# AN EXAMINATION OF THE APPLICABILITY OF CREW RESOURCE MANAGEMENT TRAINING CONCEPTS TO A COMBINED AIR OPERATIONS CENTER TEAM: AN OPERATIONAL-LEVEL ANALYSIS OF THE USAF F-15C FRATRICIDE OF TWO US ARMY BLACK HAWKS IN OPERATION PROVIDE COMFORT

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

AN EXAMINATION OF THE APPLICABILITY OF CREW RESOURCE MANAGEMENT TRAINING CONCEPTS TO A COMBINED AIR OPERATIONS CENTER TEAM: AN OPERATIONAL LEVEL ANALYSIS OF THE USAF F-15C FRATRICIDE OF TWO US ARMY BLACK HAWKS IN OPERATION PROVIDE COMFORT by Major Dirk D. Smith, 99 pages.

On 14 April 1994, two USAF F-15C pilots mistakenly shot down two US Army Black Hawk helicopters and killed 26 American and coalition service members during Operation Provide Comfort (OPC). The USAF Combat Air Forces (CAF) Crew Resource Management (CRM) program emphasizes error-management training at the tactical level with respect to individual flight crew members. The goal of the USAF CAF CRM program is to maximize operational effectiveness and combat capability while preserving Air Force personnel and material resources. This program emphasizes team-training concepts including situational awareness, communication, crew coordination, decision making, task and risk management, flight integrity, and mission planning and debriefing. This research has shown that "CRM-type" errors made within the OPC Combined Task Force within the operational level command structure ultimately contributed to the tactical level errors. The Combined Air Operations Center (CAOC) provides operational level command and control for air operations. This research has also shown that CRM-type skills are applicable to the CAOC Offensive Operations Team in its time critical targeting function. Thus, future CAOC team training developers may find utility in a CRM-type team coordination training program.

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TABLE OF CONTENTS

# ACRONYMS

| | |
|---|---|
| ATO | Air Tasking Order |
| ACO | Airspace Control Order |
| AOC | Air Operations Center |
| CAOC | Combined Air Operations Center |
| CAF | Combat Air Forces |
| CJTF | Combined-Joint Task Force |
| CRM | Crew (or Cockpit) Resource Management |
| CTF | Combined Task Force |
| CTI | Crew Training International |
| CFAC | Combined Force Air Component |
| CFACC | Combined Force Air Component Commander |
| CJTF | Combined Joint Task Force |
| JAOC | Joint Air Operations Center |
| JOIC | Joint Operations and Intelligence Center |
| MCC | Military Coordination Center |
| ODO | Offensive Duty Officer |
| OOT | Offensive Operations Team |
| OPC | Operation PROVIDE COMFORT |
| TCT | Time Critical Targeting |
| TST | Time Sensitive Target |

## ILLUSTRATIONS



## TABLES

# CHAPTER 1

# INTRODUCTION

## Introduction

On 14 April 1994, two USAF F-15C pilots mistakenly shot down two US Army Black Hawk helicopters over Iraq and killed twenty-six American and coalition service members. The Chairman of the Joint Chiefs of Staff, at the time, General John Shalikashvili stated:

> For over 1,000 days, the pilots and crews assigned to Operation Provide Comfort flew mission after mission, totaling over 50,000 hours of flight operations, without a single major accident. Then, in one terrible moment on the 14th of April, a series of avoidable errors led to the tragic deaths of 26 men and women of the American Armed Forces, United States Foreign Service, and the Armed Forces of our coalition allies. In place were not just one, but a series of safeguards--some human, some procedural, some technical--that were supposed to ensure an accident of this nature could never happen. Yet, quite clearly, these safeguards failed. (Bowren 1994, 47)

The series of "avoidable errors" mentioned by General Shalikashvili and a possible program to prevent such errors in the future will be the focus of this research project. The researcher hypothesizes that errors made at the operational level ultimately contributed to the fratricide at the tactical level. The United States Air Force Combat Air Forces (CAF) Crew Resource Management (CRM) program as it now stands tends to emphasize error-management training at the tactical level with respect to individual flight crew members. If it can be shown that "CRM-type" errors not only occurred on the part of the individual flight crew members at the tactical level, but also at the operational and combined joint task force level, combined joint task force (CJTF) leaders may find utility for a similar training program. In a multinational theater of operations, there is typically a Combined Air Operations Center (CAOC) tasked to provide command and control for

air operations. On 8 September 2000 General Michael E. Ryan declared the US Air Force Air Operations Center (AOC) an official weapons system. "We need a baselining of capabilities in that weapons system, just as we do in our capabilities in something like an F-16. In the F-16 we have a crew chief that knows how to maintain it, and we have pilots who know how to fly it. We have to have the same concept for our air operations centers" (Alford 2000, 1). The AOC (CAOC serves as the AOC in a multinational theater, JAOC serves as the AOC in a joint theater) is the "eyes, ears, hands and legs of the commander," Ryan said (Alford 2000, 1). This research project will analyze the fratricide of the two US Army Black Hawks by two USAF F-15Cs over Iraq during Operation Provide Comfort (OPC) on 14 April 1994 with respect to the "core CRM skills" listed in Air Force Instruction (AFI) 11-290, *Cockpit/Crew Resource Management Training Program*. OPC was a combined-joint task force involving the US Air Force, the US Army, and several coalition forces. Errors at the operational level will be addressed primarily. In addition, the USAF CRM program outlined in AFI 11-290 will be examined for applicability to a CAOC team. Findings from the fratricide analysis and the CRM applicability research will be used to draw conclusions regarding the possible use of CRM concepts to CAOC team training.

