March 1984*, Supporting Document 113; "Communications Plan for GOLDEN SABER IX," 30 December 1983 and Supporting Document 115, "GOLDEN SABER IX Site Survey Report," 18 January 1984.

[21] Among others see Wexlar, et. al., *Modular Operations Concept Study;* Goodell, *Modular Control Equipment: Concept of Operations for the European Tactical Air Control System;* and TAC/DOY, *MTACC CONOPS.*

[22] *602D TAIRCW History January-March 1982*, p. 32.

[23] Ibid.

[24] Ibid., p. 32-33.

[25] *602D TAIRCW History 1 January through 31 March 1982*, p. 32.

[26] Ibid., 32-33.

[27] Message 12COS (Chief of Staff) to 12AF Headquarters, 15 December 92, Supporting Document II-5, *12AF History*, Davis-Monthan AFB, AZ, 1993 [SECRET-NF]. Information extracted is unclassified.

[28] Robert J. O'Brien, Lt Col, USAF, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXE, 17 March 1998.

[29] *History of Headquarters Twelfth Air Force for 1993*. Davis-Monthan AFB, AZ, 1993 [SECRET-NF], p 52. Information extracted is unclassified.

[30] Ibid., p. 53.

[31] O'Brien, interview, 17 March 1998.

[32] Ibid.

[33] Ibid.

Notes

[34] Interview (U), Dr. Robert B. Sligh, 12AF/HO, with Lt Col Craig Dreier, 12AF/DO, 8 June 1994, Supporting Document II-2 in *History of Headquarters Twelfth Air Force for 1993*, Davis-Monthan AFB, AZ, 1993 [SECRET-NF], p. 7. Information extracted is unclassified. Also, Robert O'Brien, Lt Col, USAF, personal interview, Davis-Monthan AFB, AZ: 12AF/DOXE, 17 March 1998.

[35] Randy Bright, Major, USAF, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXP, 16 March 1998.

[36] Thomas J. Keck, Major General, USAF, personal interview, Davis-Monthan AFB, AZ: 12 AF Vice Commander (CV), 17 March 1998.

[37] Ibid., and interviews with Lt Col O'Brien and Major Bright, as well as the Sligh interview with Dreier.

[38] Ibid.

[39] Stephen Croker, "UNIFIED ENDEAVOR 95 JFACC Lessons Learned," (U) Briefing slides in Harold P. Myers, *History of the Eighth Air Force 1 January to 31 December 1995* (U) [*8AF History, 1995*] Barksdale AFB, LA: 8 AF/HO 13 February 1997 [SECRET], Supporting Document 176, slide 8. Information extracted is unclassified.

[40] Myers, *8AF History, 1995* [SECRET], p. 51-53. Information extracted is unclassified.

[41] Myers, *8AF History, 1995* [SECRET], Supporting Document 176, slide 7. Information extracted is unclassified.

[42] Ibid., slide 8.

[43] Ibid.

[44] Ibid.

[45] Ibid., p. 3.

[46] Ibid.

[47] Ibid., p. 2.

[48] Ibid.

[49] Ibid., p. 5.

[50] Ibid.

[51] Ibid., emphasis added.

[52] Myers, *8AF History, 1995* [SECRET], p. 52. Information extracted is unclassified.

[53] Stephen B. Croker, "Initial Look at JFACC Operations During UE-95 Phase III," Attachment One to letter from General Croker (8AF/CC) to Colonel George H. Kotti (8AF/XL), 16 May 1995, p. 1. in Myers, *8AF History, 1995* [SECRET], Supporting Document 175 [U]. Information extracted is unclassified.

[54] *8AF History*, 1995, p. 53.

[55] Ibid.

[56] *8AF History*, *1996*, p. 102-3.

[57] Secret Internet Protocol Router Network, essentially a classified local area network (LAN) or classified Internet. Dave L. Maher, personal interview, Davis-Monthan AFB, AZ: 612 ACOMS/SCXP, 17 March 1998.

[58] *8AF History*, *1996*, Supporting Document 659 ("CTAPS Connectivity Impaired by Addressing Problems in JTFEX 97-1").

Notes

[59] Harold P. Myers, *History of Eighth Air Force 1 January to 31 December 1996* (U) (Barksdale AFB, LA: 8AF/HO, 5 February 1998 [SECRET], p. 105. Information extracted is unclassified.

[60] Ibid.

[61] This problem could be equated to not having someone's e-mail address.

[62] *8AF History, 1996*, Supporting Document 659 "CTAPS Connectivity Impaired by Addressing Problems in JTFEX 97-1."

[63] *8AF History, 1996*, Supporting Document 659 "CTAPS Not Used to Build First Eleven ATOs for JTFEX 97-1."

[64] Ibid.

[65] Ibid.

[66] *8AF History, 1996*, Supporting Document 659, "Secure Phone Service to the Joint Task Force Commander (JTF) was Limited."

[67] *8AF History, 1996*, Supporting Document 659, "Resolution of Communications Outages Delayed by Inadequate Telephone Service."

[68] *8AF History, 1996*, Supporting Document 659, "Access to Information on the Navy Secure Bulletin Board Difficult."

[69] *8AF History, 1996*, Supporting Document 659, "Remoting UHF TACSAT Via Operations Center Systems Support Console (OCSS) Degraded Audio Quality."

[70] *8AF History, 1996*, Supporting Document 659, "CTAPS Configuration Delayed ATO Delivery"; and "Communications in LRC/CSSC Vault Needs to be Upgraded."

[71] *8AF History, 1996*, Supporting Document 659, "Lack of GMF Satellite Technical Data and Maintenance Training Caused Prolonged Outage for Exercise JTFEX 97-1."

[72] Gregory M. Swider, *The Navy's Experience With Joint Air Operations: Lessons Learned From Operations Desert Shield and Desert Storm* (Alexandria, VA: Center for Naval Analysis, 1993), p. 31.

[73] *8AF History, 1996*, p. 106.

[74] Ibid.

[75] Ibid., p. 111-2.

[76] James Welshans, "UE 97-1 Internal After Action Review," briefing slides, (Barksdale AFB, LA: 8AF/A3-5, 27 February 1997), Slide 9 and 15. Other items noted a need for AOC SOPs, to have staggered shift changeovers and standard changeover briefings, and the need for a better AOC floor layout.

[77] Ibid., Slides 6 and 21.

[78] *8AF History, 1996*, p. 109.

[79] Ibid., p. 109-111.

[80] Ibid., p. 109.

[81] Ibid., p. 111 and Lt Col James Welshans, personal interview, Barksdale AFB, LA: 8AF/A3-5, 18 March 1998.

[82] Randy Bright, Major, USAF, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXP, 16 March 1998.

[83] James Welshans and Gary Cox, Lt Cols, USAF, personal interviews, Barksdale AFB, LA: 8AF/A3-5 and 8AF/CCG, 18 March 1998.

Notes

[84] Thomas J. Keck, Maj Gen, USAF, personal interview, Davis-Monthan AFB, AZ: 12AF/CV, 17 March 1998.

[85] USCINCACOM, "EXER UNIFIED ENDEAVOR 98-1 POST EXERCISE SUMMARY," message to CJCS, Washington, DC: USCINCACOM, 18 December 1997, p. 2.

[86] Ibid.

[87] David W. Barno (USACOM/JTASC director) electronic mail (e-mail) to Colonel Kevin Kennedy (8AF A-3/5), "JFACC Cell at JTASC/UE 98-1," 6 September 1997. E-mail copy provided by Lt Col James Welshans, Barksdale AFB, LA: 8 AF/A3-5, 18 March 1998.

[88] Gary Cox, personal interview, Barksdale AFB, LA: 8AF/CCG, 18 March 1998.

[89] USCINCACOM Message, p. 3.

[90] Ibid.

[91] Ibid.

[92] Gary Cox, personal interview, 18 March 1998.

[93] Gary Cox, e-mail to 8 AF/CC (General P. Ford), "UE 98-1 CINCUSACOM TRAINING REVIEW," 2 December 1997, p. 1.

[94] Ibid.

[95] Ibid.

[96] Ibid.

[97] Gary Cox, Lt Col, USAF (8AF/CCG) e-mail to P. Ford, Lt Gen, USAF (8 AF/CC), "UE 98-1 Postmortem," 10 November 1997.

[98] James Welshans, personal interview, Barksdale AFB, LA: 8AF/A3-5, 18 March 1998.

[99] Ibid.

[100] James Welshans, (8AF/A3-5), telephone interview, Maxwell AFB, AL: SAAS, 23 February 1998.

[101] Ibid.

[102] General Frank B. Campbell, e-mail to Major General J. Hawley, ASC2A Commander, 6 December 1997. Copy on file at the School of Advance Airpower Studies, Maxwell AFB, AL.

[103] Mark H. Lindsley, "BLUE FLAG 98-1 Executive Summary," Unclassified message from 505 Command and Control Exercise Group, Hurlburt Field, Florida to Air and Space Command and Control Agency, Langley AFB, VA, 1 November 1997.

[104] Air and Space Command and Control Agency (ASC2A) /USAF Command and Control Technical Innovation Center (C2TIC), "Distributed Operations Quick Look for BLUE FLAG 98-1." Langley AFB, VA: ASC2A/C2TIC, 27 February 1998.

[105] Kenneth J. George, Major, USAF, personal interview, Davis-Monthan AFB, AZ: 12 AF/DOXE, 17 March 1998.

[106] ASC2A/C2TIC, "Distributed Operations Quicklook," p. 1.

[107] Ibid., p. 2.

[108] Ibid.

[109] "CHECKMATE Observations, Blue Flag 98-1 (Execution Phase)," undated, p. 3.

Notes

[110] Thomas Dean, "Interviews/Observations Reference Split AOC Ops BF 98-1," Hurlburt Field, FL: Air Force Command and Control Agency, 26 November 1997, p. 1.

[111] Ibid., p. 2.

[112] Ibid., p. 1.

[113] Ibid., p. 2.

[114] Chris Christon and John Lewis, "Trip Report: BLUE FLAG 98-1" (Colorado Springs, CO: Autometrics, Inc., undated), p. 10.

[115] USAF Battlestaff Training School (BTS), "Exercise BLUE FLAG 98-1 Observations, Deficiencies, and Issues (ODI) Data Review," ODI Number BF 98-1-28, 19 November 1997. Hereafter referred to as "*ODIs*."

[116] ASC2A/C2TIC "Quick Look," p. 2.

[117] Ibid., p3.

[118] General Campbell, e-mail to General R. Hawley (ACC/CC), "BLUE FLAG 98-1 ENDEX Message to COMACC," 3 December 1997, p. 2.

[119] *ODIs*, ODI Number BF98-1-28, 19 November 1997.

[120] Ibid.

[121] *ODIs*, ODI Number BF98-1-84, 20 November 1997.

[122] *ODIs*, ODI Number BF98-1-96, 20 November 1997.

[123]*ODIs*, ODI Number BF 98-1-72, 19 November 1997.

[124] Ibid., ODI Number BF98-1-5, 20 November 1997.

[125] General Campbell e-mail to General R. Hawley (COMACC), "BLUE FLAG 98-1 ENDEX Message to COMACC," 3 December 1998, p. 2.

[126] *ODIs*, ODI Number BF98-1-79, 20 November 1997.

[127] Ibid.

[128] USAF BTS comment to ODI BF98-1-79.

[129] ASC2A, "Quicklook," p. 3.

[130] Dean, "Interviews/Observations," p. 2.

[131] *ODIs*, ODI Number BF98-1-53, 20 November 1997.

[132] The most significant benefit of a partial functional overlap between geographically separated cells is the ability to temporarily continue operations if communications links between forward and rear are severed.

[133] Randy Bright, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXP, 16 March 1998.

[134] Terre J. Kyle, personal interview, Davis-Monthan AFB, AZ: 12 AF/SCXP, 17 March 1998. Much of this equipment was duplicated for the Hurlburt, Tyndall, and Tinker AFB (AWACS simulator) connections.

[135] Dave L. Maher, personal interview, Davis-Monthan AFB, AZ: 12 AF/SCXP, 17 March 1998.

[136] T-1 cables are commercial high capacity cables over which both commercial and military communications can flow. These cables were leased from commercial providers and all military exercise traffic over these cables was encrypted. Despite their name, they actually consist of a network of cables throughout the United States. If any one connection was broken, the flow would be automatically rerouted without disruption. There was bandwidth leased on two T-1 cables between Davis-Monthan AFB (D-M), AZ

and Homestead ARS, FL, while the T-1s connecting Hurlburt to Tyndall, Homestead, and D-M were already in-place and leased as part of the Blue Flag Distributed Wargaming System that was established in 1992. Maher, interview, 17 March 1998. Also see Bob Daniels, *Blue Flag Distributed Wargaming System* (Griffiss AFB, NY: Rome Laboratories, 1992), especially p. 30.

[137] A firewall can be equated to an "airlock" through which only selected computer addresses are allowed to flow. These addresses are controlled by the defensive information warfare personnel installing the firewall. Maher, interview, 17 March 1998.

[138] Kyle, interview, 17 March 1998.

[139] Maher, interview, 17 March 1998.

[140] Ibid.

[141] Leasing the commercial T-1 cables' bandwidth requires an approximate lead time of 120 days using existing contracting arrangements. Moreover, many potential deployment locations do not have such a robust T-1 network as that existing in the United States. For example, in South Korea, the T-1 cables there are reportedly severed at least twice a year. In a situation such as this or for other locations where T-1 are not available at all, increased reliance on satellite communications would be required. This, in turn, would limit the available number of VTCs, and would slow some information transfer operations. Maher, interview.

[142] Thomas J. Keck, personal interview, Davis-Monthan AFB, AZ: 12 AF/CV, 17 March 1998.

[143] Kyle, interview, 17 March 1998.

[144] The IW security measures apparently prevented Strategy Plans personnel from direct contact with the Joint Warfighting Analysis Center over secure computer systems. Post-exercise assessment determined that in fact contact may have been possible by using one system in the Secure, Compartmented Information Facility (SCIF); however, due to time pressures and unfamiliarity with the system and its capabilities, contact could not be established during the exercise. There is still debate as to whether or not these capabilities were actually in place. Randy Bright and Dave Maher, personal interviews, Davis-Monthan AFB, AZ: 17 March 1998.

[145] ASC2A/USAF C2TIC "Quicklook," p. 2.

[146] Dean, Hurlburt, p. 3.

[147] Colonel (select) Carr interview in Ibid.

[148] Ibid.

[149] Maher, interview, 17 March 1998.

[150] ASC2A "Quicklook," p. 2.

[151] Ibid.

