

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

TITLE:

***TWO HEADS ARE BETTER THAN ONE: THE NEED FOR A TWO-
SEAT AIRCRAFT FOR STRIKE COORDINATION AND
RECONNAISSANCE MISSIONS AND AIRBORNE FORWARD AIR
CONTROL MISSIONS***

**SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES**

AUTHOR:

Major Michael J. Bergerud, USMC

AY 00-01

Mentor: Col. Ron R. McFarland

Approved: _____

Date: _____

Mentor: Dr. James A. Ginther, Jr.

Approved: _____

Date: _____

Report Documentation Page

Report Date 2001	Report Type N/A	Dates Covered (from... to) -
Title and Subtitle Two Heads are Better Than One: The Need For a Two-Seat Aircraft for Strike Coordination and Reconnaissance Missions and Airborne Forward Air Control Missions	Contract Number	
	Grant Number	
	Program Element Number	
Author(s)	Project Number	
	Task Number	
	Work Unit Number	
Performing Organization Name(s) and Address(es) United States Marine Corp Command and Staff College 2076 South Street MCCDC Quantico, VA 22134-5068	Performing Organization Report Number	
Sponsoring/Monitoring Agency Name(s) and Address(es)	Sponsor/Monitor's Acronym(s)	
	Sponsor/Monitor's Report Number(s)	
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes		
Abstract The purpose of this research is to advocate development and procurement of a two-seat aircraft to fill the Airborne Forward Air Control (FAC(A)) and the strike coordination and reconnaissance (SCAR) role for both the Air Force and Marine Corps. Historically, the Marine Corps has a firm grasp of the importance of the SCAR/FAC(A) missions: the concepts went-hand-in-hand with close air support. Because the Marines understood the importance of the operational tactical transition area, they developed and procured the two-seat F/A-18D which provides an excellent platform for the SCAR/FAC (A) role. Unfortunately, the Marine Corps currently has no plans to replace the F/A-18D with another two-seat aircraft. The Air Force placed more emphasis on the Strategic/Operational transition than on the operational/tactical transition. Based on their viewpoint, the Air Force typically learns the need for effective SCAR/FAC(A) capable aircraft only as major conflicts progress. As a result, the Air Force uses AD-HOC procedures and adapts airframes for the SCAR/FAC (A) mission that are actually better suited for other missions. The result is the lack of a viable Two-Seat aircraft to fulfill the SCAR/FICA (A) mission for the Air Force in the current inventory.		
Subject Terms		

Report Classification unclassified	Classification of this page unclassified
Classification of Abstract unclassified	Limitation of Abstract UU
Number of Pages 47	

REPORT DOCUMENTATION PAGE		FORM APPROVED - - - OMB NO. 0704-0188
public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters services, directorate for information operations and reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the office of management and budget, paperwork reduction project (0704-0188) Washington, DC 20503		
1. AGENCY USE ONLY (LEAVE BLANK)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED STUDENT RESEARCH PAPER
4. TITLE AND SUBTITLE TWO HEADS ARE BETTER THAN ONE: THE NEED FOR A TWO-SEAT AIRCRAFT FOR STIKE COORDINATION AND RECONNAISSANCE MISSIONS AND AIRBORNE FORWARD AIR CONTROL MISSIONS		5. FUNDING NUMBERS N/A
6. AUTHOR(S) MAJOR MICHAEL J. BERGERUD UNITED STATES MARINE CORPS		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USMC COMMAND AND STAFF COLLEGE 2076 SOUTH STREET, MCCDC, QUANTICO, VA 22134-5068		8. PERFORMING ORGANIZATION REPORT NUMBER NONE
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) SAME AS #7.		10. SPONSORING/MONITORING AGENCY REPORT NUMBER: NONE
11. SUPPLEMENTARY NOTES NONE		
12A. DISTRIBUTION/AVAILABILITY STATEMENT NO RESTRICTIONS	12B. DISTRIBUTION CODE N/A	
ABSTRACT (MAXIMUM 200 WORDS) THE PURPOSE OF THIS RESEARCH IS TO ADVOCATE DEVELOPMENT AND PROCUREMENT OF A TWO-SEAT AIRCRAFT TO FILL THE AIRBORNE FORWARD AIR CONTROL (FAC(A)) AND THE STRIKE COORDINATION AND RECONNAISSANCE (SCAR) ROLE FOR BOTH THE AIR FORCE AND MARINE CORPS. HISTORICALLY, THE MARINE CORPS HAS A FIRM GRASP OF THE IMPORTANCE OF THE SCAR/FAC(A) MISSIONS: THE CONCEPTS WENT HAND-IN-HAND WITH CLOSE AIR SUPPORT. BECAUSE THE MARINES UNDERSTOOD THE IMPORTANCE OF THE OPERATIONAL TACTICAL TRANSITION AREA, THEY DEVELOPED AND PROCURED THE TWO-SEAT F/A-18D WHICH PROVIDES AN EXCELLENT PLATFORM FOR THE SCAR/FAC(A) ROLE. UNFORTUNATELY, THE MARINE CORPS CURRENTLY HAS NO PLANS TO REPLACE THE F/A-18D WITH AOTHER TWO-SEAT AIRCRAFT. THE AIR FORCE PLACED MORE EMPHASIS ON THE STRATEGIC/OPERATIONAL TRANSITION THAN ON THE OPERATIONAL/TACTICAL TRANSITION. BASED ON THEIR VIEWPOINT, THE AIR FORCE TYPICALLY LEARNS THE NEED FOR EFFECTIVE SCAR/FAC(A) CAPABLE AIRCRAFT ONLY AS MAJOR CONFLICTS PROGRESS. AS A RESULT, THE AIR FORCE USES AD-HOC PROCEDURES AND ADAPTS AIRFRAMES FOR THE SCAR/FAC(A) MISSION THAT ARE ACTUALLY BETTER SUITED FOR OTHER MISSIONS. THE RESULT IS THE LACK OF A VIABLE TWO-SEAT AIRCRAFT TO FULFILL THE SCAR/FAC(A) MISSION FOR THE AIR FORCE IN THE CURRENT INVENTORY.		
14. SUBJECT TERMS (KEY WORDS ON WHICH TO PERFORM SEARCH) COMMAND AND CONTROL, F/A-18D, CLOSE AIR SUPPORT, AIR INTERDICTION, AIRBORNE FORWARD AIR CONTROL		15. NUMBER OF PAGES: 44
		16. PRICE CODE: N/A

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE:	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	

EXECUTIVE SUMMARY

Title: TWO HEADS ARE BETTER THAN ONE: THE NEED FOR A TWO-SEAT AIRCRAFT FOR STRIKE COORDINATION AND RECONNAISSANCE (SCAR) MISSIONS AND AIRBORNE FORWARD AIR CONTROL (FAC(A)) MISSIONS

Author: Major Michael J. Bergerud, United States Marine Corps

Thesis: Effective war fighting across the spectrum of conflict requires effective service Command and Control systems at the transition from the tactical to the operational level of war; to facilitate that transition, the Air Force must develop and procure a two-seat aircraft for the SCAR/ FAC(A) role and, for the same reason, the Marine Corps must maintain its two-seat F/A-18D capability or procure an adequate two-seat replacement aircraft.

Discussion: From the outset, Marines approached the use of air differently than the Air Force. The Marine Corps tends to look at the use of air first from the tactical level of war then from the operational level, the Air Force tends to view air employment first from the strategic level of war then from the operational level. Neither view is necessarily incorrect, but the views place different emphases on what each service considers important in air employment. Historically, the Marine Corps has a firm grasp of the importance of the FAC(A): the concept went hand-in-hand with Close Air Support. The transition to the operational level of war, with its need of a viable aircraft to perform the Strike Coordination and Reconnaissance (SCAR) mission, also proved natural for the Marine Corps. Because the Marines understood the importance of this transition area, they developed and procured the two-seat F/A-18D which provides an excellent platform for the SCAR/FAC(A) role. On the other hand, the Air Force placed more emphasis on the strategic/operational transition than on the operational/tactical transition. Based on their viewpoint, the Air Force typically learns the need for effective SCAR/FAC(A) capable aircraft only as major conflicts progress: they tend to forget the need between major conflicts. As a result, the Air Force uses ad-hoc procedures and adapts airframes for the SCAR/FAC(A) mission that are actually better suited for other missions. The result is the lack of a viable two-seat aircraft to fulfill the SCAR/FAC(A) mission for the Air Force in the current inventory. Although the Air Force currently employs the F-16 Block 40 Mod in the FAC(A) role, a two-seat aircraft would perform better in the SCAR/FAC(A) role without significant reduction in ability to perform other roles: technological improvements increase cockpit workload rather than reduce it. The Marine F/A-18 D provides an effective platform for the role, but the Marine Corps currently has no plans to replace the two-seat F/A-18D aircraft.