## Problem Statement

AOC evolution has tended to focus primarily on technology, hardware, computer software, and organizational structure. Since any system includes people and equipment, only one-half of the equation is addressed. Training personnel how to operate equipment and follow procedures is important, but it is very important that they understand how to work as a team in order to maximize mission effectiveness. The fratricide of the two US

Army Black Hawks by two USAF F-15Cs over Iraq during OPC on 14 April 1994 involved many human errors. The goal of the USAF CAF CRM training program is to maximize operational effectiveness and combat capability while preserving Air Force personnel and material resources (USAF 1998, 3). It is presumed that a CJTF commander would be interested in the same goal. The CAF CRM training program lists nine core skills to be addressed during (CRM) training. The nine core skills are: situational awareness, crew coordination, flight integrity, communication, risk management, decision making, task management, mission planning, and debriefing. The chain of errors that led to the Black Hawk fratricide incident may have included some or all of the nine core skill concepts included in the CAF CRM Training Program. These errors may have occurred at the tactical or operational levels involving individuals of the combined joint operations team. If it could be proven that the CRM concepts are applicable to this "real-world" incident at the operational level in a combined-joint task force, the findings of this research could be used as convincing material to justify "CRM-type training" for members of the CAOC team.

## Thesis Question

Are CRM training concepts applicable to a Combined Air Operations Center (CAOC) Offensive Operations Team?

## Subordinate Questions

There are two main branches of subordinate questions. First, the fratricide incident will be analyzed for operational level CRM-type errors. Second, each of the nine CRM core skills listed in AFI 11-290 will be addressed with respect to their applicability to a CAOC team. The CAOC typically contains four divisions including the

strategy, combat plans, combat operations, and air mobility divisions. Support and specialty teams augment these divisions (AFDD 2-8 2001, 29). In order to limit the scope of this research, only elements of the Offensive Operations Team (OOT), which is a division within the Combat Operations Division, will be addressed.

Subordinate Questions Relating to the
Black Hawk Fratricide Incident

1. What are the errors occurred at the operational level and how did they influence tactical aircrew execution in the Black Hawk fratricide incident with respect to:

    a. Situational Awareness

    b. Crew Coordination

    c. Flight Integrity

    d. Communication

    e. Risk Management

    f. Decision Making

    g. Task Management

    h. Mission Planning

    i. Mission Debriefing

2. What is the definition of tactical error?

3. What is the definition of operational error?

4. Can a line be drawn between the tactical and operational levels? If so, where?

5. Which of the nine core skills applicable at the operational level to a CAOC OOT?

Subordinate Questions Relating to Applicability
of CRM concepts to CAOC OOT

1. Who are the primary members of the CAOC OOT?

2. What are the CAOC OOT's primary tasks?

3. What tasks involve elements of the nine core CRM skills listed in AFI-11-290?

    a. Situational Awareness

    b. Crew Coordination

    c. Flight Integrity

    d. Communication

    e. Risk Management

    f. Decision Making

    g. Task Management

    h. Mission Planning

    i. Mission Debriefing

4. Are CRM-type concepts and or skills currently applied to other than aviation teams?

5. Are there any other CRM or Team skill sets that would be of value to an CAOC team-training program?

Fratricide Incident Summary

This summary of events is a condensed version of the facts pertaining to this case analysis found in the *Aircraft Accident Investigation Board Report Executive Summary for US Army UH-60 Black Hawk Helicopters 87-26000 and 88-26060*. This summary

will provide an explanation of the basic command and control structure and a sequential flow of events surrounding the incident.

In April 1991, the US National Command Authority directed US forces to conduct OPC. The OPC Combined Task Force consisted of four component organizations: a headquarters staff command element, Combined Forces Air Component (CFAC), and a Joint Special Operations Force (JSOTF) all based at Incirlik, Turkey, a Military Coordination Center (MCC) based in Diyarbakir, Turkey, with a forward-based element of the MCC in Zakhu, Iraq, located in the extreme northwestern corner of Iraq. Tactical airlift assets, fighter assets, the Joint Special Operations Task Force, and all other fixed-wing aircraft in OPC operated from Incirlik. The two Black Hawks involved in the fratricide operated from the MCC in Zakhu. The Combined Forces Air Component Commander (CFACC) was responsible for coordinating the employment of all air forces to accomplish the OPC mission. The CFAC Deputy for Operations was responsible for ensuring all aircrews are informed of all aspects of the OPC mission including the rules of engagement (ROE) and the airspace control order (ACO). The ACO provided general guidance to aircrews regarding the conduct of OPC missions. The CFAC Deputy for Operations was also responsible for publishing the daily air tasking order (ATO) that includes the daily flight schedule for aircraft operations over the tactical area of responsibility (TAOR). All helicopter and fixed-wing aircraft were required to comply with the ATO (Andrus 1994, 4). A Joint Operations and Intelligence Center (JOIC), responsible for command, control, and communications, at Incirlik, provided a 24-hour point of contact for communications within the CTF. (In the OPC Joint Task Force, the JOIC performed the CAOC function.) When tasked, the JOIC received, delivered, and

transmitted communications up, down, and across the CTF command and control structure.

At the time of the incident, the MCC exercised extreme flexibility in scheduling Black Hawk helicopter operations. Detailed information regarding Black Hawk operations was not requested by the CFAC and was not included in the daily ATO. The accident occurred while two Black Hawks, an E-3B airborne warning and control system (AWACS) aircraft, and two F-15Cs were engaged in OPC missions. The Black Hawks were flying a transportation mission in support of the MCC. The AWACS was tasked to provide airborne threat warning and air control for all OPC aircraft operating in the TAOR. The F-15Cs were conducting a mission to detect, identify, and take appropriate action regarding any Iraqi military aircraft flying north of the 36th parallel.

At 0654 Zulu (Z) time the Black Hawks departed Zakhu, contacted the AWACS en route controller, and reported his route of flight and destination within the TAOR. The AWACS controller received and acknowledged the call. At 0720Z, the two F15Cs entered the TAOR and began their fighter sweep to ensure the TAOR was clear of Iraqi aircraft. Since the ATO did not contain any detailed information regarding the Black Hawks' mission and the AWACS did not inform the F-15Cs of the Black Hawks presence, the F-15Cs were not aware of the Black Hawks' presence. At 0722Z, the F-15C flight lead reported a low, slow-flying aircraft fifty-two miles north of the southern no-fly-zone boundary. The TAOR AWACS controller responded with a “clean there” call indicating that he had no radar contacts in that area. Attempts by the F-15Cs to electronically identify the aircraft were unsuccessful, so they proceeded with an intercept to visually identify (VID) the aircraft. Subsequently after two VID passes, the F-15C

pilots misidentified the Black Hawks as Iraqi Hind helicopters, engaged the Black Hawks, destroyed both aircraft, and killed all twenty-six people on board (Andrus 1994, 5).