[152] Ibid. Battlefield Coordination Division (BCD) personnel found this problem especially significant. They lacked the capability to transmit map data between locations (other than by classified fax, which was very time-consuming and lacked color capability). This ability is especially critical to keep both forward and rear personnel informed of the movement and location of ground forces. Obviously, this information is critical for all aspects of air campaign planning.

Notes

[153] Burke Beaumont, 12AF Deputy Comptroller, telephone interview, Davis-Monthan AFB, AZ, 24 March 1998. This rental cost included a $2,773.00 non-recurring setup fee, and a $2,421.00 recurring monthly charge for the service. The Air Force was billed for an entire month of service, despite the fact that the bandwidth was only used for the exercise time period. Martin Morse, telephone interview, Davis-Monthan AFB, AZ: 612ACOMS/SCXP, 28 April 1998.

[154] Keck, personal interview, 17 March 1998.

[155] ASC2A "Quicklook," p. 3.

[156] Personal interviews with Lt Gen Frank Campbell, Maj Gen Thomas Keck, Lt Col Robert O'Brien, Maj Randy Bright, Maj Eric Herr, Maj Ken George, Lt Commander Dave Zimmerman, USN conducted at the AOC-F, Homestead ARS, FL, 16-20 November 1997.

[157] Hugh Smith, personal interview, Davis-Monthan AFB, AZ: 12AF/DO, 16 March 1998.

[158]

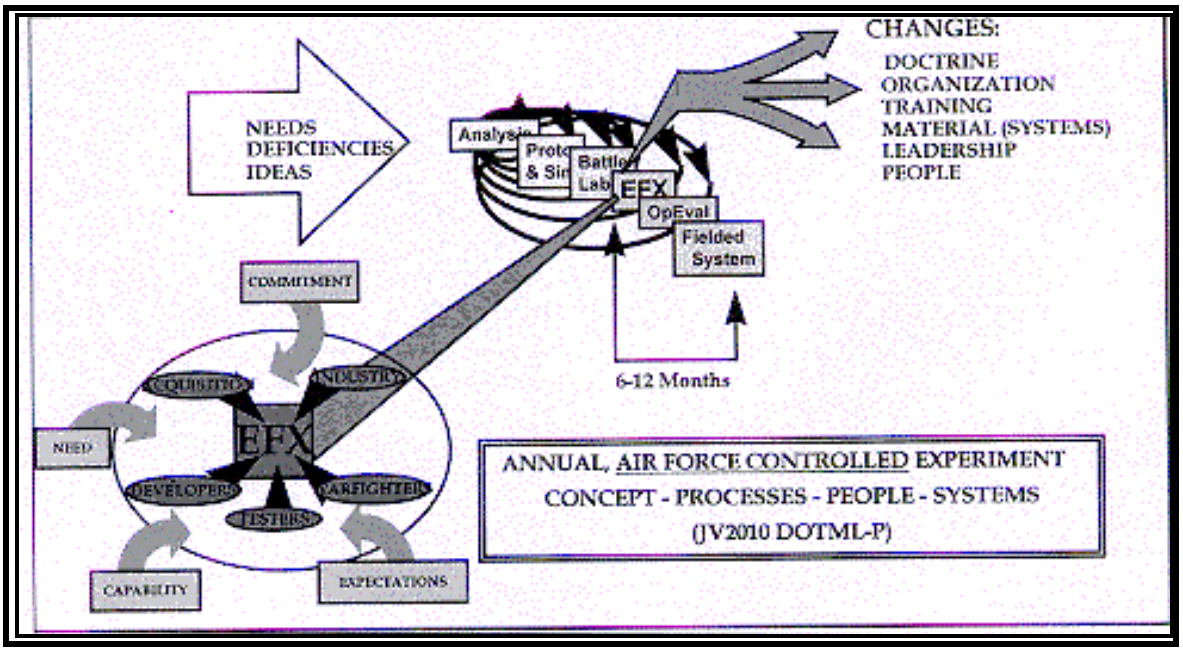
Chapter 4

The Future of the Split AOC

> *[Our vision is:] Global command and control of aerospace forces throughout the spectrum of military operations by exploiting information to know, predict, and dominate the battlespace [in order to] engage aerospace forces to observe, shape, and affect the battlespace and to operate these forces in a joint or coalition environment as directed.*
>
> —USAF Scientific Advisory Board
> Vision for Aerospace Command and Control for the 21st Century

The Air Force's Command and Control (C^2) Roadmap reveals the path to the Split AOC's future. This C^2 Roadmap follows the above vision chartered by former Chief of Staff of the Air Force, General Ronald Fogleman and the then-Assistant Secretary of the Air Force for Acquisition, Lt General George Muellner.[1] The purpose of the C^2 Roadmap is to "represent a feasible investment strategy for achieving the desired C^2 operational objectives, as outlined in the draft Air Force Strategic Plan, and based on *Joint Vision (JV) 2010*."[2]

Accordingly, the roadmap defines a "spiral engineering development strategy,"[3] from which technologies and processes to support the roadmap can be developed and evaluated. As shown in Figure 10, the first spiral leads to Expeditionary Forces Exercise (EFX) 98, which in turn, will provide insights for the successive spirals needed to achieve the objectives of *JV 2010* and *Global Engagement*.



Source: Space Applications Corporation, Concept of Operations for United States Air Force Expeditionary Force Experiment 98, Figure I-3-1.

Figure 10. Spiral Development Process for EFX 98

Before an organization ascends these successive spirals, there should be agreement on the starting point as a common frame of reference. This is the objective of the "AOC Baseline" program now ongoing at the Air and Space Command and Control Agency/ Command and Control Technical Innovation Center (ASC2A/C2TIC) at Hurlburt Field, Florida. This chapter will briefly describe this program and the various technologies and processes that are expected to evolve from this starting point. These include those that will support the first spiral — EFX 98 — as well as technologies for the Rear Operations Support Center (ROSC) and the Distributed Air Operations Center (DAOC). Additionally, the Joint Warrior Interoperability Demonstrations (JWID) showcased many of these technologies. Finally, this chapter will conclude with a look at the expected product of the second development spiral, the JFACC After Next.

AOC Baseline

According to Colonel Mark Lindsley, Director of the AOC Baseline effort, "there are seventeen different agencies worldwide that purport to be an AOC. Moreover, each has its own structure and processes."[4] The AOC Baseline is an effort to standardize these functions within the Air Force. In addition to standardizing AOC and JFACC training, the ASC2A authored *Air Force Instruction (AFI) 13-AOC*. This publication, still in draft, is expected to be released in May 1998.[5] Its purpose is to treat the AOC like a weapons system and require its personnel to undergo standardized training, documentation, and certification of proficiency. *AFI 13-AOC* will categorize AOC training in a manner similar to that required for aircrew members as initial qualification (IQT), mission qualification (MQT), and continuation (CT).[6] At present, this training is only proposed for core AOC team members, who would still be augmented in a contingency by relatively untrained personnel provided by tasked wings. However, this would insure that a core of expertise is resident in the AOC at the time of its mobilization. There are some concerns about this process. Those trained would receive a relatively "permanent" personnel system designator that might prohibit them from cross-training into another specialty. Likewise, many personnel perceive AOC duty, and indeed assignment to a Numbered Air Force (NAF), as undesirable from a career progression standpoint.[7] Care must be taken to insure that NAF-assigned personnel are adequately rewarded for their service.

In addition to developing *AFI 13-AOC*, the AOC Baseline program is attempting to standardize AOC equipment lists for mobilization and deployment. NAFs are currently in the process of submitting their AOC Unit Type Codes (UTCs) and commenting on

proposed "standard" UTCs. Currently, these will include the Quick Response Package (QRP), Limited Response Package (LRP), and Theater Response Packages (TRP) packages described in Chapter Two, as well as a proposed "Interim Response Package (IRP)."[8]

Notably, none of these proposed UTCs, nor the associated publications or training currently support or describe Split AOC operations. Despite this omission, Lt Col Gary Cox noted that this attempt at standardization should make it "easier to go from 1200 to 300, [known quantities, if both collocated and split AOC numbers are standardized] than to go from 'I don't know what' to 'I don't know what,' which is what we are doing right now."[9]

Rear Operations Support Center (ROSC)

Concept Description. The Rear Operations Support Center (ROSC) is an adaptation and refinement of the Split AOC paradigm. It uses distributed operations technology and procedures similar to those tested in BLUE FLAG 98-1 and UNIFIED ENDEAVOR 98-1, as well as those demonstrated during the 1995-7 Joint Warfighting Interoperability Demonstrations (JWID). However, the ROSC is unique in that it has one permanent, centralized location from which AOC-rear functions are performed. It is also intended to support at least two forward operations simultaneously.[10] During wartime (or contingency operations), the ROSC would provide AOC-rear facilities and equipment. It will be able to support combat operations, including ATO generation, monitoring ATO execution, and supporting future ATO planning and coordination by hosting a full set of liaison officers among both service and joint elements.

The ROSC will also house personnel and facilities for Air Force Forces (AFFOR) "care and feeding" administrative control (ADCON) functions necessary to support combat operations. Additionally, the ROSC will maintain day-to-day peacetime operations that would be augmented and expanded during a contingency to include both the AOC-rear functions and the AFFOR-rear functions.[11] These include providing C^2, rescue, and weather support for aircraft deployment and delivery operations. It also provides a link to the TACC, space operations centers, and the logistics network. Additionally, it is able to support and monitor Status of Resources and Training System (SORTS) reporting.[12]

The ROSC is currently under construction at Langley AFB, Virginia and is expected to be fully operational in June of 1998.[13] Moreover, there are additional conceptual plans for Intermediate Operations Support Centers (IOSCs) to be constructed and developed in Europe, to provide a subset of these capabilities for either local Small Scale Contingencies (SSCs) or to support North Atlantic Treaty Organization (NATO) operations.[14] Like the EFX program, the ROSC is primarily intended to support rapid Air Expeditionary Force (RAEF) deployments.[15]

Assessment. The ROSC is no longer merely conceptual. As Colonel (retired) Maris McCrabb — an acknowledged C^2 expert who led the ROSC development and implementation from the Air and Space Command and Control Agency (ASC2A) at Langley AFB, Virginia — stated, the ROSC is funded and "is going to happen."[16]

The most significant advantage of the ROSC is that it gives deployed units "one belly-button to push for reachback support."[17] Traditionally, deployed units have had to call multiple entities for support of all varieties, which is made even more difficult by the

time-zone and technical difficulties inherent in world-wide operations. Under this concept, a deployed planner or crewmember requiring assistance from rear agencies has only to contact the ROSC, who then contacts whatever support agencies are required and in return, furnishes the consolidated response to the field elements. Because the ROSC operates continuously, this allows the deployed planners to continue their operations despite time zone differences that make contacting outside agencies during "normal working hours" difficult. The ROSC can also function as a central "message clearinghouse," which both deployed personnel and contractors can access at anytime. Not only is this easier for the deployed staff, but it simplifies accountability. The ROSC is responsible for following up on all support requests.[18] Similarly, outside support agencies needing to contact the deployed unit have a simple, single point of contact.

Another promised advantage of the ROSC is the elimination of the duplication of effort and facilities among the NAFs. Instead of each of the three stateside NAFs creating, equipping, staffing and maintaining their own ROSC-type facility, the central facility will provide a trained skeleton staff — which would be augmented by tasked NAF personnel for contingency operations — in addition to keeping equipment continuously connected and maintained for their use. This should result in reduced setup times during an actual contingency and may reduce the chance of initial connection problems. Additionally, it will provide the capability to support simultaneous contingency operations by different NAFs within the same facility.[19]

Moreover, Colonel McCrabb notes that the ROSC will use an Air Tasking Order (ATO) for routine aircraft delivery operations between stateside bases and overseas

contingency temporary duty (TDY) locations. This will insure that the system is continually exercised and that more personnel are familiar with its use.[20]

Despite these considerable advantages, there are disadvantages. The most politically volatile is the issue of control from the rear and the possibility of "Washington" civilian political leaders meddling in the affairs of on-the-scene operational commanders. Colonel McCrabb indicated that Langley AFB was chosen as the location for the ROSC because it was close enough to Washington, District of Columbia, to facilitate reachback operations, but far enough away to preclude easy meddling.[21] However, as will be possible with the DAOC[22] technology, with a real-time battle picture available in the ROSC, the temptation may exist for both senior military and civilian political leaders to second-guess the personnel on the scene.

In addition, the stateside, world-wide deployable NAFs fear a loss of control over "their" operation to Headquarters, Air Combat Command (ACC). Presently, ACC functions only as a force provider and is not in the combat chain of command.[23] Colonel (ret.) Maris McCrabb stated that the issue of potential interference with the combat chain of command will be personality dependent. The current ACC commander (COMACC), in order to avoid the appearance of "meddling," has not located his staff in the ROSC, and stated that he will not operate from there in wartime. In fact, to minimize the problem of apparent rank differential, a colonel will likely act as the COMACC's representative to the ROSC.[24] This would reduce the possibility that a COMACC representative who outranked the Deputy JFACC or AOC-rear (AOC-R) director would make a suggestion that would be interpreted as an order. However, in the absence of

definitive guidance, a perception that the ROSC makes field commanders vulnerable to "meddling from the rear" is likely to persist among the NAFs.[25]

Another disadvantage is the relatively limited space available in the ROSC. Although the facility has sufficient capability to house the personnel required for "two and a half" contingencies, under some conditions, this might prove inadequate. Such a situation might occur if an operation becomes either very large, or long-standing, requiring a significant long-term tie-up of available facilities.

Additionally troublesome is the fact that a single ROSC location is a critical vulnerability. Just as air operations would be severely degraded if the AOC-forward (AOC-F) was successfully attacked, should the ROSC be damaged, forward air operations would suffer severe degradation. Although the ROSC is located in the continental United States (CONUS), it would certainly be an inviting terrorist target, and however unlikely, the possibility exists that its operations could be hindered by either natural or man-made disasters.[26] Furthermore, it will depend on communications to be effective. As documented at length in Chapter Three, the ability to establish foolproof communications links among geographically separated operations has, to date, proven elusive.