Conclusions/Recommendations: The Air Force needs to develop/procure a multi-role two-seat aircraft to fulfill both the FAC(A) and SCAR missions. The Marine Corps needs to develop/procure a two seat multi-role aircraft to replace the F/A-18D in fulfillment of the FAC(A)/SAR missions.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

Table of Contents

	<i>Page</i>
MMS COVER SHEET.....	01
DISCLAIMER.....	02
TABLE OF CONTENTS.....	03
A GULF WAR OCCURANCE	04
OVERVIEW.....	05
MARINE APPROACH TO EMPLOYING AIR.....	07
AIR FORCE APPROACH TO EMPLOYING AIR.....	11
MARINE FAC(A) AND SCAR DURING GULF WAR.....	15
AIR FORCE FAC(A) AND SCAR DURING GULF WAR.....	21
POINTS OF VIEW.....	26
HELICOPTERS IN THE FAC(A) ROLE.....	29
MARINE FAC(A) AND SCAR TODAY.....	30
AIR FORCE FAC(A) AND SCAR TODAY.....	30
CHANGES FOR AIR FORCE.....	31
THE AIRCRAFT THE MISSION REQUIRES.....	33
THE PROS AND CONS OF TWO SEATS.....	35
THE FUTURE OF TWO SEAT AIRCRAFT.....	38
CONCLUSIONS/RECOMMENDATIONS.....	39
GLOSSARY.....	41
BIBLIOGRAPHY.....	43

A GULF WAR OCCURANCE

Combat 51: *Chieftain, this is Combat 51, over.*
Chieftain: *Combat 51, Chieftain, go.*
Combat 51: *Yeah Chieftain, do we have any friendly units in AG5 northwest, near the cloverleaf?*
Chieftain: *Combat, say grid?*
Combat 51: *(Combat 51 then told me the 8-digit grid location, but I no longer remember the exact numbers)*
Chieftain: *Combat, that grid would place a friendly unit well north of the FSCL (Fire Support Coordination Line). How's your visibility?*
Combat 51: *(With a slight laugh) Not good, looks like they might be British or Egyptian though.*
Chieftain: *We have no reports of anything in that area, but the ground forces are moving fast. We'll check on it. Say intentions.*
Combat 35: *Roger Chieftain, we are finishing off that stalled column, then Texaco (refueling) We'll call after that.*

We were “Chieftain,” as the Airborne Direct Air Support Center [DASC(A)] was called over the covered nets during the Gulf War. For two days we had been sending strikers to the Air Interdiction (AI) Coordinators: two-seat F/A-18Ds with the callsign Combat for strikes against the Iraqi column stalled near the highway “cloverleaf”: where the road going west out of Kuwait City turns north toward Iraq. The section of the highway Combat was working would later be known as the “Highway of Death.” Chieftain consisted of seven Marines in a box with radios (AN-UYQ-3A) in the back of a KC-130 Hercules. We were high in the sky, so when units on the ground could talk to no one else, they could talk to us. That’s why Bushhog called us that day:

Bushhog: *Chieftain, this is Bushhog, I know you're busy but we need help.*
Chieftain: *Bushhog, Chieftain, go.*
Bushhog: *We're near a highway, like an interstate, and we see several tanks and enemy vehicles moving in front of us.*
Chieftain: *Roger Bushhog, say your pos. (position).*
Bushhog: *(Gave a grid that was fairly close to the one Combat gave ten minutes earlier.)*
Chieftain: *Bushhog, do you have a guard chart¹ with you?*

¹ Guard chart is a list of frequencies (nets) associated with the agency that controls the net frequency. The Gulf War guard chart contained hundreds of frequencies.

Bushhog: *Affirmative Chieftain, how the hell do you think I got through to you, I just went right down the list calling every one to try to get through to someone. You're the first control agency I got.*

Chieftain: *We have Combat 51 working in that area, he might be at the tanker now but he'll return shortly. Contact Combat on TAD 178 and he can act as a FAC(A) and coordinate strikers for you.*

When Combat checked in off the tanker a few minutes later, I briefed him on what had transpired. Then, switched Combat to the same Tactical Air Direction net as Bushhog. Combat and Bushhog ran strikes against a couple targets; I don't recall the Bomb Damage Assessment (BDA) from the missions. However, I do recall how versatile the F/A-18D was in the AI Coordination role, and how smoothly the transition went that day (and many others) from the operational level of war to the tactical level of war. We started the day shaping the battlefield, hitting operational targets with air, and finished the day coordinating our strikes with ground forces engaged in the tactical level of war. A rapid tempo had been achieved: the transition from all air employed at the operational level to air and ground at the tactical level happened without a loss of that tempo: that is synergy on the battlefield. Synergy achieved through the coordination of ground and air forces. One of the main factors in achieving that synergy in the Marine Sector was the FA-18D Hornet filling the Airborne Forward Air Controller [FAC(A)] role as well as the Air Interdiction (AI) Coordinator/Strike Coordination and Reconnaissance (SCAR) role.²

OVERVIEW

Historically, Marine Corps has approached the use of air power differently than the Air Force. Being primarily a ground focused force it tends to look at the use of air power first from the tactical level of war, or how air power assists their forces as they

² During the Gulf War the F/A-18D were called FastFACs: FACs who controlled ground strikes from jet aircraft. Use of the term dates to the Vietnam conflict. The FastFACs generally performed an Air Interdiction Coordination role for the Marine Corps during the Gulf War. Currently called Strike

engage the enemy, then they consider the operational level and, finally, the strategic level.

On the other hand, the Air Force must first look at gaining and maintaining air superiority, second, shaping and isolating the battlefield through air interdiction operations, and finally, the Close Air Support (CAS) of troops. Not only do the services look at employment of air differently, but that view tends to make them prioritize the importance of each aspect according to their view. History demonstrates the Air Force's great success in WWII, Korea and Vietnam at the strategic and operational level. However, its use of air power at the tactical level of war exhibits a pattern of lessons learned and effectively applied, then forgotten by the beginning of the next war.

Both of these approaches were evident in each service's preparation and conduct of the Gulf War. The Marines had just established the first squadron of the two-seat F/A-18D, a near ideal platform in the role as of FAC(A) and SCAR as the war transitioned from the tactical to the operational level and back again. F/A-18Ds could operate as a FAC(A) one minute: assisting ground forces in prosecution of targets, then transition into SCAR all in the same mission. The Air Force realized a need for the SCAR mission as the Gulf War progressed. However, the Air Force airframe of choice, the F-16, was more suitable as a strategic fighter role or operational interdiction role than the role of AI Coordination(or SCAR). At the point of transition from the operational level to the tactical level, the F-16 fighter in the "Killer Scout"³ role could not transition to a FAC(A) role: it did not have the marking nor coordination ability in proximity to friendly forces.

Coordination and Reconnaissance by the Marine Corps. See glossary for more on AI Coordination and SCAR.

³ See "Killer-Scout" in glossary or discussion later in paper.

Air Force airframe development and procurement priorities between wars means they often enter a war without an airframe well suited to combined role of SCAR/FAC(A). Unfortunately, the Marine Corps may soon be facing a similar problem: the Corps has no plans to replace the F/A-18D with another two-seat aircraft to bring the Corps into the next generation of SCAR/FAC(A) capable aircraft. Effective war fighting across the spectrum of conflict requires effective service Command and Control systems at the transition from the tactical to the operational level of war. To facilitate that transition, the Air Force must develop and procure a two-seat aircraft for the SCAR/FAC(A) role and, for the same reason, the Marine Corps must maintain its two-seat F/A-18D capability or procure an adequate two-seat replacement aircraft.

THE MARINE APPROACH TO EMPLOYING AIRPOWER

Close Air Support had its origins during the Nicaraguan intervention of 1927. Various people had experimented with dive bombing, “[b]ut the Marines were the first to adopt it as standing operating procedure and they worked hardest at it.”⁴ The Marines on the ground used panels to mark the position of friendly forces for the aircraft flying overhead and Close Air Support was born. By WWII the techniques of CAS had been refined to the point that “improved communications, better trained personnel and more precise techniques enabled the aviators to bring their supporting weapons to bear in a manner that was generally—and often enthusiastically—praised by the ground commanders....”⁵ CAS means air action in close proximity to ground forces that “requires detailed integration of each air mission with the fire and movement of those

⁴ Sherrod, Robert, *History of Marine Corps Aviation in World War II*, (Combat Forces Press, Washington D.C., 1952) 25.

⁵ Ibid, 408.

forces.”⁶ It didn’t take long to figure out that coordination of strikes by aircraft did not have to be controlled from the ground only. Aspects of those strikes could be coordinated from the air as well: not surprisingly, the role was termed the “Air Coordinator” by the Marines in the Pacific Theater during WWII. The Air Coordinator was often used to make a “dry run” over the target so ground forces could see if the air intended to hit the correct target. The Air Coordinator mission evolved to the point where the Air Coordinator coordinated with the ground forces and controlled the strikers themselves. The Standard Operating Procedures for CAS by the First Marine Division during WW II makes several interesting points on the use of Air Coordinators as described in the following paragraph:

6. AIR COORDINATOR.

(a) The practice of using group and squadron commanders as Air Coordinators is good in general, but it has certain short-comings. An Air Coordinator from a newly arrived carrier, or one who has not flown for a day or two, is not fully informed of the ground situation and cannot perform too efficiently until he has had time to get acquainted... It is therefore suggested that a unit of Air Coordinator Teams be formed... Each team should consist of an experienced aviator and an experienced infantryman observer. Each team should be provided with a specially equipped TBM-1c, having a large quantity of flares, smoke grenades, Very’s Cartridges, and an extra transmitter and receiver. The plane should otherwise be stripped except possibly for extra fuel tanks.⁷

The Commander, Support Aircraft, Mariannas added comments that there should be a “specially equipped TBF to be used only for this purpose, equipped with excellent radio facilities and adequate target marking devices.” Among other comments, he states that the “use of an F6F for the Air Coordinator is unsatisfactory. A multi-placed plane is

⁶ Joint Pub 0.2 UNAAF.

⁷ Croizat, V.J., *Close Air Support Procedures in the War Against Japan: Item #2 Subject: Reports of Support Aircraft Operation, Marianas*, with Comments by Commander, Support Aircraft, Pacific published by Commander, Support Aircraft, U.S. Pacific Fleet on 11 September 1944 and republished in titled form by The RAND Corporation, 1967) Item #2, 34-35.

necessary to provide extra eyes and radio personnel to do the tuning required for efficient communications.”⁸ The FAC(A) mission was in its infancy, but even at that early stage the Marines recognized the need for two in the cockpit and the need for a specialized aircraft or a specially modified aircraft to perform the mission.

Because of its proximity to friendly forces, CAS takes place at the tactical level of war. By the Korean War, CAS procedures were more complex and led to the development of doctrine and courses of instruction to teach that doctrine to new Forward Air Controllers (FACs) and Airborne Forward Air Controllers [FAC(A)s] by Marine Air Control Group Two.⁹ The courses outlined procedures for dealing with a developing tactical problem: how to prosecute targets beyond the ability of ground forces to control but still close enough to ground troops to require some form of coordination with the ground forces. Aircraft could range over the battlefield and observe plenty of targets, but could not engage them due to possible (or actual) proximity to ground forces.