## Outline of Air Force CRM Instruction

The basics for the USAF CRM program as specified in AFI 11-290, *Cockpit/Crew Resource Management Training Program,* are as follows:

CRM program Goals:

1. Maximize operational effectiveness and combat capability.
2. Preserve Air Force personnel and material resources.

CRM training will be designed and managed to accomplished the following objectives:

CRM skills will:

- Be integrated into flight briefings and debriefings.
- Be integrated into training syllabi.
- Be evaluated during initial qualification and recurring evaluations

Six "CRM Behaviors/Skills:"

1. Situational Awareness
2. Crew Coordination / Flight Integrity
3. Communication
4. Risk Management / Decision Making
5. Task Management
6. Mission Planning and Debriefing. (USAF 1998, 8)

Crew Training International, Incorporated, (CTI) has the current contract to provide CRM training for the Combat Air Forces. Headquarters USAF, Training Division (HQ AF/XOOT), oversees this CRM training program in accordance with AFI 11-290, *Cockpit/Crew Resource Management Training Program.*

## Scope

The scope of this analysis will be limited to the facts of this fratricide as they pertain to the concepts of CRM at the operational level. The researcher's aim is not to regurgitate the laundry list of every single event in the shootdown, but to look at specific

errors, classify them by type, and determine what level (tactical or operational) the errors occurred. Specifically, the type of error will be grouped into one of the CRM core skill concepts listed in AFI 11-290. In order to better understand these CRM concepts, several sources will be reviewed in an attempt to gain a better understanding of the core skill concepts and how they may or may not relate to CAOC team operations. This paper will not address the judicial proceedings involved in this incident or the rulings of those proceedings. It will not act as a debrief of the incident. Neither will it attempt to "point a finger" at any individual, unit, or organization. The sole purpose of analyzing the Black Hawk fratricide incident is to determine if CRM-type errors were present at the operational level. If CRM-type errors are present, they may provide insight as to the areas of CRM that could be applied to a CAOC team.

## Importance

"The focal point for the command and control (C2) of theater air operations is the CAOC" (AFDD 2-8 2001, 25). The CAOC is the organization that links the CTF commander's operational campaign to the tactical warfighter. "The key C2 processes of an AOC are developing the air operations plan and master attack plan; producing the air tasking order (ATO); special instructions, and the airspace control order; executing the ATO; and assessing and reporting the effects of aerospace operations in time for the next cycle of activities" (AFDD 2-8 2001, 30).

The CAOC is not only a clearing house for operational information, but more importantly, it is the means by which the CFACC gains situational awareness, makes decisions, and facilitates decentralized execution of those decisions. "We must command aerospace power--not just administer the Air Tasking Order," said General John Jumper,

former ACC Commander and current Air Force Chief of Staff (AFDD 2-8 2001, 25). The CAOC will employ hundreds of people from various services, coalition or allied nations, and various governmental agencies. Many of these people come together to form an ad hoc organization and must quickly form cohesive teams to operate in the fast-paced decision cycle of today's digital battlefield. Thus, a timely and effective integration of information and communication technologies with cohesive, well-coordinated teams will be critical. This integrated, combined joint team of the CAOC may have some use for the training concepts addressed in this project.

## Cultural Hurdles

The term crew resource management was defined in 1984 by psychologist Jon K. Lauber as, "using all available resources--information, equipment, and people--to achieve safe and efficient flight operations." From its inception, CRM skills were primarily the "stuff" of civilian and military multiplace aircraft crews. According to Scott A. Snook's in *Friendly Fire*, a book about the Black Hawk fratricide incident, "CRM research has paid little explicit attention to intercrew and organizational phenomenon such as those operating at the heart of this incident" (2000, 12). Thus, the term CRM has historically been associated with aviation. If the CRM concepts are to be applicable to a CAOC team, then they must certainly be applicable in an intercrew scenario. A search of the literature at this time suggests that various "teams" are currently using CRM skills. CTI, Incorporated, currently is on contract with the USAF to provide CRM training to the CAF as well as many civilian agencies including hospital surgical teams and law enforcement agencies (CTI 2001). There are also many other civilian and military organizations that incorporate CRM-type training. Dr. Robert L. Helmreich defined five

generations of CRM that have resulted from the civilian airline cultural CRM evolution. In the first two generations, CRM was only applied to the pilots and crew in the cockpit. But in the third and subsequent generations, CRM began to be extended to other groups within the airlines to include flight attendants, dispatchers, and maintenance personnel (Helmriech 1996, 5). In many civilian airlines, the CRM culture touches all parts of the organization. A similar evolution has taken place in the military aviation CRM as evidenced by the USAF CAF CRM program from the early nineties to the present.

## Assumptions

There are three assumptions for the purpose of this study with repect to the CAOC. First, since the CFACC is responsible for planning and executing the operational level air campaign, it is assumed that the CAOC manages airpower at the operational level. Thus, all functions, tasks, and communications within the CAOC occur at the operational level. Second, the term CAOC will be used vice AOC or JAOC. Even though in certain theaters there may be a pure US Air Force AOC, or a Joint US AOC, the term CAOC will be used to denote the AOC organization. It is presumed that with respect to the primary research question, the specific joint or combined make-up of personnel in this organization is irrelevant. Regardless of branch or service, or nationality, the AOC, JAOC, or CAOC is all about managing and controlling airpower at the operational level of war. Finally, current guidance for the AOC in the form of AFI 13-1AOC, volume 3, 1 June 1999, provides guidance for AOC operations. It is assumed that these guidelines would apply to either a joint or combined AOC scheme of operations.