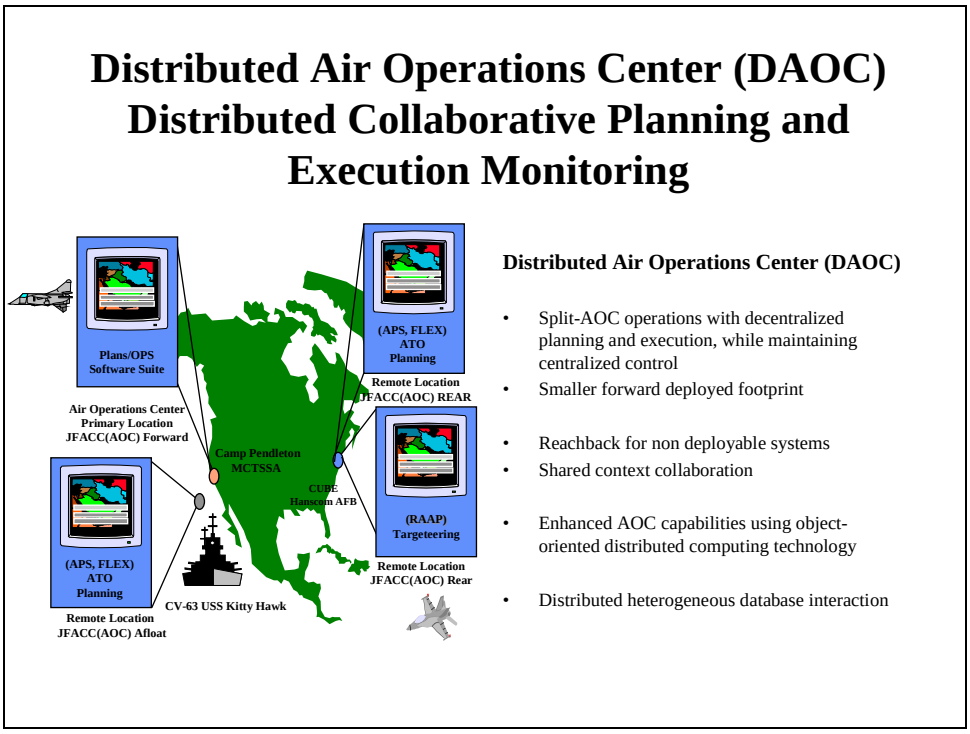
Ultimately, time will tell. Since the decision to use the ROSC is final, it will be up to users of the system to develop appropriate procedures to alleviate its potential problems. This may include formal, written procedures for control of the ROSC, in addition to establishing robust security measures and communications networks to prevent a single failure from paralyzing the whole system. Despite its vulnerabilities, there may well be economies realized through maintaining established procedures and facilities. Moreover,

keeping a trained cadre of operators familiar with its use may assist in relieving one of the perennial problems of AOC operations, having trained personnel ready to function at the start of a crisis.[27]

Distributed Air Operations Center (DAOC)

Concept Description. The Distributed Air Operations Center (DAOC) concept expands on that of the ROSC by distributing AOC operations and processes among multiple forward and rear operating locations (see Figure 11). Furthermore, the DAOC model attempts to shift the planning paradigm from sequential to parallel processes. Instead of one location generating data that the next location then processes and sequentially forwards to the next, by creating a data network that many locations can simultaneously access and modify, DAOC planning can proceed in parallel fashion with multiple locations "collaborating" on the final product.

Presently the DAOC concept has only been demonstrated at four locations due to limited equipment and manpower. However, Rome Laboratory personnel believe that it is possible to expand this concept to include at least two additional operating locations.[28]



Source: Carl DeFranco, message to author, Rome, NY: Rome Laboratories, 1 March 1998.

Figure 11. DAOC System Concept of Operations

According to Carl DeFranco, the creator of the DAOC concept under Defense Advanced Research Project Authority (DARPA) auspices at Rome Laboratories, NY,

> Distributed computing is a more sophisticated form of networking, in that once things are up, you don't need addresses for computers in the distributed system. It's all managed invisibly, 'underneath' the computer screen. You can run programs from anywhere just knowing the program name…This allows administrators to put software at more than one place, but still have the system look like one large machine.[29]

This concept uses new software tools to weaponeer targets and to build and execute the ATO. These new programs include an improved version of Contingency Theater Automated Planning System (CTAPS) software, as well as new Automated Planning Software (APS), and Force Level Execution (FLEX) software. This system allows users to access the ATO at any of the distributed operating locations. It also enables automated tracking of the ATO as it is being executed. Similar to current Split AOC operations, the

distributed locations are linked via the Secure Internet Protocol Router Network (SIPRNET), in addition to unclassified land-line and satellite channels.

As DeFranco notes, since "the system doesn't much care what you call forward or rear,… you can tailor it as required."[30] Thus, as demonstrated during the first DAOC test in 1995, DAOC equipment was located forward with the USMC at Camp Pendleton, California; on board the *USS Kitty Hawk* (a Navy carrier berthed in San Diego), and rear at Hanscom AFB, Massachusetts. During this exercise, each service planned at its own location, but due to the network configuration, planners could see simultaneously what everyone else was doing. This transparency eliminated the need to merge the final products and fix the conflicts that inevitably arise when distributed planners sequentially create ATO products.[31]

The DAOC concept has the potential to reduce the time delay inherent in traditional ATO generation cycles. Unit planners must currently wait for the AOC staff to develop and release the ATO before they begin their individual planning. Moreover, due to the size and complexity of the document, conflicts and errors may occur that are not recognized until it is too far along in the ATO process. An additional benefit of this concept is that it potentially solves the problem, which has only been partially resolved to date, of distributing the ATO to Navy vessels at sea.[32]

The DAOC technologies also offer the promise of expanded C^2 capabilities from those of traditional concepts. These enhancements include potentially enabling the JFACC to operate aboard aircraft, ships, or vehicles while traveling to a combat zone. Moreover, these same processes and equipment portend a seamless transition of authority from a JFACC afloat to a land-based command structure.[33]

Lessons to Date. The U. S. Joint Chiefs of Staff (JCS) sponsored four Joint Warfighting Integration Demonstrations (JWID) of DAOC technologies prior to 1998 (three of which have already been performed). JWID '95 tested the capability of the JFACC to move himself and his staff from afloat to ashore, while still maintaining effective control over air operations. Networked databases enabled mission planners to operate where they work, rather than transfer to an AOC. According to DeFranco, the decision to transfer authority from afloat to ashore was "typed,… on our 'whiteboard' on the machine, and three seconds later, we were done. This caused some confusion, since we didn't transfer data (it was already there), and it took longer to convince the 'players' that we were complete than it did to do it."[34] In this case, the physical footprint of the DAOC equipment at each of the four operating sites consisted only of two workstations connected by a telephone line and modem.[35] This is clearly a significant reduction of forward footprint from that of a traditional AOC or even the AOC-F, as tested in BLUE FLAG 98-1.

JWID '96 expanded the concept of distributed operations to include AOC planning operations performed between a simulated coalition partnership of Canada, Britain, and Australia, connected with planning sites at Fort Bragg, North Carolina and Shaw AFB, South Carolina.[36] The demonstration validated the concept of establishing communications links with and conducting distributed operations between U. S. sites and those located overseas. However, the demonstration encountered difficulties connecting with Canada due to network problems, while the Australian network could not be connected at all.[37]

JWID '97 successfully demonstrated the ability of the JFACC to control operations while enroute to a forward operating location aboard an aircraft. This demonstration used the "Speckled Trout" modified Boeing 707 command and control aircraft due to its ability to accommodate robust communications hardware and software connections.[38] JWID '97 also demonstrated technologies that will be incorporated into EFX 98 and the JFACC After Next programs. Among others, this included the Coalition Wide Area Network (CWAN), which is a common network, linking the United States to its allies world-wide in order to provide real-time collaborative planning.[39]

Although they have a vested interest in the success of the DAOC technologies, Rome Laboratories did consolidate both positive and negative assessments of the experiment. According to Rome Laboratories personnel, advantages of the DAOC concept include:

1. Faster ATO generation, equal to or better than current planning.
2. Reduced forward footprint for Combat Plans, Combat Ops, and Target cells.
3. Better survivability due to system redundancy.
4. Easy monitoring of ATO execution using FLEX at remote sites.
5. No loss of control or decision making.
6. Field units can watch the ATO being built and identify problems early.
7. Final version does not fail if the comm links are interrupted — it can recover and fix itself when comm is fixed.[40]

Conversely, Rome Labs lists potential disadvantages as:

1. Communications links are required between the sites.
2. There is some loss of the "personal touch" since some planners are not on site.
3. Security is tougher across a long-haul network than at a central location.41

Unsurprisingly, these disadvantages have been repeatedly documented during the exercises detailed in Chapter Three. Apparently, they are characteristic of any geographically-separated, communications-dependent operation.

Additionally, the DAOC technologies were only tested under "demonstration" conditions, with engineers and software experts present to correct any problems, and in

many cases, to operate the systems themselves. Results probably would vary under actual operating conditions. Likewise, in many cases, these technologies are not, and will not be, sufficiently "mature" for full production for several more years. Current versions have software and hardware compatibility problems that are yet to be fully resolved and may take several years to reach operational users.[42]

Questions to Answer. Carl DeFranco also noted one future question regarding DAOC technologies that will have to be answered operationally: "With collaborative planning capabilities that enable multiple distributed sites to see the ATO as it is being produced, how does the commander control access to the ATO before it is released?"[43] If deployed planners can see the ATO in a "draft" stage, too much advanced planning may occur for targets that are later changed or reassigned. Moreover, with information instantly available to the field sites, operational security concerns (OPSEC) may increase. Along the same lines, if information is available at a rear location, will rear commanders succumb to the temptation to meddle with the JFACCs "draft" ATO and provide unwanted or unneeded guidance? This is the heart of the political debate between the CONUS deployable NAFs and Headquarters, ACC over the ROSC.[44]

Another issue that must be addressed is the survivability of the communications links themselves. Rome Laboratories advertises that the DAOC has the capability to regenerate and repair its software when lost communications are restored.[45] However, regardless of the DAOC's internal software repair capabilities, if the links can be penetrated at all, then an adept adversary may create and exploit delays in the planning process. Correspondingly, will units be able to plan autonomously if the communications links are severed, or will they become so dependent on the reachback capabilities that

they are unable to continue operations and planning until the links are restored? As in previous tests, exercises, and distributed operations demonstrations, "queertrons" appeared at inopportune moments and hindered connectivity, in the case of JWID '96, degrading one distributed network and rendering another completely inoperable.[46]

Finally, how significant is the loss of "personal touch?" As addressed in Chapter Three, this was a significant finding of split operations. Even Video Teleconferences can only transmit a portion of the non-verbal communications that occur when personnel are physically co-located; moreover, a VTC often fails to capture the group dynamics of those not currently "on-screen." More than likely, due to operating constraints, this loss of personal interaction may be unavoidable. Yet, as previously discussed, many commanders feel this interaction is essential, hence their desire to be collocated with both the AOC and the CINC.[47]

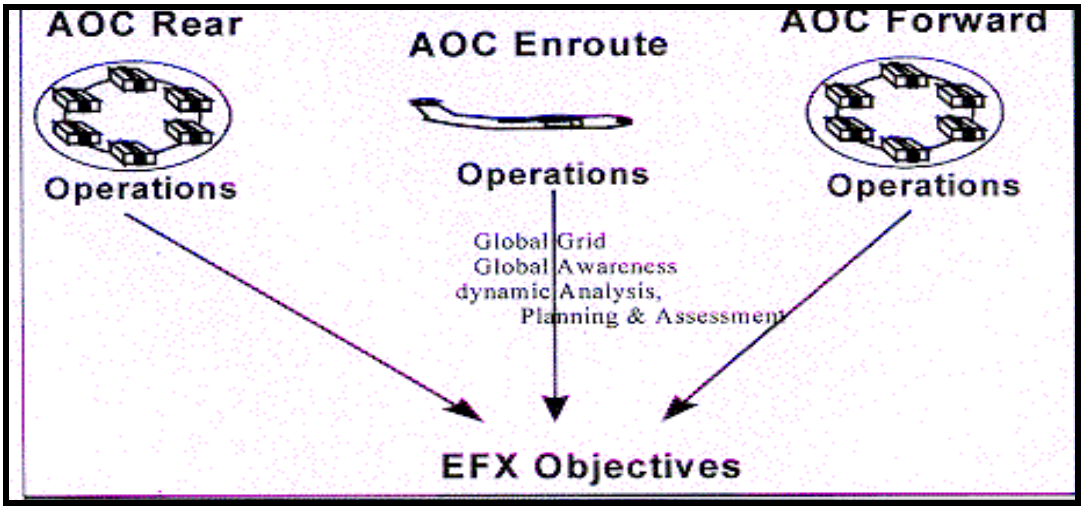
Expeditionary Force Exercise (EFX)

The EXPEDITIONARY FORCE EXERCISE (EFX) program combines almost all of the previously discussed concepts into one exercise series. It will feature several command and control initiatives that incorporate technologies demonstrated during the JWID series, as well as many of those projected for the DAOC concept. Additionally, EFX will be the first exercise to use the ROSC facility.

Concept of Operations. The EFX program itself is an annual technology and operational concept experiment which aims to merge the so-called Revolution in Military Affairs (RMA) with Air Force Core Competencies using an expeditionary mindset.[48]

Initiatives proven during EFX then serve as candidates for incorporation into the formal acquisition cycle.[49]

The EFX 98 CONOPS calls for the rapid deployment of an Air Expeditionary Force (AEF) into a large asymmetric force-on-force, simulated Southwest Asia scenario set in the years 2003-2005.[50] The execution phase of this exercise will occur 10-28 September 1998, featuring over seventy aircraft in a live-fly exercise, operating from multiple CONUS locations. The AEF from Mountain Home AFB, Idaho, will deploy to Eglin AFB, Florida, where it will operate in conjunction with aircraft from Eglin AFB, Shaw AFB, South Carolina and Pope AFB, North Carolina. The EFX program also includes four "mini-exercises" prior to the execution phase of EFX 98, in order to validate individual technology components.[51] The first of these is occurring at this writing, from 25-27 March 1998, using the AEF from Mountain Home AFB, Idaho to validate the JFACC-enroute portion of the experiment.



Source: Space Applications Corporation, Concept of Operations for United States Air Force Expeditionary Force Experiment 98, Figure I-1-1.

Figure 12. EFX 98 Distributed C^2 Operations

EFX 98 will feature several command and control initiatives that incorporate the ROSC and DAOC technologies. Specifically, EFX will test the feasibility of distributed operations between a JAOC-Rear (using the ROSC facility at Langley AFB, Virginia[52]), a JAOC-forward location (Duke Field, North Carolina), and a JFACC enroute aboard the specially configured "Speckled Trout" aircraft[53] (see Figure 12). Additionally, a simulated Wing Operations Center (WOC) will operate from Eglin AFB, Florida. The modeling and simulation center, as well as the Joint Special Operations Task Force (JSOTF) Headquarters, will be integrated into operations from Hurlburt Field, Florida.