The services responded by developing an imaginary line coordinated between ground and air forces that is now called the Fire Support Coordination Line (FSCL), beyond which aircraft could freely engage any target without coordination with ground forces. The exact placement of the FSCL and whether it should be a restrictive or permissive control measure was a matter of debate between the services that exists to this day.¹⁰ Historical debates aside, another area also defied easy controlling measures: that area beyond the observation limit of ground forces but still on the near side of the FSCL;

⁸ Ibid., 36.

⁹ Headquarters, Marine Air Control Group 2, 1st Marine Aircraft Wing, *Special Course in Instruction in Marine Tactical Air Support Procedures and Forward Air Control Doctrine* (Marine Corps Research Center Archives, Studies and Reports: CAS Studies, 26 Aug 1952).

¹⁰ Further discussion on appropriate placement of the FSCL is beyond the scope of this paper.

an area ground forces would like to “shape” but cannot see targets. Aircraft could see these targets but could not engage them due to possible proximity to friendly forces...this prompted the development of the FAC(A). A FAC(A) could engage targets from the air in coordination with ground forces, but beyond the view of ground forces. A FAC(A) acts similarly to a FAC on the ground, with both the advantages and the limitations of mobility. In the early years, FAC(A)s used relatively slow moving propeller driven aircraft; the slower speeds allowed the FAC(A) to identify targets and determine the location of friendly units with reasonable accuracy. In Korea, the Marines emphasized CAS and support of troops engaged with the enemy priority over Battlefield Air Interdiction (BAI). Therefore, the FAC(A) role became a vital aspect of Marine doctrine and training. By Vietnam, “the value of the airborne FAC became evident, [but] few air frame choices were available.”¹¹ The dense jungles of Vietnam and the relatively small concentrations of enemy in the tactical arena seemed best suited for a propeller driven aircraft. Therefore, propeller aircraft were generally used for the FAC(A) role. The Marines tried various aircraft with various levels of success. The OV-10 Bronco was developed (for both the Air Force and the Marine Corps) in response to the tactical environment in Vietnam...and it was armed. In this relatively permissive air tactical environment, the OV-10 performed admirably. The Marines had solved the FAC(A) issue at the tactical level, but the OV-10 was ill suited to the transition to the AI Coordination role. In Vietnam there was a rapid increase in anti-air war lethality through the use of Soviet surface-to-air missiles (SAMs) and anti-aircraft artillery (AAA) to

¹¹ Cooling, Benjamin F. ed., *Case Studies in the Development of Close Air Support* (Office of Air Force History, U.S. Government Printing Office, Washington D.C. , 1990) from Vietnam study by Sbrega, John J., 437.

counter AI and strategic strikes. Higher altitudes and speeds were employed by aircraft in order to survive; “however, those capabilities complicated target identification and increased potential for fratricide. **This is the compromise in jet airborne air control.**”¹² Jet aircraft could survive the increased counter-air weapon lethality but their speed made it difficult to acquire targets: a key ability for an AI Coordinator and a FAC(A). Propeller aircraft were well equipped to identify and even engage ground targets, but they were easy targets in the higher threat areas. The need to prosecute targets further north necessitated the development of the FastFAC: a jet aircraft filling the AI Coordination (SCAR) role. The Marines employed the two-seat F-9 fighter/attack jet in this role starting in 1966.¹³ However, it was the Air Force, with the vast numbers of aircraft in country and its emphasis on BAI that would really employ the FastFAC on a significant scale.

THE AIR FORCE APPROACH TO EMPLOYING AIR POWER

The history of the SCAR/FAC(A) role in the Air Force is one of realization of the requirement, followed by adaptation of an airframe to the role for the duration of the conflict, followed by rejection of the need after the conflict: the cycle continues for each new conflict. Because of their strategic and operational focus, the Air Force tends to de-emphasize their vital tactical role in supporting troops on the ground. There is no denying the importance of the strategic and operational levels, but the tactical level can also play a

¹² Scanlan, John M., *FASTFAC or FASTDAC?* (Student paper for Marine Corps Command and Staff College, Quantico VA, 1997)2. Maj. Scanlan’s paper presents a good historical overview of the FAC(A) and FastFAC. His thesis states that the term FastFAC for the mission performed by the F/A-18D in the Gulf War is a misnomer. Therefore, he coined the non-doctrinal term “FastDAC” for Fast deep air controller as more appropriate to the mission.

¹³ John W. Ellis, Jr. “The Airborne Forward Air Controller: Past Accomplishments and Future Opportunities,” lecture presented at the 1978 Air University Air Power Symposium, Air War College, Maxwell Air Force Base, Montgomery AL, 15 Feb 1978, 15.

strategic role: severe friendly troop losses can have a strategic affect. With priorities placed elsewhere, the development and procurement of a jet aircraft designed for the important SCAR/FAC(A) mission has never occurred to the Air Force.

In Korea FAC(A)s were necessary due to the mountainous terrain of Korea along with increased ground troop movement rates. Only enemy strong points could be identified by the retreating ground forces: friendly ground forces could not slow up long enough to conduct CAS missions controlled from the ground against the rapidly advancing North Koreans. The Air Force used the T-6 Mosquito in the FAC(A) role: a versatile propeller driven two-seat aircraft that adapted well to the specific needs of the FAC(A) missions. The airborne FAC in Korea had a vital role, but “the Air Force failed to translate the Mosquito success [in Korea] into organization, personnel and equipment for future use.”¹⁴ Another reason for the failure to translate the success of the FAC(A) between wars was the “Air Force interest in strategic forces.”¹⁵ The way to contain communism was at the strategic level, not the operational or tactical level. Air Force General Otto P. Weyland wrote that the Korean conflict gave the Air Force an opportunity “to prove the efficacy of airpower in more than a supporting role.”¹⁶ He advocated a massive commitment to interdiction, not to CAS. Therefore, true to form, at the outset of the Vietnam War the concept of the FAC(A) had all but been forgotten by the Air Force.

For the Air Force, the way to win the Vietnam War was at the strategic and

¹⁴ Lester, Gary R., *Mosquitoes to Wolves* (Air University Press, Maxwell Air Force Base, AL, 1997)77.

¹⁵ *Ibid.*, 77.

¹⁶ *Ibid.*, 65. Quoted from Commanding General Far East Air Force (FEAF), memorandum to chief of staff, USF, subject: *Requirements for Increased Combat Effectiveness*, 10 June 1951; Headquarters FEAF, Report on the Korean War, I. OAFH, 82-83.

operational level. They may well have been correct, but the political realities dictated a more ground based, in the mud approach. Once again, the Air Force would have to support ground troops at the tactical level and because they had focused on the strategic and operational levels before the war, they had to work with the Marine Corps to catch up at the tactical level during the war. The Air Force development of the “slow FACs” concept: O-1 Birddogs, O-2A Skymasters, and OV-10 Broncos, and working the FAC(A) concepts into doctrine initially lagged behind the Marines, but eventually caught up. By the end of the conflict the Air Force doctrine was similar to Marine Corps doctrine as it applied to “SlowFACs.” Propeller aircraft were still viable at the tactical level during the Vietnam War, but impractical in an AI or strategic role. As the Air Force conducted air interdiction operations they too noted the difficulty in target identification for striker jets and saw a need to have some type of control or coordination for AI aircraft operating in the deep battle. The Air Force called them FastFACs, like the Marines, but these FastFACs were not really conducting Forward Air Control missions in conjunction with ground forces: an important distinction. The Air Force used the jets at purely the operational level to conduct AI Coordination (SCAR) not at the tactical level in the FAC(A) role: the Air Force did not make the transition from the operational to the tactical level through the use of a single aircraft. Despite occasionally being called FastFACs, the Air Force FastFACs were conducting AI coordination (SCAR) with aircraft hitting targets beyond the immediate interest of ground forces: an operational use of air more in line with its doctrinal focus. Usually the Air Force referred to these SCAR aircraft by the callsign attached to the type aircraft, for example: F100F’s were “Misty” and F-4’s were “Stormy.”

The Air Force began to use jet aircraft as “FastFACs” in May 1967, beginning with the F-100F. The F-100F had several good features: speed, maneuverability, two rocket launchers for target marking, a 20 mm cannon, external fuel tanks “and, finally the view from both seats was fairly good.”¹⁷ Some of the same features that made a propeller aircraft effective in the FAC(A) role in WWII were the same ones that made a jet aircraft effective in the SCAR/FAC(A) role during Vietnam. Various aircraft were tried with different strengths and weaknesses. Even though the aircraft changed in the search for effectiveness, the effectiveness of the AI Coordination (SCAR) mission was clear, as the following example illustrates. A Misty crew discovered a convoy of 150 to 175 trucks lined up bumper-to-bumper. “The Misty FACs stopped the convoy by damaging the lead trucks with strafing passes and marking rockets while calling for strike aircraft. Controlled by four Misties(sic), strike aircraft destroyed or damaged 79 trucks.”¹⁸ History would repeat itself with the destruction of multiple vehicles controlled by Marine aircraft flying the SCAR mission during the Gulf War along the so-called “Highway of Death.” However, the problem of having an aircraft that could transition between the FAC(A) and AI Coordination mission remained unsolved for the Air Force. Furthermore, the Air Force would forget how effective the “Misty” type aircraft were in the AI Coordination role as well, there was no development or procurement of an airframe well suited to the role before the Gulf War.

The United States learned many lessons from the Vietnam War. After all, “Combat experience in the jungles of Vietnam was the common threat that bound all the

¹⁷ Lester, Gary R., 177.

¹⁸ *History*, 37th TFW, January-March 1968, 20-21.

senior U.S. commanders in the Persian Gulf War....”¹⁹ Certainly at the strategic and operational levels this was well understood. However, at the tactical level, the application of airpower as reflected by the viewpoints of the different services did not change.