## Key Terms Defined

The key terms used in this research are defined via several sources. The source of each definition will be annotated. The researcher will define some of the terms if they cannot be found in current literature. Some definitions will be adjusted as required to serve as criteria for analysis. Since the USAF CAF CRM training program will be used as the template for the analysis, several of the definitions used will be taken directly form the training courseware. The *F-15C Fighter Resource Management Continuation Training Guide* (2000) contains several definitions of CRM terms to be used.

Cockpit/Crew Resource Management: In much literature the terms "cockpit" and "crew" are used interchangeably or may be mission driven. CRM is the effective use of all available resources--people, weapons systems, facilities and equipment, and environment--by individuals or crews to safely and efficiently accomplish an assigned mission or task (USAF 2000, 7).

Combined Air Operations Center Offensive Operations Team: The individuals that work together in the combat operations division of the air operations center responsible for the mangement, control and coordination of all offensive assets tasked in the air tasking order.

Communication: The act of sharing information with others to cause some kind of action: to direct, to inform, to question, or to persuade (USAF 2000,7).

Crew: Any collection of personnel who work together to accomplish a mission (USAF 2000, 7).

Crew Coordination: The act of working with all members of the crew to accomplish the tasks of the mission (USAF 2000, 7).

CRM-Type Error: With respect to this study, a CRM-type error is an error of perception, decision, or execution that involves one or more of the nine CRM core skills laid out by AFI 11-290.

Decision Making: The ability to choose a course of action using logical and sound judgment based on available information (USAF 2000, 7).

Flight Integrity: Utilizing all members of a flying package to accomplish the mission at hand (USAF 2000, 7).

Intercrew Coordination: The act of crew members within one aircraft working with crew members of a separate aircraft via voice, visual, data link, or other communication means to accomplish the tasks of the mission.

Intracrew Coordination: The act of crew members within a single multiplace aircraft working together to accomplish the tasks of the mission.

Mission Debriefing: Reviewing and discussing mission accomplishment looking at what was achieved, what barriers were encountered, and how the mission could be accomplished better next time (USAF 2000, 8).

Mission Planning: Taking all of the information for a mission and developing short-term, long-term, and contingency plans to coordinate, allocate, and monitor crew and or flight and aircraft resources (USAF 2000, 8).

Risk Management: Logic-based, common sense approach to making calculated decisions on human, material, and environmental factors before, during, and after mission activities and operations (USAF 2000, 8).

Situational Awareness (SA): An aircrew member's continuous perception of self and aircraft in relation to the dynamic environment of flight, threats, and mission, and the ability to forecast, then execute, tasks based upon that perception (USAF 2000, 8).

Task Management: The ability to alter a course of action based on new information, maintain constructive behavior under pressure, and adapt to internal and external environment changes (USAF 2000, 8).

## Summary

The importance of a well-integrated and synchronized joint force will continue to be absolutely critical to the US armed forces. The ability for a CAOC to facilitate information flow between the CFACC and the tactical units will depend upon not only technology and equipment, but also on the personnel's ability to provide situational awareness to the decision makers and executers of the ATO. The CAOC will be the decisive point in wartime and in military operations other than war. As the military and political leaders work to determine the best way to organize and equip the objective CAOC, a simple, easily executable training program for the personnel in this force will be required. The concepts of CRM currently used for tactical and commercial aviation may play a role in training the CAOC team of the future. Through the analysis of the Black Hawk fratricide incident and current CRM-type training programs, this research may provide some insight toward the applicability of CRM to the echelons above the tactical level of warfare.

# CHAPTER 2

# LITERATURE REVIEW

## Introduction

The purpose of this literature review will be to: (1) provide CRM background information, (2) determine definitions of terms critical to answering research questions, and (3) present sources of factual data regarding the Black Hawk fratricide incident. The literature review will flow in the following order and cover five major areas: (1) CRM, (2) error classification, (3) operational and tactical levels of warfare, (4) CAOC Offensive Operations Team, and (5) the Black Hawk fratricide incident. Figure 1 shows a visual flow of the literature review.

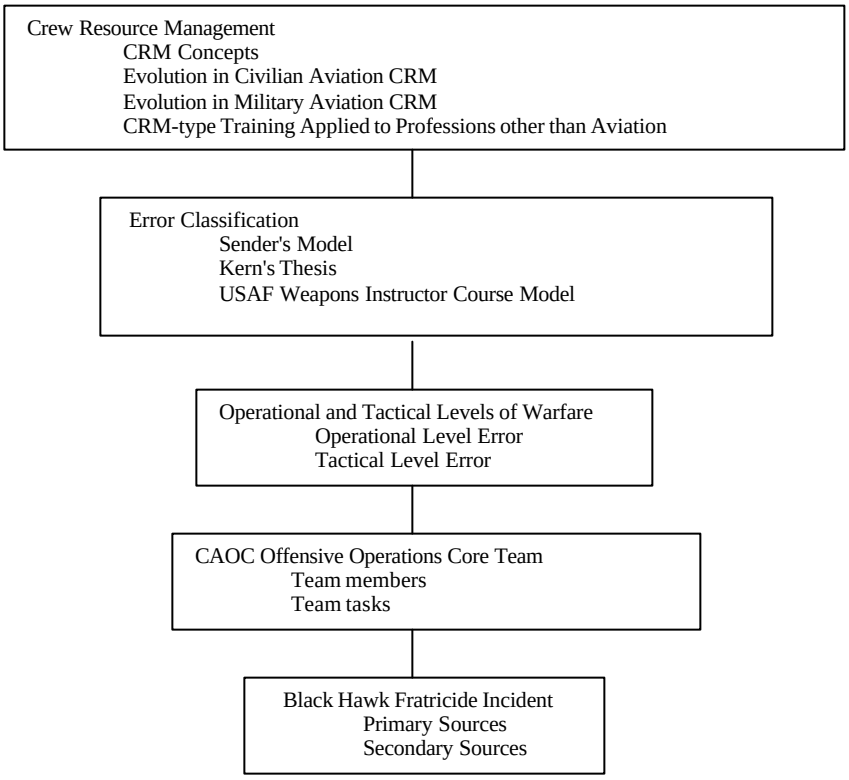


Figure 1. Literature Review Layout

First, CRM background information will be presented to illustrate the evolution of CRM as it applies to this research. Background on both the evolution of civilian CRM and military CRM will be addressed. Also, the concepts of CRM training have spilled over into many areas outside of aviation. This is significant as it may show that CRM-type training can be applied to other than aircrew personnel.