EFX 98 will also assess the JFACC's ability to use reachback capabilities so that only 100 people per shift (200 total) will be required to operate the JAOC-forward. Finally, although EFX 98 will test many other initiatives, the last C^2 issue pertinent to this study is an assessment of which, if any, emerging technologies (specifically, those developed for the DAOC) will allow the JFACC to maintain situational awareness and the ability to influence the battlespace while enroute from a rear location to the JAOC-forward location.[54]

EFX's communications architecture will be quite similar to that used during BF 98-1, with the addition of the JFACC-enroute portion aboard the "Speckled Trout" aircraft. Long-haul, land-line communications networks requiring leased commercial bandwidth will be established, similar to those created for BF 98-1. These networks will carry voice, data, messaging, and Collaborative Virtual Workstation (CVW) information, as well as VTC communications among the sites. These will all be protected from information attacks with "firewalls" and other procedures successfully employed during BF 98-1. The land-line communications will be augmented by Super High Frequency (SHF) satellite

transmissions among the distributed locations. Additionally, line-of-sight ultra-high frequency (UHF) and high frequency (HF) radio links will support the AOC-forward, in addition to the WOCs and the JFACC-enroute. The JFACC will also be able to receive VTC data transmitted over the SHF satellites while aboard the "Speckled Trout" aircraft.[55]

With the exception of the JFACC-enroute demonstration, the AOC processes will be split among the forward and rear elements similar to those of BF 98-1. The current EFX CONOPS calls for the majority of the Strategy, Combat Plans, and Air Mobility Divisions to be located in the JAOC-rear (JAOC-R). Personnel at the JAOC-R will be responsible for preparing the Air and Space Estimate of the Situation, the Strategy cell assessment of plans and objectives, development of courses of action (COAs), prioritized air objectives, the Master Air Attack Plan (MAAP), the Air Tasking Order (ATO) with Special Instructions (SPINS), the Air/Space Control Order (ACO), the Air/Space Defense Plan (ADP), and the Joint Integrated Prioritized Target List (JIPTL).[56]

EFX Objectives for the JFACC-enroute are to establish the capability to provide continual awareness of planning, intelligence, and on-going operations to the JFACC while enroute, as well as to enable the JFACC to effectively communicate decisions to the JAOC-R and, if established, the JAOC-forward (JAOC-F).[57] The JFACC will also be able to receive briefings, graphical depictions and text, in addition to receiving current intelligence updates and being able to participate in "real time" decisionmaking through the on-board Collaborative Virtual Workspace (CVW).[58]

Approximately fifteen to twenty key members of the JFACC's staff are anticipated to accompany the JFACC aboard the "Speckled Trout" enroute aircraft. These staff

members may include the Judge Advocate General (JAG), a military/political advisor, staff members from directorates A1 through A-6,[59] the Director Mobility Forces (DIRMOBFOR), as well as various technicians and operators for the "reachback" and "reach-forward" systems aboard the aircraft.[60]

The 100 persons per shift[61] (200 total personnel) deployed to the JAOC-F would give the JFACC the capability to execute the ATO, publish ATO changes, provide feedback to the remainder of the Strategy Division (located in the JAOC-R), maintain situational awareness, and control subordinate theater C^2 elements.[62] Additionally, the JAOC-F would maintain communications with the JAOC-R, the Expeditionary Operations Center (EOC) enroute, subordinate C^2 units, Army Air Defense Artillery (ADA), and Wing Operations Centers (WOCs).[63]

Concerns. Personnel at the three CONUS deployable NAFs expressed several concerns about areas to be tested during EFX 98. These sectors include proposed manning, cost, effectiveness, and near-term availability of technology that supports the EFX demonstration.

Manning. The EFX CONOPS calls for a small number of personnel, compared to both a standard AOC and the Split AOC concept tested at BF 98-1. For exercise purposes, the EFX CONOPS specifies a total of 100 personnel forward. However, unlike actual operational conditions, EFX participants will only exercise twelve hours a day. In real-world operations performed around the clock, the EFX design would require a total of 200 AOC personnel forward. For its JFACC-enroute portion, as noted earlier, the Speckled Trout aircraft has room for the JFACC and approximately twenty staff members. The JAOC-Rear will be manned by approximately 250 personnel at the ROSC

facility at Langley AFB, VA.[64] Initial EFX plans called for the full component of personnel for both a QRP to be stationed forward (338) and an LRP at the ROSC (408).[65] These did not include the additional personnel that normally support these packages to perform AFFOR functions (129 and 211 additional personnel for the QRP and LRP respectively).[66] However, EFX contract personnel state that their target is an overall reduction of ten percent from the QRP and LRP numbers, with a total of no more than 100 personnel forward.[67]

NAF personnel interviewed are concerned that these numbers are unrealistic from a standpoint of twenty-four hour operations under wartime conditions, and that the processes are not being adequately modeled to determine actual personnel requirements. Instead, contractors have established an arbitrary figure and will tailor capabilities to accommodate that number regardless of actual requirements.[68] EFX contractors counter that the personnel reductions are being leveraged by improved technology and paradigm shifts in planning that will reduce the need for the number of personnel in the QRP and LRP packages.[69]

Cost. Another concern of NAF personnel is that EFX contractors are touting this exercise as being more cost-efficient than either a traditional, collocated AOC or the BF 98-1 Split paradigm. However, comparing costs between an already deployed system and a system in development is extremely difficult, but the forecast expenditures for EFX exceed forty-three million dollars.[70] In order to ensure an accurate comparison, the cost of purchasing all of the EFX equipment should be normalized against that in the tailored AOC packages. Total personnel costs must also be considered for all exercise personnel, in terms of both Temporary Duty Costs (TDY), as well as man-hours. Additionally, if

making a comparison based on technology used for EFX with that used at BLUE FLAG 98-1, analysts must recognize that BF 98-1 employed only notional aircraft, whereas EFX will employ live-fly sorties. Therefore, the equipment and personnel costs for these assets should either be removed from the calculation or compared with BF 98-1 estimated costs, if live-fly aircraft and munitions had been used.[71] Moreover, the cost for transporting equipment and renting bandwidth must be included for a nominal deployment duration that is representative of average operational requirements. One must also consider the fact that some savings would be realized by the ROSC facility being able to support up to two contingencies simultaneously. This might eliminate the requirement for at least one of the CONUS world-wide deployable NAFs to maintain separate contingency packages.

Near-Term Technology Maturation/Availability. Because the technology used for EFX 98 is not "production-ready," there are concerns among NAF personnel that any procurement decisions based on this data will be biased and may affect the NAF's near-term combat capability. If the distributed paradigm is "proven" by this demonstration and decisionmakers correspondingly reduce near-term AOC manning levels, then the NAFs will not be combat-ready until the technology actually matures some five to ten years from now. Furthermore, should the technology not prove adequate when fielded, the NAFs may be unable to perform their wartime functions, without an available "back-up" system.

Effectiveness. Finally, with all of the above considerations in mind, many permanent-party NAF personnel, who are tasked to man both the EFX AOC and other real-world AOCs on a daily basis, feel that they would be unable to do the appropriate job

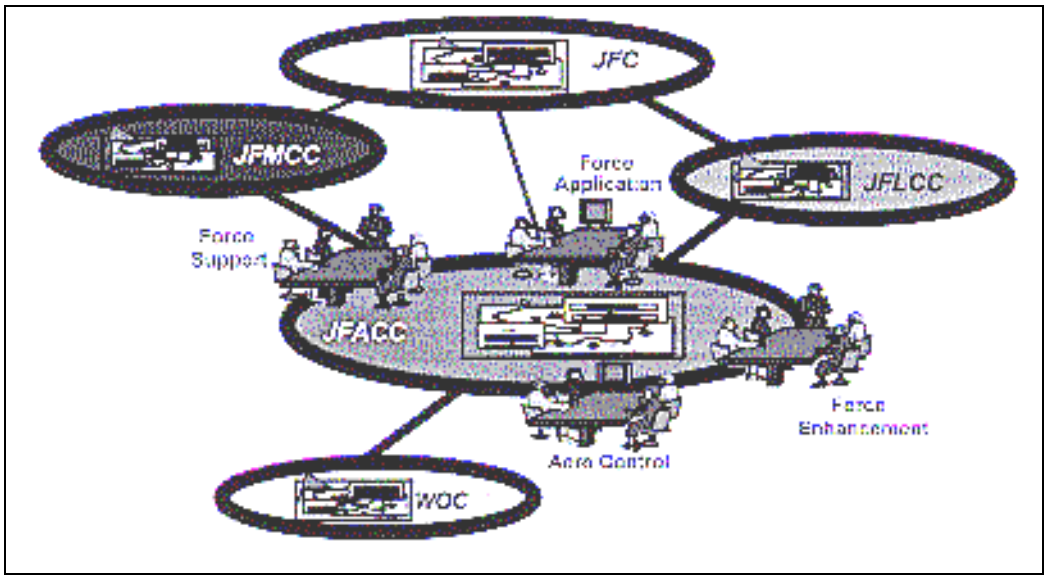
with reduced manning and the demonstration-level technology planned for EFX 98.[72] Thus, the EFX results will require careful analysis to determine what capabilities are actually available before committing to near-term modifications of AOC UTCs. Many of these same NAF personnel also believe that a significant number of operational tests and evaluations should be conducted on the distributed operations concept — in accordance with an objective test plan — to compare processes with requirements and, in turn, determine what the optimum split AOC configuration and manning level should be, prior to committing scarce resources for acquisition.[73]

JFACC After Next[74]

After-action reports from BF 98-1 indicated a need for a fundamental paradigm shift in AOC processes. The JFACC After Next program is an attempt to do exactly this by providing a long-range vision for the JFACC support environment for the year 2010 and beyond.[75] According to the JFACC Operational Concept Document (OCD),

> The operational vision for the JFACC program is built around fundamental changes in the C^2 processes that implement air operations planning, execution and assessment management. Capturing this futuristic vision requires suspending, for a moment, the near-term constraints imposed by today's processes, today's environment, and the capabilities of today's technology.[76]

These fundamental changes involve reducing the number of personnel in a contemporary AOC and shifting its processes from a "sequential and hierarchical"[77] nature to a "distributive, collaborative network" of core and virtual staff members interacting with "thinking agents — human, machine, and reachback" *[sic]*[78] (see Figure 13).



Source: Figure 5-9 JFACC OCD, p. 5-15.

Figure 13. JFACC Distributed Collaboration Planning Concept

The goals of the JFACC After Next study are to:

> develop a new process — an objectives oriented planning, execution, and assessment process for enhanced responsiveness, efficiency, effectiveness, and flexibility; enable the process with advanced technologies and systems — [that] . . . provides the foundation for strategy-to-task, cross-domain (Ops/Intel/Support) integration in a continuous, dynamic, event-driven operational tempo; and empower the JFACC with the next-generation capabilities.[79]

The desired end-state of this concept is in line with apolitical, "rational actor"[80] arguments for executing split operations — reduced footprint, increased survivability, enhanced flexibility, and improved response time. It also addresses many critiques of the Split AOC concept, such as reducing the loss of efficiency, situational awareness, and personal interaction that accompany geographically-separated, electronically-connected, codependent operations. If developed as conceived,

> Air operations planning teams will conceivably consist of a commander, a core staff of highly experienced senior officers (about two dozen, working two shifts a day), and a supporting network of specialized analysis and planning cells (virtual staff) on call to provide reachback support to the

> core staff. Instead of layers of mid-grade officers and junior operators, there will be a highly interactive and automated collection of computing agents, agents that can take direction from the JFACC and his staff (both core humans and virtual agents), and in minutes produce refined plans in response to significant changes in guidance…. Finally the system will have the ability to present the results of all of these agents' work in a visualization environment that allows the commander and his staff to very quickly absorb and understand the overall structure of the current plan, to easily identify and "dig down" to critical plan assumptions and decisions, to easily compare alternate plans and view proposed plan changes, and to instantaneously see the current status of the execution of the plan and its impact on the changing battlespace.[81]

As described in the JFACC OCD, currently available technology precludes immediately fulfilling this vision. Yet, the JFACC After Next concept is an attempt to creatively address the impact of future technology on Split AOC processes and fundamentally rethink the traditional AOC model. Until technology matures, however, JFACCs may have to accept somewhat less efficient operations in order to achieve the benefits of a reduced forward AOC footprint, decreased airlift requirements, and increased flexibility in AOC deployment. Chapter Five will summarize many of the issues affecting the Split AOC paradigm and will offer some recommendations for near-term AOC operations, pending the maturation of these evolutionary technologies.

Notes

[1] United States Air Force Scientific Advisory Board (SAB), *Vision of Aerospace Command and Control for the 21st Century* (Washington, DC: USAF SAB, 1996), p. xi.

[2] *USAF C2 ROADMAP*, downloaded from ASC2A Internet Web Site <http://wwwmil.acc.af.mil/asc2a/info.htm>. Copy on file at SAAS.

[3] Ibid., p. 1.

[4] Mark Lindsley, telephone interview, Hurlburt Field, FL: ASC2A/C2TIC, 13 January 1998.

[5] Kahao, interview, 16 March 1998 and *Air Force Instruction 13-AOC, Volume 1* (Draft) 1 May 1998, (Washington, DC: HQ XOCE, 1998).

[6] *AFI 13-AOC* (Draft), p.3.

[7] Lt Col Gary Cox, 8 AF/CCG, personal interview, Barksdale AFB, LA: 18 March 1998.

Notes

[8] The Interim Response Package (IRP) was not mentioned earlier. Colonel (select) Robert Haseloff describes it as being between the QRP and LRP in size and capability. Robert Haseloff, Col (sel.), USAF, personal interview, Shaw AFB, SC: Central Command Air Forces (CENTAF), Commander, Combat Operations (A-3), 20 March 1998.

[9] Cox, interview, 18 March 1998.

[10] ROSC designers have tentatively made contingency plans to support up to two simultaneous Smaller Scale Contingencies (SSC) or one SSC and one Major Theater of War (MTW). In such an event, the ROSC facilities would provide AFFOR-rear support to one and AOC-rear support to the other. If a third conflict broke out during this time, sufficient space would only exist to provide AFFOR-rear support and/or AOC-rear support to two of the operations. Colonel McCrabb stated that perhaps additional temporary facilities would be constructed outside the ROSC itself to support this scenario. However, based on the *National Security Strategy* which only calls for simultaneous support of two MTWs and would shift assets out of SSCs to support MTW operations, he considers this possibility unlikely. Colonel (retired) Maris McCrabb, personal interview, Maxwell AFB, AL: SAAS, 4 March 1998. See also *A National Security Strategy For A New Century*, May 1997, (Washington, DC: The White House, 1997), p. 12.

[11] Ron Junge, Colonel, USAF, "Rear Operations Support Center Concept of Operations (draft)" (Langley AFB, VA: Air and Space Command and Control Center, undated), slides 7-10. Hereafter referred to as "ROSC CONOPS."

[12] Junge, "ROSC CONOPS," slide 7. SORTS is the readiness and training reporting system through which the Department of Defense (DOD) tracks a unit's combat readiness status.