Although air power had prepared the battlefield, the Army fought its AirLand Battle with little need for close air support from the other services. Indeed, *during* the ground war, the Army satisfied almost all of its own firepower requirements, while the Air Force conducted its preferred air interdiction campaign against enemy ground forces somewhat removed from the ground front. The Marines adhered to their integrated air-ground concept (MAGTF) and relied mostly on their own firepower, including close air support.²⁰

Each service tends to maintain their own specific approach to conducting war in the development of doctrine, tactics and airframes. At the beginning of each war the Air Force asserts it can win the war at the strategic and operational level, but they inevitably get caught up in the tactical fight as well. In wars prior to the Gulf War, the Air Force adapted airframes to different roles or developed new airframes to fill the needs in the SCAR/FAC(A) role. The Gulf War and beyond would provide more difficult challenges due to technological advances and the amount of time necessary to develop adequate airframes.

MARINE FAC(A) AND SCAR DURING THE GULF WAR

Before the Gulf War, there was disagreement among Marine aviators on the need for a two-seat Hornet. The extra weight that was required for the second seat was not worth the loss of fuel and on station time that would result according to some pilots. Despite those early misgivings, VMFA(AW)-121 stood up on 1 October 1991 with 12

¹⁹ Summers, Harry G., Jr., *On Strategy II: a Critical Analysis of the Gulf War* (Dell Publishing, New York, NY, 1992) 1.

²⁰ Winnefeld, James A.; Niblack, Preston; Johnson, Dana J.; *A League of Airmen: U.S. Air Power in the Gulf War* (Rand, Santa Monica, CA, 1994) 265.

F/A-18D aircraft: the Gulf War was approaching. The squadron would see extensive use as FAC(A)s and SCARs in the war. Fortunately, “Nine officers had served on previous tours as members of infantry battalion-regimental tactical air control parties, or had been school trained in that capacity.”²¹ The pilots and the Weapons Systems Officers (WSO) were not trained to conduct Battlefield Air Interdiction (BAI)²² as it had generally been associated with Air Force operations, “but did apply FAC(A) techniques to accomplish the same results.”²³ As the Air War entered Phase III, preparing the battlefield, AI in the Kuwaiti Theater of Operations (KTO) would take on the predominant focus of air effort. The Marine Corps still had OV-10 aircraft during the Gulf War: the “SlowFACs” handled FAC(A) and Airborne Tactical Air Control [TAC(A)] missions on the friendly side of the Fire Support Coordination Line (FSCL). Due to the numerous AI missions conducted in the Marine controlled sector of the KTO, there was a need for continuity of control beyond the FSCL that the F/A-18D provided:

After a target was located most aircrews opted for a modified 9-line CAS brief to get strike aircraft into the target area.... Strike aircraft were instructed to report a minute and a half, inbound to the target, and F/A-18D aircrew would time the delivery of a white phosphorous (WP) rocket mark to appear out in front of the strike aircraft. If the strike aircraft could not find the target, then the FastFAC would locate the strike aircraft visually and talked the pilot’s eyes onto the target.²⁴

The F/A-18D proved to be a good platform for SCAR, but it had two big weaknesses: first, on station time is limited even with no bombs and external fuel tanks. Therefore, an F/A-18D could only stay on station for one hour before proceeding to a tanker. Second, because of this same weight limitation, the F/A-18D did not carry ordnance on board

²¹ Robertson, James S., Maj., *FastFACs in the KTO: the First Combat Test of the F/A-18D* (Marine Corps Gazette, vol. 65 no. 5, May 1992) 86.

²² 1991 term for Air Interdiction (AI).

²³ *Ibid.*, 88.

with enough punch (such as a 250 or a 500 lb. Bomb) to really engage a target on its own without strikers. Instead, it carried marking rockets and extra fuel tanks.

However, F/A-18Ds provided more than just AI Coordination (SCAR) during the Gulf War. The Marine Corps had retired its last Marine Corps RF-4B reconnaissance aircraft shortly before the Gulf War. The resulting dearth of tactical reconnaissance information resulted in a glaring intelligence weakness at the tactical level for the Marine Corps. A weakness filled by the F/A-18D as related by the Marine Corps' Tactical Air Commander during the Gulf War:

The grunts always love the OV-10, but they're picking the wrong airplane. The intelligence they were getting was from the F/A-18D that operated deep into the battlefield. It is true I kept the OV-10s up there, but I did this primarily so that any ground commander who got into trouble could use them to relay back to me so we could help. They got very little intelligence from the OV-10...we brought VMFA(AW)-121 into theater, to do nothing but forward air controller/tactical air coordinator airborne (FAC(A)/TAC(A) missions. No night attack, no other fancy stuff, just FAC(A)/TAC(A).²⁵

Moreover, the performance of the OV-10 proved it could not survive the modern, more lethal, battlefield. As a result, the F/A-18D would eventually have to take over the FAC(A) role from the OV-10 as well. As Phase III of the Air War progressed and it became obvious that a ground assault was likely. Procedures had to be developed to handle the expected increase in CAS missions while continuing to conduct AI in the Marine Sector. Theater wide, a system of "push CAS" was reintroduced (first use in the Korean War) "in which aircraft launched into particular areas at set intervals—in some cases as rapidly as seven-minute intervals [to support ground combat operations.] If ground forces did not need that close air support, these aircraft then moved on to strike

²⁴ Ibid., 90.

²⁵ LtGen Moore, Royal N., Jr., USMC, Marine Air: There When Needed (U.S. Naval Institute Proceedings, Nov 91) 68.

predetermined targets deeper on the battlefield.”²⁶ The Marine Command and Control System (MACCS) established the DASC(A) to coordinate AI with the F/A-18D aircraft. The Marine sector of the KTO was divided in half with one F/A-18D and escort on station in each half at all times. Additional support was provided to each sector in the form of electronic jamming and anti-radiation support with HARM missiles by EA-6B Prowlers. If the CAS aircraft were not given a target in direct support of ground forces, they were “pushed” to the DASC(A) who would brief them on threat and likely targets. In coordination with the F/A-18D, the Airborne Direct Air Support Center DASC(A) would again push the aircraft to the SCAR at a predetermined point and sometimes with predetermined route into the target area. The SCAR would then give the striker a target to prosecute autonomously or mark the target for the striker. The DASC(A) provided continuity between F/A-18D aircraft as they transitioned to and from the tankers. Due to the shortage of UHF radios on the part of the DASC(A) and the SCAR, the EA-6B aircraft, having one radio tuned into the DASC(A) control and the other to the SCAR frequency, would often relay calls from the DASC(A) to the SCAR. The DASC(A) had direct communication to the Marine Tactical Air Command Center(TACC) through the HF Tactical Air Coordination net and the Air Force airborne battlefield command and control center (ABCCC), Marine ground DASC, and numerous other agencies through a “clearing house UHF frequency. The Marine TACC informed the DASC(A) of any new targets and/or any updates to the target list or target priorities. Initially, the system was devised so that each new target would have to be approved by the Tactical Air Commander, MajGen. Moore, before any target could be attacked. However, after the

²⁶ Cohen, Eliot A., Dr., Director Gulf Air Power Survey Staff, *Gulf War Air Power Survey, Vol. II* (Department of Defense, U.S. Department of the Air Force, Washington D.C., 1993) Pt I, Operations, 1-2.

first two days this was considered too cumbersome. The targets the SCARs discovered were often mobile and if approval did not come immediately, the targets would difficult to interdict. Therefore, the DASC(A) was allowed to approve interdiction targets as long as TACC was briefed and concurred with the mission. With the new procedures “command and control performed much better...DASC-FastFAC coordination was refined and the flow of Marine air [and coalition air] into the battle area was streamlined.”²⁷ The F/A-18D was central to the entire process of the Marine Command and Control System. The pilot could focus on the enemy threat and flying the aircraft while the Weapons System Officer could focus on coordination with striker aircraft and the numerous control agencies required of the mission.

Due to the lack of visual reference points in the desert, joint planners devised a system of reference called “kill boxes.” These boxes were grid references on maps that were thirty miles on each side and then designated by two letters and a numeral. The boxes were then further divided into quadrants.²⁸ The grid reference system was useful because pilots and controllers were aware of the bounds of each area without looking at a map. For example, on two occasions the Air Force Airborne Command and Control Center (ABCCC) called the DASC(A) to provide support for Air Force aircraft that were shot down in an area outside of the Marine sector, but still relatively close. The downed aircraft locations were initially coordinated in reference to kill box location, the DASC(A) passed the exact grid when the SCAR was enroute. On both occasions the F/A-18D was able to break away from AI Coordination, make a check of the downed aircraft area, and request strike aircraft for immediate support to the downed pilots.

²⁷ Robertson, James A., Maj., 90.

²⁸ Gulf War Air Power Survey, 266.

The SCAR provided the MACCS with a tool with which to focus our air effort for the deep battle as well as that area closer to ground forces. Marine ground forces noticed that Iraqi artillery would quit firing whenever an aircraft flew over or near to the gun position because of the well-founded fear that the aircraft would be able to target their artillery. When a Marine infantry unit was pinned down by Iraqi artillery fire, the FAC called the DASC(A) (on the western sector tactical air direction net because he was unable to contact the ground DASC) and requested a fly-over of the suspected enemy artillery site. The F/A-18D said he could “scoot over there and have a look around.” As the jet flew over the suspected site, I informed the ground FAC and the infantry unit was able to move to more covered positions while the enemy artillery ceased firing.

What these examples illustrate is that at the area in the battlefield where the operational level of war begins to blur with the tactical level of war, it is imperative to have a SCAR capable aircraft that can also transition to the FAC(A) role. Warfare will be even quicker in the future; the units will be more dispersed. Control of the air may even defy the use of identifiable control measures such as the FSCL. An airborne team in a survivable platform capable of understanding the needs of forces engaged on the ground capable of performing as a FAC(A) who also have a firm grasp of AI Coordination concepts is vital for the future of our armed forces. Certainly the synergy and teamwork generated by having capable airborne coordinators is well documented, as in this experience related by General Myatt, commanding general of 1st MarDiv during the Gulf War:

One night during one of the combined arms raids, I heard over our radios the voice of the F/A-18D FastFAC pilot telling the wolfpack pilots: “...hurry up! They are attacking our Marines...” as he watched muzzle flashes of the Iraqi

artillery firing at our ground raid force. That was one of the most poignant moments of my life.²⁹

By the end of the Gulf War, the Air Force had generated some synergy in the SCAR role, but never in the FAC(A) role: a tactical lack that would have strategic consequences.