The next two sections answer several of the subordinate questions. In order to classify error at the operational level as it relates to the CRM concepts, several key parameters have been determined. These parameters (definitions) serve as the criteria to answer the primary and remaining subordinate questions.

Next, CAOC OOT members and tasks will be addressed. Since the construct of the CAOC is currently a doctrinal debate, a notional CAOC organization will be determined using available references. This notional CAOC will provide the framework for analysis for the second branch of subordinate questions. Finally, with the groundwork and criteria for case analysis determined, both primary and secondary sources regarding the Black Hawk fratricide incident will be reviewed.

## Crew Resource Management

This section will provide a basic CRM background critical to understanding the context of this work. This section is broken down into the following areas: CRM concepts, civilian airlines CRM, military aviation CRM, and CRM applications other than aviation. The basic concepts of CRM will be addressed first. The USAF CRM governing regulation (AFI 11-290) categories of situational awareness, crew coordination, flight integrity, communication, risk management, decision making, task management, mission planning, and debriefing will provide the framework for review.

Next, three different areas of CRM application are addressed: civilian aviation CRM, military aviation CRM, and other than aviation use of CRM concepts. Each of these areas will address the distinctly different cultures currently using CRM training concepts. Each culture is unique and therefore warrants individual consideration in the review of literature.

## CRM Concepts

This section will address several CRM concepts. Since AFI 11-290 is providing the framework for CRM concept categorization, each concept will be defined in accordance with AFI 11-290, and then amplifying information with respect to its applicability to a CAOC team will be added. There are several sources that supply ample information.

A key book addressing all of the listed CRM concepts is *Refining Airmanship* by Dr. Tony Kern. Dr. Kern (Lieutenant Colonel USAF, retired) was the Chief of CRM Plans and Programs at Air Education and Training Command where he designed and supervised a comprehensive training program adopted by the USAF and which is now outlined in AFI 11-290.

### Situational Awareness

Situational awareness is an aircrew member's continuous perception of self and aircraft in relation to the dynamic environment of flight, threats, and mission, and the ability to forecast, then execute, tasks based upon that perception (USAF 2000, 8).

Vast amounts of material are available on situational awareness as it applies to aviation. Dr. Kern applies three levels of SA to aviation. "An aviator must be able to accurately *perceive* elements of a current situation, *comprehend* their meaning, and

*project* their implications on likely future scenarios" (Kern 1998, 234). The combined forces air component commander (CFACC), the CAOC's primary decision maker, must continually make decisions based on the SA he is given by his staff and the various CAOC teams. The CAOC staff and team members must know what information is critical for the CFACC to accurately perceive, comprehend, and project with respect to his area of interest to shape his battle space. General John Jumper's Global Strike Task Force concept alludes to "predictive battle space awareness" (Somerville 2001, 2). Predictive battle space awareness is the ability to know one's own current situation as well as the enemy's, and additionally, to proactively anticipate the right move rather than to simply react to enemy moves (Somerville 2001, 2). Basically, this ability to perceive, comprehend, and project at a rate exceeding that of the enemy is the true goal of the CFACC through his various CAOC teams and technology. This ability to channel the appropriate SA will be challenged by noncollocated operating locations of various CAOC team members.

The CFACC may not be colocated with all members and assets in the CAOC. CAOCs will include distributed operations. "Distributed operations occur when independent or interdependent nodes or locations participate in the operational decision-making process to accomplish goals and missions for engaged commanders" (AFDD 2-8 2001, 31). Since the CAOC team members "feed the CFACC's SA picture" from various locations, they need to understand what is important to his concept of SA. They must supply him with timely, pertinent information with which he can make decisions.

Virtually every aviation CRM program addresses SA in some way. However, a concept known as shared SA may have particular utility to a CAOC team. In a Defense

Advanced Research Projects Agency (DARPA) project, the concept of shared SA was explored. Key factors that affect how teams, particularly distributed teams, develop a common clear and accurate, relevant picture of the battle space can greatly enhance the decision-making process (Nofi 2000, 3). This shared SA picture may be distributed to various tactical commanders as well as the operational commander via any number of information and communication assets. A common information network via data link can enable information to be shared by tactical units and operational commanders. "Network-centric warfare can result in knowledge superiority by tying sensor, shooters, and commanders together in a common information scheme" (Friedman 2000, 24). "Given the situational awareness offered by the network picture, decisions can be made more quickly and precisely" (Friedman 2000, 24). CAOC teams operate and manage the many systems that "feed" the commander's picture, thus it is critical that they understand how to prioritize and pass the right SA (information), at the right time, to the right place.

General John N. Abrams, TRADOC Commander, while speaking to the US Army Command and General Staff College on 6 November 2001 about Objective Force leadership stated, "Technologies alone will not allow success. Soldiers and their leaders are the centerpiece. Operational leaders will need to focus the energies of our command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) assets." General Abrams went on to highlight the need for joint teamwork by saying, "Leadership is not comfortable with the joint teaming that is required for effective coordination" (Abrams 2001). Training for the joint teaming required in an AOC may be achieved by use of a CRM-type training program. He also stated that it is critical to "see first, understand first, act first, and be decisive," with respect to the operational-level

leadership decision cycle. The ability to see and understand a situation is very similar to Dr. Kern's first two levels of SA: perceive and comprehend.