[13] Junge, "ROSC CONOPS," slide 25.

[14] McCrabb, personal interview, 4 Mar 1998.

[15] Maris McCrabb, Col (ret.), USAF, "Command and Control Concept of Operations: Dynamic Battle Management (draft)" (Langley AFB, VA: ASC2A, 21 January 1998), slide 7.

[16] McCrabb, personal interview, 4 Mar 1998.

[17] Ibid.

[18] Ibid.

[19] McCrabb, interview, 4 March 1998.

[20] Ibid.

[21] Ibid. In addition, Colonel McCrabb stated that Langley was the best choice for the ROSC due to the availability of space, familiarity with the proposed operations, and it was the most logical site because in a contingency — such as happened during DESERT STORM — the NAFs provide personnel to Air Combat Command (ACC) headquarters at Langley AFB, VA to assist with the AFFOR functions, anyway.

[22] The following section details DAOC technologies and processes.

[23] Joint Chiefs of Staff, *Joint Publication 0-2, Unified Action Armed Forces* (UNAAF), (Washington, DC: U. S. Joint Chiefs of Staff, 1995), p. III-7. Also, see Combat Air Forces (CAF), *Presentation of U. S. Air Forces ["Little Red Book"]*

(Langley AFB, VA: CAF, 1997), p. 15 and United States Air Force, *Air Force Doctrine Document 1* (Maxwell AFB, AL: Headquarters, Air Force Doctrine Center, 1997), p. 69.

[24] McCrabb, Personal interview, 4 March 1998. The problem of rank differential could exist if a four-star general were to be operating in the ROSC, who could potentially outrank JTF commanders or JFACCs being supported in a contingency. Obviously, any suggestion made by the ACC commander would carry the weight of an order to the field commander.

[25] Colonel McCrabb concedes this possibility does and will exist.

[26] Such possibilities, though remote, would include hurricanes, tornadoes, earthquakes, floods, aircraft accidents, and the like.

[27] *ODIs*, ODI Number BF98-1-8.

[28] Carl DeFranco, e-mail to author, "DAOC Concept of Operations," <defranco@rl.af.mil>, 1 March 1998.

[29] Carl DeFranco, e-mail to author, "DAOC Concept of Operations," <defranco@rl.af.mil>, 1 March 1998.

[30] Ibid.

[31] Ibid.

[32] For a complete accounting of the Navy's problems receiving the ATO during DESERT SHIELD and DESERT STORM, see Gregory M. Swider, *The Navy's Experience with Joint Air Operations: Lessons Learned from Operations Desert Shield and Desert Storm* (Alexandria, VA: Center for Naval Analyses, 1993), especially pages 30-35.

[33] DeFranco, e-mail to the author, 4 March 1998.

[34] Ibid.

[35] DeFranco, e-mail to the author, 4 March 1998.

[36] DeFranco, e-mail, 3 March 1998.

[37] Ibid.

[38] DeFranco, e-mail, 4 March 1998.

[39] *Joint Warrior Interoperability Demonstration (JWID) 97 Guidebook*, "Executive Summary." See "Participating Demonstrations" section for a complete description of all of the technologies demonstrated.

[40] DeFranco, e-mail, 1 March 1998.

[41] Ibid.

[42] Cox, interview, 18 March 1998.

[43] DeFranco, e-mail, 1 March 1998.

[44] Randy Bright, Major, USAF, 612CPS/DOXP, telephone interview, Maxwell AFB, AL: SAAS, 21 January 1998.

[45] DeFranco, e-mail, 1 March 1998.

[46] DeFranco, e-mail, 3 March 1998.

[47] For example, Lt Gen Frank Campbell listed this as one of his primary reasons for wanting to be forward. Personal interview while at the AOC-Forward, Homestead ARS, FL, during BLUE FLAG 98-1, 17 November 1997.

[48] David Maldonado, "Expeditionary Force Exercise (EFX) 98," briefing slides, Davis-Monthan AFB, AZ: 12AF, January 1998, slide 5.

Notes

[49] Space Applications Corporation, *Concept of Operations for United States Air Force Expeditionary Force Experiment 98* (Vienna, VA: Space Applications Corporation, 1998), Section 3.0. Hereafter referred to as *EFX CONOPS*.

[50] Ibid., Section 3.1.

[51] Maldonado, "EFX 98," briefing slides, slide 10.

[52] This will also be the first large-scale test of the ROSC facility. Maris McCrabb, Colonel (retired), USAF, personal interview, Maxwell AFB, AL: SAAS, 3 March 1998.

[53] Ibid. The "Speckled Trout" aircraft is a Boeing 707 extensively re-configured to support robust communications testing and has room for the JFACC and approximately twenty staff members.

[54] Space Applications Corp., *EFX CONOPS*, Sections 8.0 and 8.1.

[55] Dave Maher, "EFX 98 Intrasite Communications Architecture," Davis-Monthan AFB, AZ: 612 ACOMS/SCXP, 16 March 1998.

[56] Space Applications Corp., *EFX CONOPS*, Section 5.3.1.

[57] Ibid., Section 5.3.2.

[58] Ibid., Section 5.3.2.3.

[59] The nomenclature for these staff positions mirror that of the Joint Staff directorates J-1 through J-6. A-1 is personnel, A-2 is intelligence, A-3 is current operations, A-4 is logistics, A-5 is plans, and A-6 is communications. "A" merely indicates "Air Staff," where the number indicates the specialty. For further details, see Armed Forces Staff College Publication 1, *The Joint Staff Officer's Guide 1993* (Norfolk, VA: Armed Forces Staff College, 1993), p. 2-14.

[60] Space Applications Corp., *EFX CONOPS*, Section 5.3.2.1.

[61] Ken Dahl and Bob French, personal interview, Hampton, VA: EFX Task Force, 19 March 1998.

[62] These subordinate agencies would include the elements of the TACS discussed in Chapter Two, such as ASOCs, CRCs, CREs, FACPs, AWACS, ABCCC, JSTARS, etc. *EFX CONOPS*, Section 5.3.3.

[63] Ibid., Section 5.3.3.1.

[64] *EFX CONOPS*, p. II-8-2, and Sections 5.3.2 and 5.3.3.

[65] David Maldonado, "Expeditionary Forces Experiment (EFX) 98," Briefing slides (Davis-Monthan AFB, AZ: 12AF, January 1998), p. 13.

[66] Kahao, "How We Fight," Briefing slides. Davis-Monthan AFB, AZ: 12AF, 4 February 1998.

[67] Personnel interviewed expressed concern that these numbers were being used as marketing ploys, when actual numbers would be considerably higher based on wartime conditions and when all reachback players were included. Gary Cox, Lt Col, USAF, personal interview, Barksdale AFB, LA: 8AF/CCG, 18 March 1998; James Welshans, Lt Col, USAF, personal interview, Barksdale AFB, LA: 8AF/A3-5, 18 March 1998; Jim Hartney, Colonel, USAF, personal interview, Shaw AFB, SC: 9AF/DO, 20 March 1998, and Randy Bright, Major, USAF, personal interview, Davis-Monthan AFB, AZ: 612 CPS/DOXP, 16 March 1998.

[68] Ibid.

[69] Ken Dahl and Bob French, Personal Interviews, Hampton, VA, 19 March 1998.

Notes

[70] David Maldonado, "Expeditionary Forces Experiment (EFX) 98," briefing slides, (Davis-Monthan AFB, AZ: 12AF, 1998), p. 22.

[71] The use of the "Speckled Trout" aircraft should probably not be included, since if a JFACC desired that capability, it would be an additional cost, regardless of what AOC configuration the JFACC used.

[72] Bright, Cox, Hartney, Welshans, Keck, Haseloff interviews.

[73] Hartney, Cox, Bright, Welshans, Keck, Campbell interviews. Lt Col Cox was especially concerned about this issue.

[74] In order to reduce any confusion due to potentially erroneous association with "The Army After Next," the "JFACC After Next" program name was changed to simply the "JFACC Program." However, since there are many JFACC programs, for purposes of clarity, in this study I will continue to refer to the "JFACC Program" by its original name — "JFACC After Next." Virginia Albert, e-mail to author, San Pedro, CA: Logicon Information Technologies Group, 14 April 1998.

[75] *Joint Forces Air Component Commander (JFACC) Program Operational Concept Description (OCD)* (San Pedro, CA: Logicon Information Technology Group, 1997), p. 1-3. Hereafter referred to as "*JFACC OCD*."

[76] Ibid.

[77] Current AOC processes are described as being sequential and hierarchical in that one level of leadership produces guidance that is then handed to a lower level for further action, until it is finally converted into an executable ATO. Ibid., p. 1-3.

[78] Ibid., p. 1-4.

[79] Ibid., p. 3-3.

[80] See Chapter Five for a brief discussion of Graham Allison's three decisionmaking models.

[81] *JFACC OCD*, p. 8-1.

Chapter 5

Summary, Conclusions, and Recommendations

If I had to pick the one lesson learned most often repeated, it is that trying to get someone to accept a new concept is very difficult, even when the benefits are obvious.

—Carl DeFranco
Rome Laboratories (DARPA)

It all comes down to bandwidth — think commercial or die!

—Major General John A. Corder, USAF (Ret.)
BLUE FLAG 98-1

When assessing the viability of the Split AOC paradigm, one must be aware that there is more at issue than simply the ability of technology to support split operations. Concomitantly, studies purporting to determine the optimum AOC configuration in a split, distributed, or collaborative environment may not always be what they appear. This paper has revealed that the routes along the *C^2 Roadmap* are fraught with potholes created by hidden agendas, as well as fissures occasioned by inadequate doctrine. Because only a few data points exist, this study cannot definitively determine the optimum configuration for split AOC operations. However, this chapter will point to some of the opportunities, as well as to several of the pitfalls characteristic of the various AOC configurations discussed in this study. This will leave it to the reader, and ultimately the JFACC, to decide, based on this information, what the best solution is to the particular problem at hand. In order to make this decision, the decisionmaker should be aware of all of the available facts. However, there are several "hidden agendas" that attend the Split AOC

paradigm. Therefore, this section uses Graham Allison's decisionmaking framework to dispassionately relate these underlying issues that currently shape perceptions of those involved with the Split AOC.

In *Essence of Decision,* Graham Allison develops three decisionmaking frameworks. Model One consists of decisions made by a leadership group functioning as a single, unitary actor, acting in the best interests of its organization (in the case of the military, the nation as a whole). Model Two decisionmaking processes are those made by resolutely following standard operating procedures with little deviation or situational flexibility. Model Three is characterized by competing Bureaucratic/Political pressures, in which interest groups within the organization compete for resources and prestige via "pulling and hauling." Decisions made in this model are for the good of the interest group, which may or may not coincide with the interests of the larger organization.[1]

Model One Concerns. Despite the ulterior motives influencing the Split AOC issue, there are many Model One arguments that significantly shape the debate. The seemingly "rational" benefits that proponents of a split AOC often tout include reduced forward footprint, lower manning requirements, more cost-effective employment, enhanced deployment flexibility, as well as improved AOC effectiveness. Equally important are the "rational" reasons not to split AOC operations. The major drawbacks include the potential vulnerability of critical communications links, limited interpersonal communications, and due to this restricted interaction, reduced efficiency.

Currently, the most significant benefit of split operations is a reduced forward footprint. As documented, the Split AOC does lower the number of personnel deployed forward. However, with currently available technology, the split operation appears to

increase overall AOC manning requirements. As experience with split operations grows, the process may be refined and supported by mature technology. Manning might then be streamlined. Until that time, JFACCs will have to be satisfied with reducing the forward AOC footprint and the jury will remain out on total personnel savings.

In the near term, cost savings may similarly prove to be a chimera. Fewer personnel and less equipment deployed forward may reduce costs; yet, a significant amount of equipment will still be necessary to ensure effective communication links. Of course, communications equipment requires support personnel.[2] Regardless of their location, costs — in terms of man hours — will rise if total personnel numbers increase, as they did in BLUE FLAG 98-1. Additionally, the Split AOC's dependence on communications preordains the purchase of large shares of commercial bandwidth (which may not always be available). These expenses, detailed in Chapters Three and Four, must be considered in any cost-benefit analysis, and — as we have seen — can be significant, especially as the length of the deployment increases. However, long-term reductions in personnel and equipment may eventually result in savings in command and control infrastructure requirements.

Because of the need for a large amount of communications equipment forward, expected savings in lift requirements may not materialize. Therefore, only a marginal improvement in deployment timing is likely. However, because the ROSC will be operating continuously from a fixed site, if used, it may yield an improvement in both deployment and setup time over a conventional, collocated AOC. In a similar fashion, the DAOC technologies, if they mature, may eventually allow reductions in personnel and

equipment. Still, some argue that a reduced forward footprint is largely a moot point from a personnel standpoint — what is important is a reduction in lift requirements.[3]

Offsetting these advantages are equally significant disadvantages of split operations. As evidenced by the data presented in Chapter Three, to date, every attempt at the Split AOC, regardless of its form, has in some way experienced communications difficulties. Whether it was due to hardware malfunctions or simply due to the electronic equipment's inherently limited ability to transmit non-verbal signals, elements of Split AOC operations impede communications. Efforts to insure redundancy and improve functionality, such as those demonstrated at UNIFIED ENDEAVOR (UE) 98-1, BLUE FLAG (BF) 98-1, and proposed for the EXPEDITIONARY FORCES EXERCISE (EFX) 98, go a long way toward resolving the problem.

The communications lifeline necessitated by split operations is undoubtedly a critical vulnerability, if not the Split AOC's "center of gravity." Initial experience in defending information attacks offers evidence that this weakness can be successfully managed. However, over the long term, the vulnerability cannot be totally eliminated. A determined and capable adversary may find a way to exploit this dependence or unforeseen malfunctions may unintentionally give the enemy a window of opportunity. Clearly, when considering split operations, one can probably not devote too much attention to communications vulnerabilities.

Present experience with the Split AOC has also not shown it to have a more efficient process than a traditional AOC. Intuitively, this appears logical, since a process that is developed and executed by codependent elements is likely to degrade if those components are separated. As noted from the results of BF 98-1, this may be a function

of training. Personnel new to the system apparently had less trouble adapting to the split process than did those steeped in traditional processes.[4] As of yet, however, technology has not proven capable of replicating direct, personal communications. This translates either to reduced effectiveness via outright miscommunications or to the intangible losses of synergy from geographically-separated interaction.[5] On the other hand, if developmental technologies successfully mature and make the AOC's processes more transparent, this may eventually mitigate these inefficiencies.