AIR FORCE AIR INTERDICTION IN THE GULF WAR

The execution of Phase I, Strategic Air Campaign, and Phase II, Air Supremacy in the KTO, had gone largely according to plan. For Phase III, Battlefield preparation, the “desired effects were to cut the Iraqi supply lines...and reduce Iraqi combat effectiveness in the KTO by at least fifty percent.”³⁰ Considering the large amount of Iraqi forces and equipment in the KTO, this was a significant requirement. As time went by, more and more air assets could be committed to AI because further Phase I targeting in Iraq and Baghdad was viewed as risky to the coalition without a significant return. Phase II was complete: the Iraqi Air force was either destroyed or chocked in Iran. For the Air Force (like the Marines) “difficulties in target recognition in the faceless desert, even within the kill box system, led to reintroduction of ‘fast’ forward air controllers for F-16s, although this time called ‘Killer Scouts.’”³¹

The Killer Scout is another name for SCAR or AI Coordination. In that specific capacity, the Killer Scouts filled a similar function as the Marine F/A-18D. Because the Marine Corps had a two-seat aircraft that was suited to the role as well as pilots and Weapons Systems Officers with FAC(A) experience, it was relatively easy for them to transition to a SCAR role from the FAC(A) role. It was not so easy for the Air Force to

²⁹ Myatt, Michael J., MajGen, *Close Air Support and Fire Support in DESERT SHIELD and DESERT STORM* (Marine Corps Gazette, Vol. 82 No. 5, May 1988) 74.

³⁰ Cohen, Eliot A., Dr., Director Gulf Air Power Survey Staff, *Gulf War Air Power Survey, Vol. I*, (Department of Defense, U.S. Department of the Air Force, Washington D.C., 1993) Part I, Planning, 6.

³¹ Cohen, Eliot A., Dr., Director Gulf Air Power Survey Staff, Vol. II, Part 1, 277.

take a pilot with little or no FAC(A) experience, put them in a single seat aircraft and ask them to coordinate strikes beyond the FSCL. Naturally, it took them longer to make the transition to SCAR: and the Air Force never permitted the Killer Scouts to attempt any FAC(A) missions. The Air Force ignored the lesson history provided on the SCAR/FAC(A) roles in all the previous experience since WWII. As between Korea and Vietnam and between Vietnam and the Gulf War, the Air Force had not trained in the FAC(A) nor the SCAR role for fast moving jet aircraft, nor did they have a two-seat airframe that was well suited to the role like the Marine F/A-18D.³² Instead, they were forced to the mission out of frustration.

Early in the air war F-16s dropped “dumb-bombs” (bombs without any guidance after they leave the aircraft) from medium altitude (around 15,000 feet). Dumb bombs had limited effect against Iraqi positions and the more effective cluster bombs (CBU’s) were largely being saved for the ground offensive. Something had to be done: the objective of Phase III of the air campaign required the reduction of Iraqi forces combat capability in the KTO to 50% effectiveness: a problem for Air Force leadership considering the poor results of F-16 attacks. Additionally, with so many aircraft going into the target area, the F-16 strikers could not loiter long enough to provide any accurate Bomb Damage Assessments (BDA). Once “smoke from the bombing had cleared sufficiently to permit pilots to see the targets, they were back above the clouds or busy evading enemy surface defenses.”³³ As a result, the 388th Squadron was assigned the task

³² The Air Force did have a highly capable Tactical Air Support Squadron (TASS) that was effective in training FAC(A) capabilities for slow-moving aircraft such as the Bird-dog and the Bronco. This paper focuses on primarily on “Fast FACs.”

³³ Welsh, Mark A., LtCol., USAF, *Day of the Killer Scouts* (Air Force Magazine, Vol. 76, No. 4, April 1993) 2.

of AI Coordination. The possible confusion in names between the FAC(A) role that the A-10 and OA-10 conducted and the mission of the F-16 on the far side of the FSCL was anticipated by the Air Force leadership: “General Glossen...suggested the term ‘Scout’ to define this new role for the F-16. Col. Phillips noted that the F-16s had no rockets and would have to mark targets with 500-pound bombs; thus, he observed, ‘killer scout’ might be a more appropriate description.”³⁴

The Killer Scout F-16s conducting SCAR were a huge success in that specific mission. An increase in effects on targets as well as accurate BDA reports were realized from the beginning. The mission became the primary one for the 388th squadron until the end of the war. Air Force Killer Scouts had one advantage in armament that helped them: 500 pound bombs: “The Killer Scouts learned quickly that they could not both do their job [and] avoid Iraqi surface-to-air threat. Their ‘avoid-the-threat’ concept rapidly evolved into a ‘pound-the-threat’ approach.”³⁵ Although the F-16s did not have rockets to mark targets with, they had bombs with which to conduct Suppression of Enemy Air Defense (SEAD) for themselves or for strikers entering the target area. However, with the long period they often were airborne, up to four and one half-hours with multiple refueling, they would have to husband their bombs.

The Killer Scouts would fly over the geographic area of the kill box and, over time, become familiar with it so that as striker aircraft came into the area, the Killer Scouts could “point” the way to the target:

The pointers, as the paired Killer Scouts were called, worked the kill boxes together, flying between 15,000 and 20,000 feet to avoid SAMs and AAA. The missions lasted about four and a half-hours and required as many as five air-refuels. To help spot targets along the desert floor, each flight lead was equipped

³⁴ Ibid., 4.

³⁵ Ibid., 7.

with binoculars. When a target was found, the pilots either bombed it or performed a ‘fix’ in which the coordinates were passed along to other allied aircraft so they could drop their bombs on it.³⁶

The Killer Scout F-16s were not trained to fill a FAC(A) function, but once the ground war started, coalition forces moved across the desert so rapidly that the F-16s were, on occasion, forced to the function despite airframe inadequacies. Ironically, despite the prohibition against the conduct of FAC(A) mission by the Killer-Scouts in conjunction with AI Coordination the viability of the concept found proof during the war. On one occasion an F-16 Killer Scout spotted a large armored formation near the Jaliba airfield in Iraq and reported it to the XVIII Airborne Corp’s Air Support Operation Control Center (ASOC). The ASOC identified the formation as a brigade of the 24th Infantry Division. Despite the “considerable enthusiasm by aircraft arriving on station to attack ‘the mother lode just northeast of Jaliba,” the ‘Killer Scout’ warned the aircraft off what appeared to be a wonderful target, but which in fact were friendly troops.”³⁷ Killer Scouts showed that they could act like FAC(A)s (coordinate closely with ground forces) as illustrated in this example from the Gulf War. For the most part, however, only OA-10s and A-10s were assigned the FAC(A) mission for the Air Force: aircraft that were slow moving and therefore of limited utility over any significant enemy air defense. For this reason, these aircraft could not transition to the AI Coordination (SCAR) role from the FAC(A) role. The lack of a sufficient FAC(A) aircraft in the transition area between the tactical and operational level of war in this fast moving environment, combined with

³⁶ Rosenkranz, Keith, *Vipers in the Storm: Diary of a Gulf War Fighter Pilot* (McGraw-Hill, New York, NY, 1999) 232.

³⁷ Murray, Williamson, *Air War in the Persian Gulf* (The Nautical & Aviation Publishing Company of America, Baltimore, Maryland, 1995) 292. Dr. Williamson Murry was the principle author of *Gulf Air Power Survey Volume II Book 1: Air Operations*. Therefore, many passages are duplicated into *Air War in the Persian Gulf*.

the shortfalls of the Army and Air Force coordination contributed to the escape of two divisions of the Republican Guard.³⁸

The Air Force had a great grasp of the strategic level of the Gulf War; the grasp of the operational level was improving with the introduction of the Killer Scout. However, due to shortfalls in Air Force support to the Army at the tactical level, the Army naturally depended upon organic helicopters more than Air Force air power at the tactical level. Perhaps this would not have been a problem if the ground assault portion of the war had not been so rapid. The “XVIII Airborne Corps wanted to use its helicopters against enemy targets on the causeway at Hawr al Hammar; consequently, it moved the FSCL forward to accommodate such strikes.”³⁹ Because the FSCL was moved to give Army aviation more area, it also meant the Air Force had less ability to engage targets, especially those on the friendly side of the FSCL. “In the end, the TACC appealed to Schwartzkopf to move the FSCL back to the Euphrates so that air strikes could hit both the causeway and the roads north of the river. Unfortunately, it took *fifteen* hours to resolve the dispute....”⁴⁰ This well-publicized communication break down illustrates a weakness in the connection between the operational and tactical levels of war in the Air Force system. Some critics of the conduct of the Gulf War give too much credence to this event and term the entire war a “Hollow Victory” due to the escape of the two Republican Guard Divisions. Poor visibility and difficulty in employing precision guided munitions were other factors that may have had the greatest influence on the escape.

³⁸ A great deal of ink has been spilled over this incident. A lot of it is conjecture on “what might have been.” The purpose in its inclusion here is not to place blame, but to illustrate that more confidence of Air Force capabilities in the transition between the tactical and operational level may have avoided the whole problem.

³⁹ *Gulf War Air Power Survey, Vol. II, Part 1*, 266.

⁴⁰ *Ibid.*, 315.

However, if the Killer Scouts were given more latitude to cross the FSCL and attack targets as FAC(A)s (in effect coordinating CAS missions), it is plausible that the outcome would have been much different. Certainly with Killer Scouts flying overhead and Forward Looking Infrared (FLIR) capable, they would have had a much easier time of identifying and marking targets for striker aircraft.