Crew Coordination and Flight Integrity

A crew is defined by CTI, Incorporated as any collection of personnel who work together to accomplish a mission (USAF 2000, 7). This definition of a crew is rather vague. According to this definition a crew could be two people within a cockpit crew (intracrew) or it could be several people in different aircraft (intercrew). In *Redefining Airmanship*, Dr. Tony Kern states, "Fighter pilots need CRM. The 'crew' could consist of several crews in separate aircraft working in concert with an (Airborne Warning and Control System) AWACS, intelligence gathering assets, tankers, command and control elements, and ground forces" (1998, 141). Since the CAOC works with teams instead of crews, a team concept may be a more appropriate term. In order to define the group of personnel that work together in a CAOC, the researcher has defined the term CAOC Team as any collection of individuals from various areas of expertise working together to accomplish the required tasks within a specific CAOC division. There are several distinct teams within a notional CAOC. Organization of a CAOC will be addressed in the fourth section of this literature review.

Crew coordination as defined by CTI, Incorporated is the act of working with all crew members to accomplish the tasks of a mission (USAF 2000, 7). Team coordination would seem to be a better term than crew coordination since the term "team" is used more commonly than "crew" in the CAOC's organization. Unity of command is many times impossible in a multinational force, as many governments will not submit to operational or tactical control by another nation's leadership. Team coordination may be

accomplished by unity of effort. In a coalition operation, there will undoubtedly be representatives from coalition nations that serve as members of a CAOC team or as liaison elements.

Flight integrity as defined by CTI, Incorporated, is utilizing all members of a flying package to accomplish the mission at hand (USAF 2000, 7). Two skills not addressed directly under the crew coordination or flight integrity are advocacy and assertion. Advocacy and assertion are interventions invoked when a team member's viewpoint does not coincide with that of the decision maker. These actions provide an opportunity to correct errors or loss of situational awareness (DRC 2000, 41). Simply put, a team member becomes assertive by suggesting an alternate course of action to a decision-maker and an advocate for that course of action while trying to convince the group's decision maker that his reasons are valid.

Although these are not listed “core skills” per se, the advocacy and assertion concept is addressed under the flight integrity heading. According to Lieutenant Colonel Del Linge (USAF retired) an experienced F-15C pilot who now teaches CRM for CTI Incorporated, assertiveness is definitely part of the CRM courses he teaches. “CTI has used the Black Hawk shoot down as an example of when to speak up, or be assertive when you have a reason to believe something is going wrong” (Linge 2001). “The absence of assertiveness has been cited as a causal factor in a number of aircraft accidents” (Prince 1993, 358). “Components of assertiveness include advocating a specific course of action, stating opinions on decisions/procedures even to higher-ranking crew members, asking questions when uncertain, making suggestions, and raising questions about procedures” (Prince 1993, 358).

Communication

Communication is the act of sharing information with others to cause some kind of action: to direct, to inform, to question, or to persuade (USAF 1998, 7). Information flow is the cornerstone for individual and team situational awareness. The increasingly critical flow of communication from intelligence and reconnaissance assets to weapons employment assets has become known as real-time sensor-to-shooter (STS) information flow. This concept is critical in an environment of rapidly moving targets of opportunity, for example, in a close air support (CAS) scenario. Effective communications between the *sensors* (reconnaissance and intelligence assets on the ground or in the air) in the form of voice or data link) to the *information managers* (air battle managers, forward air controllers, combat observation and lasing teams) to *command and control* (AWACS, Air Support Operations Center (ASOC), or Airborne Command and Control Center (ABCCC)), to the *shooters* (A-10s, F-16s, F-15Es, F/A-18s, and AC-130s) are critical to effectively targeting mobile ground forces. In this example, personnel from many service components must work together seamlessly to provide timely, pertinent information to the shooter. Sensors must be in tune with the types of information which are important to the shooter. Decentralized execution is a primary tenet of airpower. Command and control must resist the temptation to micro manage the execution and primarily use the battlefield information to assist the shooter, not to direct his tactical decisions. Digitized optical images piped directly into the cockpit may be very helpful in some cases, and in other cases, a succinct verbal target description at the right time may be adequate. Communication is the "glue" that binds a shared situational awareness amongst members of any team. This common level of SA is what allows timely decisions to be made.

Risk Management and Decision Making

Decision making is the ability to choose a course of action using logical and sound judgment based on available information (USAF 2000, 7). Risk management is a logic-based, common sense approach to making calculated decisions on human, material, and environmental factors before, during, and after mission activities and operations (USAF 2000, 8).

In a CAOC offensive operations team, large numbers of people must work together and the time allowed for decision making is often reduced. The following CRM concepts as addressed to a fighter formation may have some use by a CAOC team in a time-constrained, decision-making environment which is often the case during time critical targeting operations.

> In the air-to-air combat arena, decisions must be made in every phase of flight. The fluid and dynamic nature of the mission leaves a large portion of the events unpredictable. The flight lead must make his decisions quickly else the formation will lose its advantage or suffer losses. The penalty for poor decisions in the air-to-air arena is not only the death of the fighter but also possibly the loss of the entire formation or team. Every member of the formation is expected to make timely decisions based on his assigned tasks and roles within the formation.
>
> Fighter pilots will make mistakes in air-to-air combat. Risks will be taken that exceed the planned risk level based on some of these errors. The effective application of the CRM tenets, and most especially effective CRM decision making, is to manage the impact of these errors. Plan to expect certain kinds of errors at the times when they are most likely to occur, and then lay the framework for risk management and decision making to minimize the impact of those errors. Airborne decisions are generally classified as rule based or knowledge based. Rule based decisions involve the application of procedure or checklist, for example, the decision to abort based on abort speed. Knowledge based decisions involve the application of a general criteria to a situation. The facts are presented and analyzed. The team comes to a decision about action to be taken is reached. In a time critical situation, the leader manages his resources, takes input, and decides on the course of action for the team. Knowledge based decisions can be made for a well-defined problem or an ill-defined problem.
>
> Well-defined problems are easily interpreted. All of the facts are presented--there are very few unknowns. The aviator addresses all facts, applies