As of now, the JFACC cannot "have it all." No Split AOC configuration either tested or envisioned is able to offer all of the described "Model One" advantages without suffering some of its concomitant drawbacks. Also, many promised advantages of split operations have yet to materialize. Thus, based on the situation, the JFACC will be forced to accept tradeoffs in his AOC architecture. These "rational" choices will require the JFACC to balance the need for reduced forward presence and improved operational flexibility against the increased cost and manning requirements, reduced efficiency, and dependence on communications that split operations entail. These are not easy choices. Unfortunately, however, these are not the only issues that may influence the JFACC's ultimate decision.

Model Two Concerns. The inefficiencies induced by splitting codependent elements are typical of common "Model Two" concerns asserted about the split paradigm. An argument exists that it is inherently inefficient to divide an organization intended to function together. As shown during BLUE FLAG 98-1, splitting core teams caused them to "self-replicate" their missing elements, leading to duplication of effort and increased stress on the already busy forward members. In order to avoid this tendency, traditional

AOC processes may require reassessment. Obviously, changes in the battle rhythm due to the increased communications requirements are inevitable. Many of the current briefings may be eliminated in future experiments, the battle rhythm itself may require adjustment, and entirely new processes may evolve to match emerging capabilities. As noted by Chris Christon and John Lewis (civilian analysts contracted by General Willhelm, CINCSOUTH to observe BF 98-1), conducting VTC briefings and passing files back and forth will probably have to suffice in the short term, but are too resource intensive and untimely to keep pace in the long run with the demands of modern warfare. Quick process and equipment fixes will help smooth some of the rougher edges, but a thorough re-engineering… will be necessary if distributed combat planning and execution are to be supported effectively.[6]

Air and Space Command and Control Agency (ASC2A) personnel echo this conviction in their review of BF 98-1:

> It's clear many of our people are wrongly seeking to apply conventional thought to model distributed operations after the way we do our business today. "Out of the box" innovative thought must occur to reexamine every aspect of the people, process, and technology of air campaign distributed operations. For example, do we need to have plans and current ops functions; do we really need to brief the JFACC as we do now, throughout the daily ATO cycle?[7]

If our processes do not adapt to new capabilities, the Split AOC appears doomed, regardless of technological maturation. However, there is still more at issue that merely breaking out of our "conventional mindset," or as Carl DeFranco quipped, "getting someone to accept a new idea… even when the benefits are obvious."[8]

Model Three Concerns. During the course of this research, a great deal of Bureaucratic-Political "pulling and hauling" was evident. The foci of these disputes was

essentially control of airpower and financial remuneration. These clashes alternately pit the Air Force against the other services, Air Combat Command (ACC) against the NAFs, and finally, the NAF operational leadership (JFACCs and senior AOC directors) against various information technology contractors.

The most evident dispute is that of the continuing Air Force concern that air assets will be mismanaged by Army and other service personnel. This concern begets the perceived need for the JFACC to collocate with the JFC in significant number — and be of sufficient rank — to ensure that the JFC gives airpower a fair hearing. Those concerned with this issue tend not to be in favor of splitting the JFACC from his staff (or even splitting the AOC at all), and certainly do not favor sending a lower-ranking liaison officer (LNO) forward in place of the JFACC.[9]

The ongoing battle between the NAFs and ACC over control of combat operations will also be significant in shaping future AOC choices. Some present and former NAF leaders[10] feel that despite doctrinal designation as the USAF's primary warfighters, ACC is using the "salami method"[11] to usurp their warfighting functions through the ROSC. Moreover, just as they are concerned about being overwhelmed in the face of Army influence before the JFC, NAF personnel fear that the JFACC will be affected by high-ranking personnel influencing a lower-ranking deputy left in the rear. Thus, as a general position, the NAFs feel that any "garrison reachback" capability should reside within the NAFs. If a ROSC is used, as a general position, the NAFs believe that it should only handle ADCON functions traditionally performed by the AFFOR-rear. Certainly, the potential exists for this type of interference. As an interim solution, current ACC

leadership has established procedures intended to avoid interfering with NAF warfighting processes. Until then, only actual experience will reveal if the NAF fears are justified.

Finally, concerns surfaced about technology "push" instead of requirements "pull." The essence of this argument is that contractors are looking for a market in the absence of a validated command requirement. In turn, some NAF personnel fear that contractors may unduly bias the opinions of senior decisionmakers to support split operations without objectively demonstrating their effectiveness. "Just because we can execute split operations doesn't mean that we should" noted the ROSC-rear director-designate for EFX 98.[12] Although this survey sampled only a small percentage of those involved in AOC operations, it appears significant that the only ones in favor of split operations were contractors and those with a vested interest in the ROSC. Those who would actually have to use the concepts for warfighting were adamantly opposed. The *Vision for Aerospace Command and Control for the 21st Century* does establish a requirement for smaller, more easily-deployable, forward command and control structure. However, it does not necessarily follow that split operations are the only way of meeting this requirement. Future development may yield a solution that truly does offer it all. However, due to the length of our acquisition cycle and likely future funding constraints, we may have to live for a long time with what we buy today. Thus, extensive, objective analysis should precede rashly purchasing any "contractor-pushed" solution that is largely based on yet to be delivered promises. What this debate makes patently clear, however, is the need for controlled tests in an operational environment before making long-term funding decisions. In addition, as the next section discusses, doctrinal codification of split

responsibilities may offer a more permanent solution to many of the previously described procedural difficulties.

Doctrinal Gaps and Proposed Putty

In addition to the hidden agendas affecting the future of the Split AOC, this study discovered something perhaps more profound. Several major doctrinal gaps exist with respect to AOC operations. These include the Split AOC paradigm itself (whether that involves distributed operations from multiple sites or simply a functional split between two operating locations), the optimal location for the JFACC, (either forward or rear), as well as the issue of control over components of geographically-separated operations.

As discussed in Chapters One and Two, there is no doctrinal basis for any type of split or distributed AOC operation. All Joint and Service doctrine, when it discusses the AOC, assumes it to be a single, unified entity. In the absence of definitive guidance, individual services — indeed even components within a single service — have no frame of reference from which to draw recommendations about when, how, or even if AOC operations should be divided. In a modern-day case of putting the cart before the horse, the ROSC is already being built, yet no doctrinal guidance exists on its function or the degree of control it should have (if any) over forward operations. Likewise, even the Combat Air Force NAFs have no standard on AOC operations. Only 12AF has a draft SOP that addresses a potential split between forward and rear elements. 8AF and 9AF currently do not even address the possibility. Clearly, the Air Force and the joint community would benefit from a standardized doctrinal framework to cover the possibilities now afforded by technology.

Although a volatile issue between the NAFs and ACC, the same deafening doctrinal silence exists over the issue of control of forward and rear operations. Joint doctrine specifically details that COCOM flows through the CINC to the JFACC and his assigned or attached forces, whereas ADCON is the responsibility of the service components providing these forces to the CINC.[13] Air Force Doctrine additionally specifies the NAFs as its primary warfighters.[14] However, with a ROSC located at ACC headquarters, the potential exists for these lines to become blurred. As discussed in Chapter Four, the current ACC commander and his staff are aware of this possibility and are working to avoid the perception of loss of forward control through unwritten procedures. Because of the personality-dependent nature of this agreement, specifically addressing this area in doctrine could preclude future difficulties. An appropriate place would probably be in both *AFDD 2* (which incorporates much of the guidance found in the *"Little Red Book"*) and the *JFACC Primer*.

Finally, as observed in Chapter One, although Joint and most service doctrine solidly cover the JFACC's roles and responsibilities, all fail to mention where the JFACC should be located. There are certainly numerous advantages to being collocated with both the CINC/JFC and the AOC. However, for all of the reasons mentioned in Chapter Two, this will not always be possible. Therefore, both Joint and Service doctrine should capture this study's recommendations, and explain that when collocation is impossible, various split and distributed options exist, with a summary of their associated advantages and disadvantages. Although doctrine should not stifle a combat leader's individual prerogative, addressing the issue would at least provide a framework upon which a CINC or JFACC could base their choices.

Overall Assessment. In sum, it appears that while Split AOC operations are possible with the current technology, at present they are clearly less efficient than those of a "traditional" AOC. However, as shown by the varied requirements of the exercises listed in Chapter Three and Four — in addition to actual survivability concerns and political limitations — it is equally clear that there are times that Split AOC operations will be required. Toward this end, continuing evaluations should be conducted in order to determine the most efficient manner of operating a Split AOC.

The evidence presented herein offers an example of almost every conceivable AOC configuration. NTC CONOPS and UE 97-1 illustrated examples of operations with a JFACC and an AOC-rear with a LNO team forward. UE 98-1 moved the JFACC forward with the LNOs, but kept the entire AOC in the rear. UE 95 and BF 98-1 offered different methods of splitting AOC processes between forward and rear locations, while the JFACC was forward, collocated with the JFC. JTFEX 97-1 used a JFACC afloat, linked via satellite communications to an AFFOR AOC ashore. The Distributed Air Operations Center (DAOC), showcased during the Joint Warfighting Interoperability Demonstrations (JWID) from 1995-97, explored how operations could be conducted at multiple locations simultaneously, even extending to an airborne JFACC, transiting the battlespace.

While not enough objective evaluation of split operations has occurred to support a conclusive recommendation, a few observations are possible, based on the experience to date. In most conflicts, the historical solution has been to deploy the entire AOC forward. Doing so may be more efficient from an operational standpoint, but in a high-threat environment, it might be less survivable and will require more lift support to get there. This can cause the AOC to take longer to reach the action and may force tradeoffs among

equipment and personnel competing for lift priority. On the other hand, keeping the entire operation in the rear may enhance survivability, but it also appears to increase communications requirements and may result in an inefficient use of airpower if the JFACC cannot communicate effectively with the JFC. Moreover, geographic separation makes it more difficult for the JFACC and the JFC to cultivate a close working relationship. Any AOC configuration between these extremes currently requires tradeoffs between survivability or efficiency.

From the available data, if a split is necessary, the most reasonable compromise appears to be to place the JFACC and Combat Operations forward, with Combat Plans in the rear, while dividing Strategy, Intelligence, Air Mobility Division, and other LNOs between the two locales. Strong rationale exists for having Combat Operations within UHF radio range of current operations in order to enable C^2 to continue if communications links between the forward and rear locations are severed. Likewise, if survivability concerns are paramount, there appears to be little reason to have the ATO production efforts exposed forward. However, this split operation is the most complex AOC option and requires detailed communications planning and extensive procedural preparation to minimize its inherent inefficiencies.

As Lieutenant General Frank Campbell — BLUE FLAG 98-1 JFACC and former commander of 12AF — noted upon completion of BF 98-1, "our Split AOC operations is the start of a long road. We can not declare victory yet."[15] Further experimentation is clearly needed in order to determine the optimum split configuration. The "best" configuration is yet to be determined and will probably always vary depending on the

nature of the contingency, the technological capabilities, and the personality of the JFACC.

While Split AOC operations are generally undesirable, in some situations they will be inevitable. As CHECKMATE personnel noted, "the forward-rear AOC concept may become less of an option and more of a necessity in the near future."[16] Prudence dictates that the AF *should* develop a Split AOC capability as another weapon in its arsenal to deal with the unexpected. Yet, from the limited data currently available, it appears that Split AOC operations should remain a contingency — given its inefficiencies — and applied only in the face of compelling operational necessity. With current technology, doctrine and AOC processes, split AOC operations should not become the automatic answer to every operational challenge.

It also appears that there is no one "best" way to split the AOC. Each JFACC will have to weigh the relative merits of each situation, while understanding the drawbacks of the potential options. Although each configuration has its tradeoffs, they all depend on communications technology to operate. Decisionmakers must insure that we have not become so reliant on a single technology that we trade one liability (large forward footprint) for another (electronic communications) and correspondingly set ourselves up for an asymmetric attack. Finally, the doctrinal gaps cry for putty. Only with a smooth foundation, should detailed and objective evaluation of the competing concepts proceed, in order to avoid either remaining inflexibly committed to the traditional paradigm or myopically championing parochial self-interests. Hopefully, dispassionate analysis will enable us to determine how far we really should stretch the umbilical cord to support future, embryonic contingencies. In turn, this will serve the interests of the nation as a

whole, while balancing Twenty-First Century military requirements with near-term political realities.

Notes

[1] See Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis* (Boston, MA: HarperCollins Publishers, 1971) for a complete description of these models.

[2] Kahao, "How We Fight," slides 15-17.

[3] Colonel Hugh Smith: "With 40-50000 troops already deployed, what's 1100 more?" and Colonel Jim Hartney: "Generally anyone asking us in will not be concerned about AOC size in relation to the number of other assets." Smith, personal interview, Davis-Monthan AFB, AZ: 12AF/DO, 16 March 1998 and Hartney, personal interview, Shaw AFB, SC: 9AF/DO, 20 March 1998.

[4] *ODIs*, ODI BF98-1-96.

[5] Examples of this type of synergy include group members spontaneously interjecting ideas or making comments on the work of others, which might not be possible if the members are geographically separated and limited solely to electronic interaction.

[6] Chris Christon and John Lewis, "Trip Report: BLUE FLAG 98-1" (Colorado Springs, CO: Autometric, Inc., undated), p. 10.

[7] ASC2A/C2TIC, "Distributed Operations Quick Look for BLUE FLAG 98-1" (Hurlburt AFB, FL: ASC2A/C2TIC, 27 February 1998), p. 1.

[8] Defranco, e-mail, 4 March 1998.

[9] See previous assessment of UNIFIED ENDEAVOR 97-1.

[10] Specifically, Lt Gen Frank B. Campbell, Maj Gen Thomas Keck, and Colonel Jim Hartney. See previously cited personal interviews. Maj Gen (ret.) John Corder also expressed this concern. John Corder, Major General (ret.) USAF, personal interview, Homestead ARS, FL: BF 98-1 AOC-F, 18 November 1997.

[11] The "salami method" connotes taking control bit by bit, much as one would slice a salami. In this case, the NAFs feel that ACC is attempting to periodically slice off sections of NAF functions, and that eventually there will be nothing left for the NAFs.

[12] Hartney, interview, 20 March 1998.

[13] *JP 3-0*, p. II-6, 7.

[14] "LRB," p. 5.

[15] General Campbell e-mail to General R. Hawley (ACC/CC), "BLUE FLAG 98-1 ENDEX Message to COMACC, 3 December 1997.

[16] CHECKMATE Observations, BLUE FLAG 98-1 (Execution Phase), undated, p. 1

Bibliography

Official Documents

A National Security Strategy For A New Century. Washington, DC: The White House, 1997.

Armed Forces Staff College. *Armed Forces Staff College Publication 1, The Joint Staff Officer's Guide 1993*. Norfolk, VA: Armed Forces Staff College, 1993.

Gulf War Airpower Survey. *Volume II, Operations and Effectiveness*. Washington, DC: U. S. Government Printing Office, 1993.