POINTS OF VIEW

The Air Force does not need to change how it looks at conducting air operations: it is natural, and even necessary, for any air force to view the employment of air power first from the strategic level, then to the operational level and finally at the tactical level. This is the viewpoint of the U.S. Air Force and it represents their way of looking at what their responsibilities more than it represents a direct attack against the Army or Marine view of employing airpower at the tactical level. To the Air Force, AI is the best way to isolate the battlefield once air superiority is achieved. This idea does not necessarily run counter to the Marine Corps aviation view. As far back as 1952 a Marine FAC training manual states:

Three phases of Tactical Air Operations that we stress today

1. Gaining of air superiority.
2. Isolation of the battlefield.
3. Support of troops.⁴¹

Note that as one goes down that list it can also be viewed as from strategic objectives (gaining air superiority), to operational objective (isolation of the battlefield) and finally tactical objective (support of troops). It is possible to acknowledge the importance of

⁴¹ Headquarters, Marine Air Control Group Two, *Class for Airborne Forward Air Controllers*, 2.

strategic and operational air power and still give the tactical level its due. But the Air Force consistently prioritizes the strategic and operational level above the tactical level of war as the following statement illustrates: “The cold hard fact is that close air support is a third priority air combat mission.”⁴² For the Air Force, AI simply has a higher priority than CAS. Certainly an understanding by ground forces of the necessary viewpoint of their sister air services and vice versa would ease the disagreements that can break down the synergy we can achieve on the battlefield. It is well known that in the Air Force view, “the interdiction mission has usually outweighed close support...”⁴³ However, some doctrinal statements enflame the issue and do not assist the Air Force in engendering confidence in the ground forces they support with their willingness to fulfill their CAS responsibilities:

CAS also tends to be a less efficient use of aerospace power than AI, due to its localized effects, the tactical disposition of the enemy targets, and the added restrictions when attacking in close proximity to friendly ground forces.⁴⁴

While in some cases this may be a true statement: it is not *always* a true statement. The fact is that when ground forces are engaged with enemy forces to the extent where CAS is needed, it is often a matter of immediate life or death for those forces. In the CAS role the Air Force is a supporting commander, it does not engender confidence to say that such support is viewed with tertiary importance. In fact, at a given point in a war the tactical ground battle may have very real strategic consequences.

The Marine response to this Air Force viewpoint often provides such a counterweight that it is viewed by the Air Force as equally entrenched. During the Gulf

⁴² Kane, Stuart E., Jr., LtCol., USAF, *An Examination of the Close Air Support Concept* (A research report submitted to the faculty, Maxwell Air Force Base, AL, 1970) 9.

⁴³ Lester, Gary Robert, 226.

⁴⁴ Secretary of the Air Force, Air Force Doctrine Center, 2.

War “Col. Manfred Reitch, one of the Corps’s most experienced commanders, ...argued that Marine combat planes should not be assigned to drop a single bomb on a target in Iraq until the Marine ground forces had successfully launched their ground offensive in Kuwait.”⁴⁵ The point/counterpoint in the AI vs. CAS argument highlights the main weakness in an otherwise truly outstanding Air Force: the transition from the operational to the tactical level of war of war and back again needs to be improved.

The need for a jet aircraft capable of transitioning from the operational to the strategic level and back is established. That this aircraft needs to be a jet seems obvious. Nonetheless, given its doctrine and history, it seems unlikely the Air Force will develop an airframe for this role. Why is this a problem? After all, the Air Force has adapted to the challenge and been successful in the past, why not the next war? The problem is that advances in technology, in aircraft weapons systems, and threat systems complicates the SCAR/FAC(A) mission to the point that two seats (two heads) are now required to maintain effectiveness in the mission. In the past the Air Force had other two-seat aircraft it could easily adapt to the role, that is not the case today. Aircraft design and procurement takes years. The typical justification of single-seat advocates is that more capable weapons and flight systems of today decrease pilot workload to the point that there is no need for a second person in the cockpit. While that may be the case for an aircraft that can ingress to the target, drop its load and egress, the heavy coordination involved with SCAR/FAC(A) requires more. The FAC(A) role of the OV-10 has now fallen to the helicopter: however, its inherent weaknesses mean that, like the OV-10 and

⁴⁵ Gordon, Michael R and General Trainor, Bernard E., *The Generals’ War* (Little, Brown and Company, Boston, New York Toronto London, 1995) 311.

the OA-10 before, the ability to transition to the AI Coordination will be lost along with the resultant battlefield synergy such a capability produces.

HELICOPTERS IN THE FAC(A) ROLE

Marine helicopters, specifically the AH-1 Cobra and UH-1 Huey, may fill the FAC(A) role if the pilot/co-pilot possess the proper qualifications. Given the right tactical circumstances, helicopters provide an effective FAC(A) platform. Due to their capabilities to loiter, the helicopters can also take on a Supporting Arms Coordination role: acting as an observer for artillery or other fires. However, the airframe suffers from some of the same limitations as the OV-10 Bronco: specifically, limitations in speed, range and altitude limit it to specific FAC(A) roles. Roles that normally are at the tactical level (the close fight) as compared to the transition from the tactical to the operational level. Use of advanced helicopters has also not eliminated the need for a second person in the cockpit.

Maj. Eric Buer, an AH-1W pilot with over 10 years of helicopter flying experience and a Weapons Tactics Instructor, made the following observations of the nature of technology and cockpit workload:

As you know, the AH-1W has a pilot and the weapons officer. That's good, two are absolutely required. Not too long ago, the Cobra had little in the way of technology: guns and rockets...and that's all. It was pretty straightforward. Now, we have more technology, but it is not like more technology means less cockpit workload. In fact, the opposite is the case. Because of better technology, we now fly at lower altitudes, at night, with greater standoff range from targets we intend to engage. Cockpit workload has actually increased. It's possible that before advances in technology, a pilot alone may have been able to do it all, but now it's critical that we have two in the cockpit.⁴⁶

⁴⁶ Interview conducted by author with Maj Buer, Eric F., USMC, on 3 March 2001.

Advances in technology are much the same for fighter aircraft. Today, due to advances in technology, fighter aircraft are also able to fly lower, faster, at night, with further standoff from targets. Advances that mean a greater workload in the cockpit of fixed wing jet aircraft as well.

MARINE FAC(A) AND SCAR TODAY

The Marine Corps increased the number of VMFA(AW) squadrons with the F/A-18D aircraft from one during the Gulf War to the current six squadrons. A true multi-role aircraft, the two-seat aircraft can perform functions across the spectrum of the battlefield, but where it really serves a vital function to the warfighter is the transition area between the tactical and operational level of war. Coordination is the key aspect of the missions. The FAC(A) and SCAR missions are fully integrated into the Training and Readiness for F/A-18D pilot and Weapons System Officers including more than 14 different checks required for FAC(A) qualification. While the FAC(A) qualification (and subsequent Airborne Tactical Air Controller qualification) are “designed for experienced aircrew”⁴⁷ the designations are key to effective employment of the airframe and are the main capabilities that it brings to the fight beyond that of the single seat variant of the F/A-18.

AIR FORCE FAC(A) AND SCAR TODAY

Immediately following the Gulf War the Air Force acknowledged the usefulness of the F-16 in the SCAR (AI Coordination) role and continued its dependence on the A-10/OA-10 to fill the FAC(A) role, continuing its pattern of separating the operational from the tactical levels of war. However, in Bosnia “the OA-10 (historic FAC-A providers in the USAF) were unable to loiter in the threat area due to weather and threat

⁴⁷ Headquarters, U.S. Marine Corps, *Aviation Training and Readiness Manual, Volume 1, Administrative* (Marine Corps Order,P3500.14F, 24 Feb 99) 335.

without excessive risk.”⁴⁸ The USAFE/CC at the time, General Ryan (current Air Force Chief of Staff) found that the Targeting Pod (TGP) in the block 40 version F-16s was a “great tool for locating, tracking, fixing, and targeting in the Bosnian environment.”⁴⁹ Perhaps due to this high level interest in the FAC(A) program, or perhaps due to the interest of the F-16 community itself, the Air Force has taken the first step in re-evaluating its doctrine. Currently the FAC(A) mission is trained at Luke Air Force Base with the block 40 modified F-16s. The Air Force FAC(A) qualification has a formal training syllabus that consists of nine to fifteen qualification rides depending on experience and whether or not a trainee is Night Vision Goggle (NVG) qualified. FAC(A) qualified pilots are typically stationed in Aviano, Italy, or at Eilson Air Force Base.⁵⁰ These are great initial steps and they show the Air Force’s willingness to adapt. However, without a commitment to develop a two-seat aircraft with greater capability in the FAC(A)/AI Coordination role, the Air Force is destined to face its historic limitation in transitioning from the tactical to operational level of war in future conflicts.

CHANGES FOR THE AIR FORCE

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

*Guilio Douhet
Command of the Air⁵¹*

The Air Force needs a doctrinal change. Air Force Doctrine Document 2-1.3, *Counterland*, provides a good description and understanding of the SCAR role, although

⁴⁸ Tapper, Mark, LtCol. USAF, Electronic mail *RE: F-16 FAC-A QUESTIONS* (E-mail in possession of author, dated 5 Jan 01) 1.

⁴⁹ Ibid., 2.

⁵⁰ Ibid., 1-2.

⁵¹ As quoted in introduction of Air Force Doctrine Document 2-1.3: *Counterland* (Secretary of the Air Force, Air Force Doctrine Center, 27 Aug 1999) vi.

the document terms the function “Killer Scout” vice AI coordination. The document shows the picture of an A-10 when describing a FAC(A) and goes on to emphasize that *“Killer Scouts are not trained to provide CAS terminal control, and should never be used to control attacks inside close proximity to friendly ground forces.”*⁵² My point is that the aircraft that conducts AI Coordination, like the Killer Scout, is the same aircraft that needs to be able to conduct FAC(A) missions as well. The ability to transition from one role to another in possibly the same mission gives the aerial battlefield flexibility between the operational and tactical levels of war. As war continues to be more dispersed and more mobile, the ability to make this transition becomes even more important. The F-16 is a good airframe with good flight characteristics and ability to incorporate new technology. However, the SCAR/FAC(A) mission requires two in the cockpit.