> his knowledge, and makes a decision. Ill-defined problems are more difficult to solve. Many of the facts are not presented or the problems may be varied and compounded. Normally, ill-defined problems are best solved by an innovative approach involving brain storming and taking as much time as possible to analyze the situation. Unfortunately, in the air to air combat arena, decisions must me made quickly--time is not a commodity. From a CRM perspective, the formation must adapt to this and use assumptions to make the ill-defined problem well-defined.
>
> Assumptions are an attempt to limit the scope of the problem and effectively decrease the time required to investigate it. One example of an air-to-air targeting assumption is to assume that each threat on the radar scope has a minimum of two bogey fighters in it, and that each bogey fighter is carrying a minimum of two self-protection radar guided missiles. Obviously, too many assumptions render the decision invalid, and too few assumptions will increase the time required to reach an effective decision. Application of the CRM tenets in decision making will increase the success of the formation by increasing planfullness, solidifying roles, formulating a shared mental state, increasing situational awareness, and communicating perceptions. (Stapleton 2000, 4)

Task Management

Task management is the ability to alter a course of action based on new information, to maintain constructive behavior under pressure, and to adapt to internal and external environment changes (USAF 2000, 8). Task management and task prioritization are important aspects of the CAOC offensive operations team. According to AFI 13-1AOC, volume 3, *Operational Procedures--Aerospace Operations Center*, one of the tasks of the CAOC COD is: "monitor the status of air defense assets and retask, reposition, or change weapons status to respond to battlespace changes" (USAF 1999, 40). For example, within the defensive operations core team, if a specific Patriot air defense battery was reported to be nonfunctional, the team chief may possibly reflow defensive fighter combat air patrol (CAP) assets to cover that area until the Patriot was back to operational status. The team chief would have to prioritize the task of communication to the fighters regarding their new mission.

Mission Planning and Debriefing

Mission Planning is defined as taking all of the information for a mission and developing short term, long term, and contingency plans to coordinate, allocate, and monitor crew/flight and aircraft resources (USAF 1998, 8). Mission debriefing is defined as reviewing and discussing mission accomplishment looking at what was achieved, what barriers were encountered, and how the mission could be accomplished better next time (USAF 1998, 8).

Every type of aircrew from fighter pilots to airlifters has a pre-mission brief that sets the stage for the mission. Roles, responsibilities, and contracts for all crew or team members are spelled out. It would seem logical that all team members of a CAOC operations team have a brief and debrief at the start and end of each shift. The researcher assumes that some type of preshift briefing would take place, although no documentation of this could be found in AFI 13-1 AOC list of specified tasks for the offensive operations team, but it would most certainly be an implied task. The senior offensive duty officer (SODO), the team leader, could include most likely areas of concern for the day. For example, poor weather might cause certain high priority missions to be cancelled. If the team leader could provide this SA to his team, they may be better prepared to proactively rerole another asset to attack that target when conditions permit.

## Evolution of Civilian CRM

Dr. Robert L. Helmreich defined five generations of CRM that have resulted from the civilian airline cultural CRM evolution. In the first two generations, CRM was only applied to the pilots and crew in the cockpit. But in the third generation, CRM began to be extended to other groups within the airlines to include flight attendants, dispatchers,

and maintenance personnel (Helmriech 1996, 5). The fourth generation was characterized by integrating CRM into all phases of training. The fifth generation of CRM can simply be summed up as error management (Helmriech 1996, 8). The underlying premise is that human error is inevitable. And, if error is inevitable, CRM can be seen as a set of countermeasures with three lines of defense including avoiding errors, trapping errors before they become consequential, and mitigating the consequences of those errors that do occur (Helmriech 1996, 9).

A similar evolution has taken place in the military aviation CRM as evidenced by the USAF CAF CRM program for the early 1990s to the present. Specifically, the evolution of CRM training with respect to F-15C pilots will be addressed.

## Evolution of Military CRM

According to Del Linge, "CRM concepts" have been taught in one form or another at the F-15C Flying Training Unit (Schoolhouse) since the late 1980s. A course called Task Management that addressed communication, SA, task management, and briefing techniques was taught at the F-15C schoolhouse before 1992. The Aircrew Attention Awareness Management Program evolved in the mid-1990s. In the late nineties, the program's name was changed to CRM as a reaction to the success of the CRM training program in the airlines (Linge 2001). These initial CRM programs emphasized basic airmanship and flight leadership skills. The courses were very valuable to inexperienced pilots, but seasoned F-15C pilots tended to consider the training a waste of their time (Smith 2000, 2).

In 2000, CTI, Incorporated, changed the name of the course to *Fighter Resource Management* and started to emphasize the use of CRM in tactical scenarios, in an effort

to tailor CRM training to fighter pilots. Not only did it address the fighter pilots, but also showed that CRM applied in an intercrew scenario by using examples of fighters working with other combat and support aircraft crews.

At the time of this project, the researcher did not discover any of type CRM training applied to CAOC operations evidence in the literature. According to Mr. Ray Churchill, the ACC CRM Program Manager, there is not currently a CAOC CRM training program.

## Other than Aviation Uses for CRM Concepts

Concepts of team training and CRM are many times intertwined. Several examples of these CRM-type training programs exist currently. Dynamics Research Corporation currently teaches a Team Coordination Course which is aimed at improving combat care training for US Army nurses (DRC 2000). CTI not only has contracts to teach a wide variety of CRM courses to several types of USAF aircraft crews, but they also are using similar concepts to train law enforcement, firefighters, and health care personnel (CTI 2000). A new company called Human Performance Training Institute (HPTI) offers technology-based training programs designed to help reduce catastrophic errors in many safety sensitive industries. HPTI provides training in the areas of threat and error management, decision making, communication, and leadership to healthcare professionals, fire and police departments, emergency medical teams, as well as other agencies including nuclear power plant and chemical plant personnel (HPTI 2001).

A study accomplished in 1996 by A. J. Gayman at Armstrong Laboratories indicates a link between CRM and US Army tank crew training. A significant number of tank accidents have been attributed to deficiencies in crew coordination. Applying

principles of aviation-derived CRM training to tank crews may enhance mission effectiveness and operational safety. This analysis of crew coordination-related tank accidents suggests that several factors including automation, the criticality of shared perceptions, possible information overload, and increasing requirements for team decision making on the digital battlefield support the application of CRM concepts to tank crews (Gayman 1996, 1). This application of CRM-related concepts sprung from the US Army aviation's crew coordination training program.