_____. *Volume III, Logistics and Support*. Washington, DC: U. S. Government Printing Office, 1993.

United States Air Force. *Air Force Doctrine Document 1, Air Force Basic Doctrine*. Maxwell AFB, AL: Headquarters, Air Force Doctrine Center, 1997.

_____. *Air Force Doctrine Document 2* (Draft, Version 10). Maxwell AFB, AL: Headquarters, Air Force Doctrine Center, 1998.

_____. *Air Force Instruction 13-AOC, Volume 1* (Draft). Washington, DC: Headquarters USAF/XOCE, 1998.

_____. *JFACC Primer*, 2d ed. Washington, DC: Department of the Air Force, 1994.

United States Air Force 602D Tactical Air Control Wing. *History of the 602D Tactical Air Control Wing, 12th Air Force, Tactical Air Command, Bergstrom, AFB, TX 1 January — 30 June 1979* (U). Bergstrom AFB, TX: Office of History, 602D Tactical Air Control Wing, 3 August 1979 [SECRET].

_____. *History of the 602D Tactical Air Control Wing, 12th Air Force, Tactical Air Command, Bergstrom AFB, TX 1 October 1980 — 31 March 1981* (U). Bergstrom AFB, TX: Office of History, 602D TAIRCW, 1981 [SECRET].

United States Air Force 836th Air Division. *History of the 602D Tactical Air Control Wing 1 January — 31 March 1982* (U). Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1982 [SECRET].

_____. *History of the 602D Tactical Air Control Wing 1 April — 30 September 1982* (U). Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1982 [SECRET].

_____. *History of the 602D Tactical Air Control Wing 1 October 1982 — 31 March 1983* (U). Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1983 [SECRET].

_____. *602D TAIRCW History, 1 October 1983 — 31 March 1984 (U)*. Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1984 [SECRET].

_____. *602D TAIRCW History, 1 April — 30 September 1984 (U)*. Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1984 [SECRET].

_____. *602D TAIRCW History 1 April — 30 September 1986 (U).* Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1986 [SECRET].

_____. *602D TAIRCW History 1 January — 31 December 1988 (U).* Davis-Monthan AFB, AZ: 836th Air Division Office of History, 1988 [SECRET].

United States Air Force Air Combat Command (ACC). *Status of Resources and Training System (SORTS) Designed Operational Capability (DOC) Statement for Twelfth Air Force*. Langley AFB, VA: Headquarters ACC, 1 January 1998.

United States Air Force Battlestaff Training School (USAFBTS). "Exercise BLUE FLAG 98-1 Observations, Deficiencies, and Issues Data Review." Hurlburt Field, FL: USAFBTS, 1997.

United States Air Force Combat Air Forces. *Presentation of USAF Forces* ["*Little Red Book*"]. Langley AFB, VA: Combat Air Forces, 1997.

United States Air Force Eighth Air Force. *History of the Eighth Air Force 1 January to 31 December 1995* (U). Barksdale AFB, LA: 8AF/HO, 13 February 1997 [SECRET].

_____. *History of the Eighth Air Force 1 January to 31 December 1996* (U). Barksdale AFB, LA: 8AF/HO, 5 February 1998 [SECRET].

United States Air Force Tactical Air Command. *Tactical Air Command (TAC)/Pacific Air Forces (PACAF)/United States Air Forces Europe (USAFE) Pamphlet 2-2, Joint Force Air Component Commander (JFACC) Concept of Operations*. Langley AFB, VA: Headquarters TAC, 28 August 1991.

_____. "TAC Concept of Operations, Modular Tactical Air Control Center." Langley AFB, VA: Headquarters TAC/DOY, 1990.

_____. *TAC Regulation 23-2, Tactical Air Command Numbered Air Forces*. Langley AFB, VA: Headquarters TAC, 6 December 1990.

United States Air Force Tactical Air Command Directorate of Command and Control. *The Tactical Air Forces Integrated Command and Control Structure (TAFICCS) Requirements Plan*. Langley Air Force Base, VA: Tactical Air Command, Directorate of Command and Control, 1970.

United States Air Force Twelfth Air Force. *Twelfth Air Force Air Force Forces Air Operations Center Standard Operating Procedures*. Davis-Monthan Air Force Base, AZ: 12AF/DOYI, 1997.

_____. *Twelfth Air Force Air Force Forces Air Operations Center Standing Operations Procedures*. Proposed annex to Chapter 3, "Strategy Division," Section 6 "Split AOC Operations" (Draft). Davis-Monthan AFB, AZ: 612 CPS/DOXP, 1997.

_____. *History of Headquarters Twelfth Air Force for 1993* (U). Davis-Monthan AFB, 12AF/HO, 1993 [SECRET-NO FOREIGN NATIONALS].

United States Air Force Scientific Advisory Board. *Vision of Aerospace Command and Control for the 21st Century*. Washington, DC: USAF Scientific Advisory Board, 1996.

United States Army. *Field Manual 55-15, Transportation Reference Data*. Washington, DC: Headquarters, Department of the Army, 1968.

_____. *Field Manual 71-100, Division Operations*. Washington, DC: Headquarters, Department of the Army, 1996.

_____. *Field Manual 100-15, Corps Operations*. Washington, DC: Headquarters, Department of the Army, 1998.

United States Army Communications-Electronics Command. *Command, Control, Communications and Intelligence (C3I): Project Book*. Monmouth, NJ: U. S. Army Communications-Electronics Command, 1992.

United States Army Training and Doctrine Command (TRADOC). *TRADOC Pamphlet 525-5, Force XXI*. Fort Monroe, VA: Headquarters U. S. Army Training and Doctrine Command, 1 August 1994.

_____. *TRADOC Pamphlet 525-72, Army Airspace Command and Control (A2C2) Operations Concept*. Fort Monroe, VA: Headquarters U. S. Army Training and Doctrine Command, 1 June 1996.

United States Central Command Air Forces (USCENTAF). *USCENTAF Instruction 10-105, Air Operations Center Organization and Functions*. Shaw AFB, SC: Headquarters, USCENTAF, 8 February 1996.

United States Department of Defense. *Conduct of the Persian Gulf War: Final Report to Congress (Pursuant to Title V of the Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991).* Washington, DC: U. S. Government Printing Office, 1992.

United States Joint Chiefs of Staff. *Concept for Future Joint Operations: Expanding Joint Vision 2010*. Washington, DC: Joint Chiefs of Staff, May 1997.

_____. *Joint Doctrine Capstone and Keystone Primer*. Washington, DC: Joint Chiefs of Staff, 1997.

_____. *Joint Mission Essential Task List (JMETL) Development Handbook.* Washington, DC: Joint Chiefs of Staff, 1995.

_____. *Joint Publication 0-2, Unified Action Armed Forces (UNAAF)*. Washington, DC: Joint Chiefs of Staff, 1992.

_____. *Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms*. Washington, DC: Joint Chiefs of Staff, 1998.

_____. *Joint Pub 3-0, Doctrine for Joint Operations*. Washington, DC: Joint Chiefs of Staff, 1995.

_____. *Joint Publication 3-56, Command and Control for Joint Operations.* Washington, DC: Joint Chiefs of Staff, 1994.

_____. *Joint Publication 3-56.1, Command and Control for Joint Air Operations.* Washington, DC: Joint Chiefs of Staff, 1994.

_____. *Joint Warrior Interoperability Demonstration 1997 Guidebook.* Washington, DC: Joint Chiefs of Staff/J-6, 1997.

_____. *Universal Joint Task List*. Washington, DC: Joint Chiefs of Staff, 1996.

United States War Department. *Field Manual 100-20, Command and Employment of Air Power*. Washington, DC: U. S. War Department, 1943.

Books and Periodicals

Allison, Graham T. *Essence of Decision: Explaining the Cuban Missile Crisis*. Boston, MA: HarperCollins Publishers, 1971.

Baran, Paul. *Some Remarks on Digital Distributed Communications Networks*. Santa Monica, CA: RAND, 1967.

Blumenson, Martin. *The Patton Papers*. Boston: Houghton Mifflin, 1974.

Blunden, Robert J., Jr. *Tailoring the Tactical Air Control System for Contingencies*. Maxwell AFB, AL: Air University Press, 1992.

Bryant, Melrose M. *Command and Control*. Maxwell AFB, AL: Air University Press, 1975.

Buchanan, Thomas H. *The Tactical Air Control System: Its Evolution and Its Need for Battle Managers*. Maxwell AFB, AL: Air University Press, 1987.

Clark, E. B. et. al. *Tactical Air Control Functional Distribution Options*. 2 vols. Hanscom AFB, MA: Electronic Systems Command/Air Force Systems Command, 1986.

_____. *21st Century Tactical Command and Control Study (TC^2-21).* 2 vols. Hanscom AFB, MA: Electronic Systems Command/Air Force Systems Command, 1985.

Clodfelter, Mark A. *The Limits of Airpower*. New York: Free Press, 1989.

Cooling, Benjamin F., ed. *Case Studies in the Development of Close Air Support*. Washington, DC: Office of Air Force History, 1990.

Coble, Henry Joe. *JFACC: What is the Impact of the USAF Composite Wing?* Newport, RI: College of Naval Command and Staff, 1992.

Daniels, Bob. *Blue Flag Distributed Wargaming System*. Griffiss AFB, NY: Synectics Corporation/Rome Laboratory, 1992.

Dixon, Howard L. *The Impact of Technology on the Future Tactical Air Control System*. Maxwell AFB, AL: Air Command and Staff College, 1977.

Downer, Lee A. "The Composite Wing in Combat." *Airpower Journal*, Winter 1991, p. 5.

Futrell, Robert. *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1907-1960, Volume I*. Maxwell AFB, AL: Air University Press, 1989.

Goodell, Dale L. *Modular Control Equipment: Concept of Operations for the European Tactical Air Control System*. Maxwell AFB, AL: Air University Press, 1987.

Harlan, Terri J. and Richard B. Clark. *Operational Effectiveness Demonstration of the AN/TSQ-165 Modular Tactical Air Control Center (MTACC) Special Project Final Report*. Eglin AFB, FL: USAF Air Warfare Center, 1992.

Hawken, A. V. B. *Follow-On Force Attack — Now and in the Future*. Maxwell AFB, AL: Air University Press, 1990.

Hawkins, Terry L. *National Command and Control*. Maxwell AFB, AL: Air University Press, 1980.

Holland, Robert E. *Hidden Costs in Automated Command and Control Systems*. Maxwell AFB, AL: Air Command and Staff College, May 1971.

Holley, I. B., Jr., and John Terraine. "Joint RAF/USAF Seminar: Part III, Mediterranean and Northwest Theaters." *Air Power History*, Winter 1991, p. 30-42.

Huested, Patrick W. *Unit Command Post Upgrade Phase I Qualification Operational Test and Evaluation*. Eglin AFB, FL: USAF Air Warfare Center, 1992.

Johnson, Stuart E. and Alexander H. Levis, eds. *Science of Command and Control: Coping with Uncertainty.* Fairfax, VA: AFCEA International Press, 1988.

_____. *Science of Command and Control: Part II, Coping with Complexity.* Fairfax, VA: AFCEA International Press, 1989.

Kasputys, J. *Distributed Operations Survivability Evaluator (DOSE*). Hanscom AFB, MA: The Mitre Corporation, 1983.

Keaney, Thomas A. and Eliot A. Cohen. *Revolution in Warfare?* Annapolis, MD: Naval Institute Press, 1995.

Kincaid, Gregory R. and Richard A. Poligala. *An Independent Evaluation of Information Systems Support of the Joint Forces Air Component Commander Concept of Operations*. Wright-Patterson AFB, OH: Air Force Institute of Technology, 1993.

Krepinevich, Andrew. *The Army in Vietnam*. Baltimore, MD: Johns-Hopkins Press, 1986.

Labash, Matt. "The Scapegoat: How the Secretary of Defense Ended the Career of an Exemplary Air Force General." *The Weekly Standard*, November 24, 1997, p. 20-9.

Layman, Arch H. *Tactical Control Squadron/Tactical Control Flight Commander's Handbook on Ability to Survive and Operate*. Maxwell AFB, AL: Air Command and Staff College, 1987.

Levis, Alexander. H. and Ilse. S. Levis, eds. *Science of Command and Control: Part III, Coping with Change*. Fairfax, VA: AFCEA International Press, 1994.

Logicon Information Technology Group. *Joint Forces Air Component Commander Program Operational Concept Description*. San Pedro, CA: Logicon, 1997.

_____. *JFACC Plan Generation (PlanGen) Operational Concept Description*. San Pedro, CA: Logicon, 1997.

McNamara, Stephen J. *Air Power's Gordian Knot: Centralized Versus Organic Control.* Maxwell AFB, AL: Air University Press, 1994.

McPeak, Merrill A. "For the Composite Wing." *Airpower Journal*, Fall 1990, p. 4-12.

Manwaring, Max G. and John T. Fishel. "Insurgency and Counter-Insurgency: Toward a New Analytical Approach" in *Small Wars and Insurgencies* (SAAS Reprint). London: Frank Cass, 1992.

Martin, Terry L. *Command Control and Communications Mission and Organization: A Primer*. Monterey, California: Naval Postgraduate School, 1984.

Mayer, Michael G. *The Influence of Future Command, Control, Communications, and Computers (C4) on Doctrine and the Operational Commander's Decision-Making Process*. Newport, RI: College of Naval Command and Staff, 1996.

Meilinger, Phillip A. *10 Propositions Regarding Airpower*. Washington, DC: Office of Air Force History, 1996.

Moore, Daniel E., Jr. "Bosnia, Tanks, and ' …From the Sea'." *Proceedings*, December 1994, p. 42-5.

Nelson, Michael A. "A Commander's View of Command and Control" in A. H. Levis and Levis, I. S. eds., *Science of Command and Control: Part II Coping with Change*. Fairfax, VA: AFCEA International Press, 1994, p. 6-10.

Nugent, Mark H. *Tactical Air Control System (TACS) Concept of Employment in NATO's Central Region*. Maxwell AFB, AL: Air War College, 1982.

Odell, David A. "The Next Generation: Problems and Possibilities in Command and Control for the Unified and Specified Commands." Carlisle Barracks, PA: U. S. Army War College, January 1967.

RAND Corporation. *A Strategic Battle Management Concept*. Santa Monica, CA: RAND Corporation, 1978.

_____. *Some Remarks on Digital Distributed Communications Networks*. Santa Monica, CA: RAND Corporation, 1967.

Rechtenback, Charles. *The Tactical Air Operations Center*. Maxwell AFB, AL: Air Command and Staff College, 1980.

Reynolds, Richard T. *Heart of the Storm*. Maxwell AFB, AL: Air University Press, 1995.

Russ, Robert D. "The Eighty Percent Solution." *Air Force Magazine*, January 1991, p. 60-2.