Certainly Air Force doctrine notes the changing nature of war and attempts to anticipate how those changes may impact command and control in the future. However, instead of making the FSCL the restrictive line current Air Force doctrine now describes between the close battle and the deep battle, there needs to be a transition between the two: the line must be more porous. The Air Force Command and Control system does not need any additional systems to incorporate this change. The ABCCC and Air Force Air Support Operations Center (ASOC) typically coordinate numerous control operations. If an aircraft is coordinating AI beyond the FSCL and needs to cross the FSCL to hit targets, the ABCCC/CRC can contact the ASOC to coordinate the mission. The ASOC would inform the SCAR of any friendly units or friendly fires in the area. As the aircraft proceeded closer to friendly positions and closer coordination is required, the SCAR would fill the FAC(A) role and coordinate with the FAC on the ground as targets

⁵² Ibid., 54.

are engaged. In the joint environment the Air Force SCAR/FAC(A) could easily transition to operations in Marine controlled airspace and coordinate with the equivalent Marine agencies. Note that if an artillery unit was firing long-range fires but didn't have good observation of those fires, the SCAR/FAC(A) could provide feedback. Flexibility and support to ground units would be achieved. Of course, neither the SCAR role nor the FAC(A) role is easy, especially as the threat becomes more sophisticated. "Task saturation" characterizes the FAC(A) mission: to realize the greatest success, an airframe must be well suited to handle the mission. The Air Force can easily make changes in doctrine and minor adjustments to control procedures. However, the Air Force doesn't have an aircraft well suited to the FAC(A) role and airframes take years to develop and procure.

THE AIRCRAFT THAT THE MISSION REQUIRES

The ideal AI Coordination/FAC(A) aircraft is a fast multi-role aircraft. It should have two engines because it often operates close to the ground and in close to enemy fire. Good armor protection is required, but not so much that speed and load capacity is significantly impacted. Forward Looking Infrared Radar (FLIR) is required along with a laser targeting and rocket marking capability. Loiter time required is mission and scenario dependant, but it must have stations for extra fuel and for one or two 500 lb. bombs in order to engage important targets when no striker aircraft are immediately available. In flight refuel capability is a must in order to allow the same aircraft to return to loiter in the target area. Two air-to-air missiles for self-defense from enemy air threat are mandatory. Finally, it should have two seats.

The AI Coordination/FAC(A) mission requires aircraft to operate in a dangerous area of the battlefield. Therefore, the aircraft must be fast and targeting capable at a high altitude in both medium and low threat environments. Even if the threat is relatively benign, the cockpit workload is tremendous in the FAC(A) and AI Coordination role. Usually, FAC(A) aircraft or AI Coordination aircraft flies with an escort aircraft that can look out for enemy air threat or any Surface to Air Missiles (SAM) that threaten the FAC(A) aircraft. One argument for those in favor of a single seat FAC(A) aircraft is that the escort aircraft provides adequate lookout while allowing the coordinator aircraft to accomplish its mission. However, what if there are not enough aircraft on hand to provide that escort? Perhaps the “escort” will be a detached Combat Air Patrol (CAP). Also, what if the threat level goes up? As the threat level goes up, the workload increases. The closer the target location to friendly forces, the greater the workload. The closer to the ground the coordinating aircraft, again, the greater the workload. Therefore, as the workload increases for the targeteer, the workload increases for the pilot to just keep the aircraft flying, which means less time to engage in the primary mission of targeting the enemy.

Imagine a SCAR at 15,000 feet actively involved in targeting an enemy tank column and the escort aircraft gives the preliminary report of a SAM or an enemy aircraft heading toward them. In a single-seat targeting aircraft, the pilot will have to pull his/her attention away from the targeting problem and focus on the air threat. Only when that threat is clearly neutralized or proved benign will the pilot be able to return to the targeting solution. With a two-seat coordinating aircraft, the Weapons System Officer (WSO) would never lose focus on the targeting solution. Even if minor evasive

maneuvers from a SAM or minor adjustments for an enemy aircraft on radar were required, the WSO would not lose concentration on the target.

In a high threat environment, it would not be advisable to use a single-seat coordinator aircraft into the environment. The pilot simply cannot fly at the low-altitudes the high threat requires and still have any chance of target acquisition. On the other hand, a two-seat aircraft could fly over the target area at a low altitude with the pilot focused on terrain avoidance and evading the threat, meanwhile, the WSO could scan sensors for target identification. Striker aircraft would then hit the target identified by the FAC(A)/SCAR from standoff or by low level laydown, as required by nature of target, ordnance available, and threat. If required following the mission, the coordinator could again overfly the target (obviously from a different direction) for the BDA. These were the exact tactics used in high threat environments during the Vietnam War. Note that the coordinator aircraft always had two seats: those with a better view from the rear seat were considered better coordinator aircraft.⁵³ Of course, the expense of aircraft operating this close to the ground exposed to enemy fire is a factor that proved important in the Vietnam War and may well become important in a future War. However, there are many missions where the risk may be deemed necessary: it would be a shame to have a mission that a two seat aircraft could accomplish, but not have the aircraft available to accomplish the mission.

THE PROS AND CONS OF TWO SEATS

Some may argue that the earlier missions did not have the technology that we have available today which makes targeting and flying at the same time easier. In other

⁵³ Lester, Gary Robert, 181-182.

words, technology makes it possible for one person to do it all in the modern cockpit.

Major Lex Brown, an F/A-18D pilot disagrees:

Most pilots in my squadron like having a WSO. Yeah, it would be nice to be alone in the cockpit, but as technology increases, the workload in the cockpit increases. Most of the pilots who complain about the WSO in the back transitioned from the [single-seat] F/A-18A that had fewer gadgets. They still think they can do it all. I think as a CAS aircraft the single-seat is fine, one guy can do that. But when you add in the mission complexity of the FAC(A)—you keep piling on tasks until at some point one pilot alone reaches task saturation. There is only so much one person can do. Even if you have an escort to watch out for threat, as a pilot there is a certain percentage of concentration you have to give to piloting the aircraft. I don't know, 20 to 30%? It varies depending on the situation and the pilot...but as a FAC(A) that's 20 to 30% of concentration that doesn't go toward a demanding mission. That can mean the difference between mission success and mission failure.⁵⁴

Workload increase in the FAC(A) role is the main reason to go to a two-seat aircraft, but two-seat aircraft have some physical trade-offs to consider.

The biggest trade off is two-seat aircraft suffer is the weight loss for fuel. For example, the two-seat F/A-18F Super Hornet loses “about 900 pounds of fuel”⁵⁵ in comparison to the single-seat F/A-18E Super Hornet: it is reasonable to assume a similar loss in any other airframe. As already pointed out, fuel for loiter time is a key asset for a coordinator aircraft. However, external fuel tanks can be added. Those external fuel tanks would be extra drag, which would inhibit maneuverability in case of air-to-air engagement. However, external tanks can be jettisoned bringing the maneuverability of the two-seat aircraft on par with any single-seat variant of the same aircraft. In fact, the WSO has an important role in air-to-air engagements that probably increase the

⁵⁴ Interview conducted by author with Maj Brown, Lex, USMC on 9 January 2001.

⁵⁵ Greeley, Mac, *The New Hornet is Coming: Interview with Jerry Daniels* (Proceedings, Vol. 121/6/1,108, June 1995) 52.

effectiveness of a two-seat aircraft over a single-seat aircraft in a multi-plane enemy engagement, but that is outside the consideration of this paper.

Expense is another important consideration. Right now the Air Force has three F-16 block 40 single-seat variant squadrons engaged in the FAC(A) role. Which would mean at least three two-seat variant aircraft squadrons capable of the FAC(A)/AI Coordination role in the Air Force: an increase of 60 to 90 Air Force WSOs. Certainly this is an important consideration in the era of shrinking budgets and drawdowns and the drain that the airlines have on the active duty pilots in all of the services. However, it is the drain on pilots to the airlines, not WSO's. Which makes the WSO even more important. LtCol. Mark Tapper, former Commanding Officer of the Air Force training unit that conducts pilot FAC(A) training (among other missions) at Luke Air Force Base states: "the number of squadrons we have is adequate as long as the units keep the right number of pilots qualified. Tough to do when the experienced guys are typically the ones able to exit the service but also the ones able to upgrade to FAC."⁵⁶ While the services typically lose pilots, WSO attrition is not as severe. Therefore, those WSO with experience can still conduct the FAC(A) mission effectively even with an inexperienced pilot. The dynamic of experience paired with inexperience within a cockpit shortens the time it takes for any one element of the team to get qualified. "Although, having a poor WSO can be worse than just doing the mission alone." According to Maj. Brown. "Ultimately, the pilot is in command, he has the capability to do every task, and if the WSO is really messing up, he [the pilot] can just take over." Crew coordination is vital in a two-seat aircraft, but the sum of the parts can be greater than the whole in this case. The FAC(A) mission is important to the forces engaged on the ground. It is a good bet

that both the Marine Corps and the Army would accept two-seat FAC(A) requirement for the Air Force along with the larger force structure requirement: an increase of personnel for a sister service that would actually be embraced!

While the two-seat aircraft places an emphasis on crew intracrew coordination, the single-seat aircraft places the emphasis on intercrew coordination between the FAC(A) and the escort aircraft. LtCol. Tapper is a single seat advocate:

My peers, superiors and subordinates would all agree the F-16 pilots handle the FAC-A mission very well. That does not mean that it cannot be improved, it can. I will say the only reason to have two guys is because one would concentrate on coordination and playing radio relay while the other can look out the window for threats. The wingman is the lookout, extra firepower and ABCCC, AWACS coordinator, while the FAC does the fighter-to-fighter and Tactical Air Control Party (TACP) coordination, makes decisions, etc.⁵⁷

When an escort works often with the FAC(A), this may be a good arrangement. But what about when the escort aircraft pilot is inexperienced? The same limitations apply to two aircraft that apply to the pilot and the WSO. Additionally, single seat pilots are not as adapted to the necessary coordination role that two-seat pilots/WSOs train to on every flight.