Science Applications International Corporation. *21st Century Tactical Command and Control Study (TC2-21)*, 2 vols. Washington, DC: Defense Advanced Research Projects Agency, 1985.

Simpkin, Richard E. *Race to the Swift*. London: Brassey's Defence Publishers, 1985.

Sink, J. Taylor. *Rethinking the Air Operations Center: Air Force Command and Control in Conventional War*. Maxwell AFB, AL: School of Advanced Airpower Studies, 1994.

Space Applications Corporation. *Concept of Operations for United States Air Force Expeditionary Force Experiment 98*. Vienna, VA: Space Applications Corporation, 1998.

Stanford Research Institute. *Marine Tactical Command and Control Study Functional System Requirements*. 7 vols. Menlo Park, CA: Naval Warfare Research Center, 1966.

Sunderland, Riley. *Evolution of Command and Control Doctrine for Close Air Support*. Washington, DC: U. S. Air Force Historical Research Center, 1973.

Swider, Gregory M. *The Navy's Experience with Joint Air Operations: Lessons Learned from Operations DESERT SHIELD and DESERT STORM*. Alexandria, VA: Center for Naval Analyses, 1993.

Syrett, David. "Northwest Africa, 1942-1943." In *Case Studies in the Achievement of Air Superiority*, ed. Benjamin F. Cooling, 223-263. Washington, DC: Office of Air Force History, 1994.

_____. "The Tunisian Campaign, 1942-1943. In *Case Studies in the Development of Close Air Support*, ed. Benjamin F. Cooling, 153-192. Washington, DC: Office of Air Force History, 1990.

Tillotson, David III. *Restructuring the Air Operations Center: A Defense of Orthodoxy*. Maxwell AFB, AL: Air University Press, 1993.

U. S. Army Communications-Electronics Command. *FY 93-95 Command, Control, Communications, and Intelligence (C3I) Project Book*. Fort Monmouth, NJ: U. S. Army Communications-Electronics Command, 1995.

Van Creveld, Martin. *Command in War*. Cambridge, MA: Harvard University Press, 1985.

Wexlar, Maurice P. et. al. *Modular Operations Concept Study*. 2 vols. Griffiss AFB, NY: Rome Air Development Center, 1981.

Willcox. A. M., M. G. Slade and P. A. Ramsdale. *Command, Control, and Communications (C3).* New York: Brassey's Defence Publishers, 1983.

Williamson, Porter B. *I Remember General Patton's Principles*. Tucson, AZ: Management and Systems Consultants, Inc., 1979.

Wilt, Alan F. "Allied Cooperation in Sicily and Italy, 1942-1943." In *Case Studies in the Development of Close Air Support*, ed. Benjamin F. Cooling, 193-236. Washington, DC: Office of Air Force History, 1990.

Wright, John J. "Command and Control of Theater Forces: Adequacy." Maxwell Air Force Base, AL: Air Command and Staff College, April 1988.

Unpublished Sources

Air and Space Command and Control Agency (ASC2A)/Command and Control Technical Innovation Center (C2TIC). "Distributed Operations Quick Look for BLUE FLAG 98-1." Langley AFB, VA: ASC2A/C2TIC, 27 February 1998.

Britten, Scott M. "Reachback Operations for Improved Air Campaign Planning and Control (Draft)." Unpublished Air War College Thesis. Maxwell AFB, AL: Air War College, 1997.

Christon, Chris and John Lewis. "Trip Report: BLUE FLAG 98-1." Colorado Springs, CO: Autometrics, Inc., undated.

Corum, James S. "The Air War in El Salvador." Unpublished monograph. Maxwell AFB, AL: School of Advanced Airpower Studies, 1997.

Dean, Thomas. "Interviews/Observations Reference Split AOC Ops BF 98-1." Hurlburt Field, FL: ASC2A, 26 November 1997.

Headquarters, USAF/XOOCD. "CHECKMATE Observations, BLUE FLAG 98-1 (Execution Phase). Washington, DC: HQ USAF/XOOCD, undated.

Mayer, Michael G. "The Influence of Future Command, Control, Communications, and Computers on Doctrine and the Operational Commander's Decision-making Process." Unpublished College of Naval Command and Staff Research Paper. Newport, RI: U. S. Naval War College, 6 March 1996.

McCrabb, Maris. "The Evolution of NATO Air Doctrine." Unpublished monograph. Maxwell AFB, AL: School of Advanced Airpower Studies, undated.

Owen, Robert C., Colonel, USAF. "Summary of the Air University Balkans Air Campaign Study." Unpublished course handout, Maxwell AFB, AL: School of Advanced Airpower Studies, November 1997.

Electronic Sources

Albert, Virginia. "JFACC After Next." E-mail to author. San Pedro, CA: Logicon Information Technologies Group, 2 March 1998.

_____. "JFACC Program." E-mail to author. San Pedro, CA: Logicon Information Technologies Group, 14 April 1998.

Air and Space Command and Control Agency. Internet Web Site, <http://wwwmil.acc.af.mil/asc2a/info.htm>.

Barno, David W. "JFACC Cell at JTASC/UE 98-1." Electronic mail to Colonel Kevin Kennedy (8AF/A3-5), 6 September 1997.

Bright, Randy, Major, USAF. "Split AOC Decision Brief." Electronic copy of briefing slides. Davis-Monthan AFB, AZ: 612 CPS/DOXP, 27 October 1997.

Campbell, Frank B., Lieutenant General, USAF. "BLUE FLAG 98-1 ENDEX Message to COMACC." E-mail to General R. Hawley, ACC/CC. Davis-Monthan AFB, AZ: 12AF/CC, 3 December 1997.

Cox, Gary. "UE 98-1 Postmortem." E-mail to 8AF/CC (General P. Ford). Barksdale AFB, LA: 8AF/CCG, 10 November 1997.

_____. "UE CINCUSACOM TRAINING REVIEW." E-mail to 8AF/CC (General P. Ford). Barksdale AFB, LA: 8AF/CCG, 2 December 1997.

DeFranco, Carl. "DAOC Concept of Operations." E-mail to author. Griffiss AFS, NY: Rome Laboratories, 1 March 1998.

_____. E-mail to author. Griffiss AFS, NY: Rome Laboratories, 3 March 1998.

_____. E-mail to author. Griffiss AFS, NY: Rome Laboratories, 4 March 1998.

Fouse, Scott. "JFACC Vision Brief (Draft)." Briefing slides. San Pedro, CA: Logicon Information Technologies Group, 18 March 1998.

George, Kenneth. "BLUE FLAG 98-1 Lessons Brief." Electronic copy of briefing slides. Davis-Monthan AFB, AZ: 12AF/DOXE, undated.

Hobba, Mark E. "C2 Roadmap." E-mail to author. Langley AFB, VA: Air and Space Command and Control Agency, 22 March 1998.

Junge, Ron, Colonel, USAF. "Rear Operations Support Center Concept of Operations (Draft)." Electronic copy of briefing slides. Langley AFB, VA: Air and Space Command and Control Agency, undated.

Kahao, Martin A., Lt Col, USAF. "How We Fight." Electronic copy of briefing slides. Davis-Monthan AFB, AZ: 612CPS/DOXO, 4 February 1998.

_____. "12AF Initial Draft 7FVX1 UTC: Generic AOC Baseline." Electronic copy of spreadsheet. Davis-Monthan AFB, AZ: 612CPS/DOXO, 17 March 1998.

Lauritzen, Kris. "BLUE FLAG 98-1 EXECUTIVE SUMMARY." Message. Hurlburt Field, FL: 505 Command and Control Evaluation Group, 26 November 1997.

Lindsley, Mark H. "BLUE FLAG 98-1 Executive Summary." Message from 505th Command and Control Evaluation Group, Hurlburt Field, FL to ASC2A, Langley AFB, VA. Hurlburt Field, FL: 505CCEG, 1 November 1997.

Logicon Information Technology Group. Internet Web Site. <http://www.jfacc.logicon.com:222>.

Los Angles Times. "Saudi Arabia to let U. S. move 4,000 of its troops" in *The Seattle Times*, 1 August 1996, on-line edition. <http://www.seattletimes.com>.

McCrabb, Maris, Colonel (retired), USAF. "Command and Control Concept of Operations: Dynamic Battle Management (Draft)." Briefing slides. Langley AFB, VA: Air and Space Command and Control Agency, 21 January 1998.

Maher, Dave L. "BLUE FLAG 98-1 AOC Operations Exercise." Briefing slides. Davis-Monthan AFB, AZ: 612 ACOMS/SCXP, 15 October 1997.

_____. "EFX 98 Intrasite Communications Architecture." Briefing slides. Davis-Monthan AFB, AZ: 612 ACOMS/SCXP, 16 March 1998.

Maldonado, David. "EXPEDITIONARY FORCES EXPERIMENT (EFX) 98." Briefing slides. Davis-Monthan AFB, AZ: 12AF/DOXE, 1998.

USAF C^2 Roadmap. Downloaded from ASC2A Internet Web Site, <http://wwwmil.acc.af.mil/asc2a/info.htm>.

U. S. Army Training and Doctrine Command Internet Web Site, <http://www-tradoc.monroe.army.mil/tpubs/>.

USCINCACOM message to CJCS, Washington, DC. "EXER UNIFIED ENDEAVOR 98-1 POST EXERCISE SUMMARY." Norfolk, VA: USCINCACOM, 18 December 1997.

Welshans, James. "UE 97-1 Internal After Action Review." Briefing slides. Barksdale AFB, LA: 8AF/A3-5, 27 February 1997.

Interviews

Albert, Virginia, Logicon Information Technologies Group. Personal interview. Homestead Air Reserve Station, FL: BLUE FLAG 98-1 Air Operations Center-Forward, 18 November 1997.

Beaumont, Burke, Captain, USAF. Telephone interview. Davis-Monthan AFB, AZ: 12AF Deputy Comptroller, 24 March 1998.

Betherum, Richard E, Lieutenant General, USAF. Personal interview. Maxwell AFB, AL: School of Advanced Airpower Studies, 23 February 1998.

Blackwell, Rocky. Telephone interview. Hurlburt AFB, FL: Air and Space Command and Control Agency/Command and Control Technical Innovations Center, 23 February 1998.

Bright, Randy, Major, USAF. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 Air Operations Center-Forward, 20 November 1997.

_____. Telephone interview. Davis-Monthan AFB, AZ: 612 CPS/DOXP, 21 January 1998.

_____. Personal interview. Davis-Monthan Air Force Base, AZ, 16 March 1998.

Campbell, Frank B, Lieutenant General, USAF. Personal interview. Davis-Monthan Air Force Base, AZ: 12AF Commander, 20 September 1997.

_____. Personal interview. Homestead Air Reserve Station, FL: BLUE FLAG 98-1, Air Operations Center-Forward, 17 November 1997.

Cody, James, Major, USAF. Personal interview. School of Advanced Airpower Studies, Maxwell AFB, AL, 22 October 1997.

Corder, John, Major General (retired), USAF. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 Air Operations Center-Forward, 18 November 1997.

Corum, James S., Major, U. S. Army Reserve. Personal interview. School of Advanced Airpower Studies, Maxwell AFB, AL, 17 April 1998.

Cox, Gary, Lieutenant Colonel, USAF. Personal interview. Barksdale AFB, LA: 8AF/CCG, 18 March 1998.

Dahl, Kenneth. Personal interview. Hampton, VA: EXPEDITIONARY FORCE EXERCISE (EFX) 98 Task Force, 19 March 1998.

Fawcett, Jay, Lieutenant Colonel, USAF. Personal Interview. Montgomery, AL: School of Advanced Airpower Studies, 24 November 1997.

French, Robert. Personal interview. Hampton, VA: EFX 98 Task Force, 19 March 1998.

George, Kenneth J., Major, USAF. Personal interview. Davis-Monthan AFB, AZ: 12AF/DOXE, 17 March 1998.

Hartney, Jim, Colonel, USAF. Personal interview. Shaw AFB, SC: 9AF/DO, 20 March 1998.

Haseloff, Robert, Colonel (select), USAF. Personal interview. Shaw AFB, SC: 9AF/A3, 20 March 1998.

Herr, W. Eric, Major, USAF; United States Joint Chiefs of Staff/J-8 Resources and Assessment. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 AOC-Forward, 18 November 1997.

Hobba, Mark E. Personal interview. Langley AFB, VA: Air and Space Command and Control Agency/Advanced Technology Branch, 19 March 1998.

Keck, Thomas J, Major General, USAF. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 AOC-F, 18 November 1997.

_____. Personal interview. Davis-Monthan AFB, AZ: 12AF Vice Commander, 17 March 1998.

Kyle, Terre J., Captain, USAF. Personal interview. Davis-Monthan AFB, AZ: 12AF/SCXP, 17 March 1998.

Leed, Maren, RAND Doctoral Fellow. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 Air Operations Center-Forward, 19 November 1997.

Lindsley, Mark. Telephone interview. Hurlburt Field, FL: Air and Space Command and Control Center/Command and Control Technical Innovation Center, 13 January 1998.

McCrabb, Maris, Colonel (retired), USAF. Telephone interview. Langley AFB, VA: Air and Space Command and Control Agency, 26 January 1998.

_____. Personal interview. Maxwell AFB, AL: School of Advanced Airpower Studies, 3 March 1998.

Maher, Dave L., Captain, USAF. Personal interview. Davis-Monthan AFB, AZ: 12AF/SCXP, 17 March 1998.

Moore, Charles. Telephone interview. Fort Hood, TX: U. S. Army III Corps Historian, 16 April 1998.

Morse, Martin., Technical Sergeant, USAF. Telephone interview. Davis-Monthan AFB, AZ: 612ACOMS/SCXP, 28 April 1998.

Murray, Patrick. Telephone interview. Davis-Monthan AFB, AZ: 12AF/HO, 16 April 1998.

O'Brien, Robert J., Lieutenant Colonel, USAF. Personal interview. Davis-Monthan AFB, AZ: 612 CPS/DOXE, 17 March 1998.

Smith, Hugh, Colonel, USAF. Personal interview. Davis-Monthan AFB, AZ: 12AF/DO, 16 March 1998.

Sullivan, Shannon M., Major, USAF. Personal interview. Maxwell AFB, AL: School of Advanced Airpower Studies, 12 April 1998.

Welshans, James, Lieutenant Colonel, USAF. Telephone interview. Barksdale AFB, LA: 8AF/DOXP, 23 February, 1998.

_____. Personal interview. Barksdale AFB, LA: 8AF/DOXP, 18 March 1998.

Zimmerman, David, Lieutenant Commander, USN. Personal interview. Homestead ARS, FL: BLUE FLAG 98-1 Air Operations Center-Forward, 18 November 1997.