THE FUTURE OF TWO SEAT AIRCRAFT

The Navy has developed and procured the F/A-18E and F Super Hornet. The F model is the two-seat version. The F/A-18 C/D models have ceased production due to low foreign interest in the model. The Navy hopes to use the two-seat version of the Super Hornet to fulfill the critical shortage of electronic capable aircraft within the Navy and Marine Corps.

⁵⁶ LtCol.Tapper, Mark, USAF, 2.

⁵⁷ LtCol. Tapper, 2.

The Marine Corps has no plans to procure the F/A-18E/F. Instead, it plans to procure a VSTOL capable Joint Strike Fighter(JSF): there are no plans for a two-seat variant of the JSF. One of the selling points of the JSF is commonality, and for all the reasons already highlighted in this paper, two seats is not a common item.⁵⁸ With no two-seat variant of the JSF, the Marine Corps will eventually lose the significant FAC(A)/AI Coordination capability it now has with the F/A-18D. It is unfortunate that instead of supporting a two-seat variant for the JSF, the Marine Corps decided to emphasize development of a VSTOL JSF. Certainly the Air Force has no plans to expand the role of the F-22 Raptor, the next generation air superiority fighter, and procure a two-seat variant: unless it is a trainer version.

CONCLUSIONS/RECOMMENDATIONS

Procurement of two-seat aircraft by the Air Force that would be highly capable in the FAC(A)/ AI Coordination role is unlikely. The Air Force does have some hope of at least a marginal, single-seat capability, as long as the precedent of FAC(A) trained pilots resurrected in 1995 remains in effect. However, the Air Force has always emphasized the strategic and operational levels of war before the tactical level, a emphasis that makes perfect sense, given their perspective, but the effect of that perspective is that the Air Force typically enters a conflict with marginal FAC(A) capability. The Air Force's current interest in the FAC(A) mission is due to emphasis by the F-16 block 40 community and the need identified during operations in Bosnia. There is no reason to think this will continue. The Air Force needs to recognize that a single-seat aircraft is barely adequate for SCAR missions and totally inadequate for FAC(A) missions. The Air Force needs a two-seat platform as capable as the F/A-18D to assist the command

⁵⁸ White paper JSF homepage: www.jast.mil/html/body_jsfwhitepaper.htm

and control effort to transition from the operational to the tactical level of war. Despite its preparedness to conduct SCAR/FAC(A) missions, the Marine Corps may break its legacy of efficiency at the transition from the tactical to the operational level of war.

Instead of entering a war prepared to conduct the FAC(A)/SCAR mission, the Marine Corps may enter the next major conflict without the capability. If the Marine Corps maintains the current plan and decides not to buy the F/A-18F to replace the F/A-18D, then the JSF must have a two-seat variant. Unfortunately, currently no plans exist for a two-seat JSF. Due to its understanding of the battlefield, the Marine Corps has historically had the aircraft necessary to implement an effective SCAR/FAC(A) program: success on the battlefield in the transition from the tactical to the operational level of war bears this out. However, the Marine Corps insistence of supporting the VSTOL JSF over a two-seat variant of the JSF bodes ill for the FAC(A) mission within the Corps. Joint capability is a good thing for the armed forces, but in the search for airframe commonality, we could all miss a capability that will be sorely missed in the next conflict. The challenge of United States military aviation in the future will not be in air superiority: that we will gain and maintain air superiority over any potential enemy is a given. What is not so certain is our ability to transition from the tactical level of war to the operational level: we need an effective two-seat multi-role jet aircraft to make the transition.

Glossary

AAA	antiaircraft artillery
ABCCC	airborne battlefield command and control center
:	
AI	air interdiction: Air operations conducted to destroy, neutralize, or delay the enemy's military potential before it can be brought to bear effectively against friendly forces at such a distance from friendly forces that detailed integration of each air mission with the fire and movement of friendly forces is not required. (Joint Pub 1-02)
AI COORDINATION	author's term to describe coordination of AI strike missions by another airborne platform. (see also SCAR)
BAI	battlefield air Interdiction: Early term for AI.
BDA	battle damage assessment
CAP	combat air patrol
CAS	close air support: Air action by fixed- and rotary-wing aircraft against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces. (Joint Pub 1-02)
CBU	cluster bomb unit
DASC	direct air support center
DASC(A)	airborne direct air support center
FAC	forward air controller: An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close air support of ground troops. (Joint Pub 1-02)
FAC(A)	airborne forward air controller
FastFAC	fast forward air controller: term that dates to Korean War that refers to a FAC(A) in a jet. Term no longer in general use.
FLIR	forward looking infrared
FSCL	fire support coordination line

HARM	high speed anti radiation missile
HF	high frequency
JSF	joint strike fighter
MACCS	Marine air command and control system
NVG	night vision goggles
SAM	surface-to-air missile
SCAR	strike coordination and reconnaissance: a Marine term for a mission flown for the purpose of acquiring and reporting deep air support targets and coordinating armed reconnaissance or air interdiction missions upon those targets. (MCRP 5-12C)
TAC(A)	tactical air coordinator (airborne): An officer who coordinates, from an aircraft, the action of combat aircraft engaged in close support of ground or sea forces. Also called TAC (A). (Joint Pub 1-02)
TAC	tactical air commander
TACC	tactical air command center
UHF	ultra high frequency
VSTOL	vertical/short takeoff and landing
WSO	weapons systems officer

BIBLIOGRAPHY

Maj. Brown, Lex, USMC. Interview conducted on 9 January 2001. Notes in possession of author.

Commander, Support Aircraft, U.S. Pacific Fleet on 11 September 1944 and republished in titled form by The RAND Corporation, 1967) Item #2.

Commanding General, Far East Air Force (FEAF), memorandum to chief of staff, USF, subject: *Requirements for Increased Combat Effectiveness*, 10 June 1951; Headquarters FEAF, Report on the Korean War, I. OAFH.

Cohen, Eliot A., Dr., Director Gulf Air Power Survey Staff, *Gulf War Air Power Survey, Vol. I*, (Department of Defense, U.S. Department of the Air Force, Washington D.C., 1993) Part I, Planning.

Cohen, Eliot A., Dr., Director, Gulf Air Power Survey Staff, *Gulf War Air Power Survey, Vol. II*, Department of Defense, U.S. Department of the Air Force, Washington D.C., 1993, Part I, Operations.

Cooling, Benjamin F. ed. Case Studies in the Development of Close Air Support (Office of Air Force History, U.S. Government Printing Office, Washington D.C. , 1990) from Vietnam study by Sbrega, John J., 437

Ellis, John W., Jr. "The Airborne Forward Air Controller: Past Accomplishments and Future Opportunities," lecture presented at the 1978 Air University Air Power Symposium, Air War College, Maxwell Air Force Base, Montgomery AL, 15 Feb 1978.

Gordon, Michael R and Gen. Trainor, Bernard E., *The Generals' War*, Little, Brown and Company, Boston, New York Toronto London, 1995.

Greeley, Mac, *The New Hornet is Coming: Interview with Jerry Daniels*, Proceedings, Vol. 121/6/1,108, June 1995.

Headquarters, U.S. Marine Corps, *Aviation Training and Readiness Manual, Volume 1, Administrative*, Marine Corps Order,P3500.14F, 24 Feb 99.

Headquarters, Marine Air Control Group 2, 1st Marine Aircraft Wing, *Special Course in Instruction in Marine Tactical Air Support Procedures and Forward Air Control Doctrine*, Marine Corps Research Center Archives, Studies and Reports: CAS Studies, 26 Aug 1952.

Kane, Stuart E., Jr., LtCol, USAF, *An Examination of the Close Air Support Concept*, A research report submitted to the faculty, Maxwell Air Force Base, AL, 1970.

Lester, Gary R., *Mosquitoes to Wolves*, Air University Press, Maxwell Air Force Base, AL, 1997.

LtGen. Moore, Royal N., Jr., USMC, *Marine Air: There When Needed*, U.S. Naval Institute Proceedings, Nov 91.

Murray, Williamson, *Air War in the Persian Gulf*, The Nautical & Aviation Publishing Company of America, Baltimore, Maryland, 1995

MajGen. Myatt, Michael J., *Close Air Support and Fire Support in DESERT SHIELD and DESERT STORM*, Marine Corps Gazette, Vol. 82 No. 5, May 1988.

Robertson, James S., Maj., *FastFACs in the KTO: the First Combat Test of the F/A-18D* (Marine Corps Gazette, vol. 65 no. 5, May 1992.

Rosenkranz, Keith, *Vipers in the Storm: Diary of a Gulf War Fighter Pilot*, McGraw-Hill, New York, NY, 1999.

Scanlan, John M., *FASTFAC or FASTDAC?* Student paper for Marine Corps Command and Staff College, Quantico VA, 1997.

Secretary of the Air Force, Air Force Doctrine Document 2-1.3: *Counterland*. Secretary of the Air Force, Air Force Doctrine Center, 27 Aug 1999

Sherrod, Robert, *History of Marine Corps Aviation in World War II*, (Combat Forces Press, Washington D.C., 1952

Summers, Harry G., Jr., *On Strategy II: a Critical Analysis of the Gulf War*, Dell Publishing, New York, NY, 1992.

LtCol. Tapper, Mark, USAF, Electronic mail *RE: F-16 FAC-A QUESTIONS*, Electronic-mail in possession of author, dated 5 Jan 01

LtCol. Welsh, Mark A., USAF, *Day of the Killer Scouts*, Air Force Magazine, Vol. 76, No. 4, April 1993.

Winnefeld, James A.; Niblack, Preston; Johnson, Dana J.; *A League of Airmen: U.S. Air Power in the Gulf War*; Rand, Santa Monica, CA, 1994.