## Classification of Error

A method for determining types of error is required for the Black Hawk shoot down operational level case analysis. This section will present three approaches to error classification discovered during research.

In Dr. Kern's analysis of USAF tactical aircrew error in Operation Desert Shield and Storm, he mentions two different approaches to error classification. The first is by J. W. Senders. Kern summarizes Senders:

> One of the most flexible and elegant explanations of human error is outlined by J. W. Senders. He breaks down error into categories of, perception, execution and intention. Senders uses a traffic light analogy to outline the differences between each. Let's assume that Bob (after he lands and debriefs) is driving home and sees a red traffic light. He correctly decides to stop, but accidentally steps on the accelerator instead of the brake. This is an error of execution. On the other hand, if Bob had been looking into the sun and misperceived the red light as green or yellow, he would have committed a perception error. However, if Bob was in a hurry, correctly saw the light as red and yet decided to go through anyway, he would have committed an error of intention. (Kern 1995, 25)

Kern references Alan Diehl, an aviation psychologist with the USAF Safety Agency for another method of classifying aircrew error.

> Diehl recommends dividing tactical aircrew errors into three categories, namely, procedural activities, perceptual-motor activities, and decision-making activities--what he refers to as slips, bungles, and mistakes. Perceptual errors are linked closely to situational awareness. A mis-perceived cue could cause a pilot to lose track of the current dynamic state of his mission. Bungles, or motor mistakes indicate the possibility of training or flight currency related errors. Mistakes, or decision-making errors will focus on the issue of judgment. (Kern 1995, 39)

Finally, a technique used in searching for the root cause of error during USAF Weapons School flight debrief is alluded to in several USAF Weapons School articles. Simply stated, a root cause for an error is one of perception, decision, or mechanics of execution (Smith 2000, 35). In determining the type of error, the following questions are asked: What did you see? What did you do? How did you do it? The answer will point to an error of perception, decision, or execution.

All three of these approaches are very similar and can be summarized in table 1.

Table 1. Error Models

| Senders | Diehl | USAF Weapons School |
|---|---|---|
| Perception | Perceptual-motor | Perception |
| Intention | Decision making | Decision |
| Execution | Procedural | Execution |

Due to its similarity to Senders' and Diehl's model and its simplicity, the USAF Weapons School model will be used for the Black Hawk shoot down analysis. Errors will be classified into one of these three “bins” and then analyzed to see which of the nine core CRM skills were involved.

## Operational and Tactical Levels of Warfare

This section will review the literature to determine an acceptable set of definitions to serve as criteria for error classification methodology. Since only operational level errors are to addressed, a definition for operational level must be determined. No definition of operational level error could be found in current publications, thus the researcher has framed one for the purpose of this research.

### Operational-Level Error

The operational level of war is defined in JP 1-02 as:

> The level of war at which campaigns and major operations are planned, and sustained to accomplish strategic objectives within theaters or areas of operations. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, applying resources to bring about and sustain these events. These activities imply a broader dimension of time and space than do tactics; they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical successes are exploited to achieve strategic objectives. (JP 1-02 2000, 335)

Logically, the definition of "operational" would follow the definition above and "error" as determined from the previous section is one of perception, decision, or execution. Since this project is limited to the operational level only, consideration must be given to where the dividing line for the tactical and operational levels lies.

### Tactical Level

The tactical level of war is defined in JP1-02 as, "The level of war at which battles and engagements are planned and executed to accomplish military objectives assigned to tactical units or task forces. Activities at this level focus on the ordered arrangement and maneuver of combat elements in relation to each other and the enemy to achieve combat objectives" (2000, 453).

The definition of a tactical unit in JP 1-02 is, “An organization of troops, aircraft, or ships which is intended to serve as a single unit in combat. It may include service units required for its direct support” (2000, 454).

## Distinction Between Operational-Level and Tactical-Level Error

Can a line be drawn between the tactical and operational levels? If so, where? The answer to this question is very subjective. Major Robert D. Evans compares the effects of CAS and interdiction at the tactical and operational levels of war,

> Close Air Support (CAS) represents aerial maneuver in direct support of the ground commander's scheme of maneuver. While interdiction may have effects at the operational level of war, close air support generally produces tactical results to directly influence the ground battle. This distinction accounts for the different procedures used to target CAS and interdiction sorties. Interdiction targeting is done from the top down, starting with the (Joint Force Commander) JFC's priorities. In contrast, targets for CAS flow from the bottom up, through various levels of command before reaching the air component providing support. With preplanned CAS and flexible air interdiction the lines may become blurred. (Evans 2001, 51)

The lines between CAS and interdiction may become blurred, just as the definitions of deep, close, and rear battlefield operations may become blurred in a noncontiguous battlefield. The operational and tactical levels of war are intertwined between major operations and battles. According to US Army Field Manual 3-0, “An operational-level headquarters sets the terms of battle and provides resources for tactical operations” (2001, 3-5). The CAOC is the place where operational art links strategic plans, to operational campaigns, and hands taskings to the tactical units via the wing operations center (WOC). Therefore, anything at the CAOC or above will be considered operational level and at the WOC or below will be considered tactical level.

## CAOC Offensive Operations Team

This section will describe the members and tasks of a notional CAOC OOT. Various references describe slightly different organizations for a CAOC. This is not surprising due to the rapidly advancing technologies available and the current continued improvement of AOC operations. Technological, organizational, and procedural lessons learned from Desert Storm, Alleid Force, and most recently, the Enduring Freedom air campaign in Afghanistan are continually shaping the CAOC's concept of operations. Sources used as reference for the CAOC's composition were: (1) Air Force Instruction 13-1AOC, volume 3, *Operational Procedures--Aerospace Operations Center*; (2) Technical Order AN-USQ-163-1, Version 1, 1 December 2001; (3) *JEFX 2002, Concept of Operations and Tactics, Techniques, and Procedures for Time Critical Targeting during Millennium Challenge 2002*, 20 November 2001; (4) Air Force Doctrine Document 2-8, *Command and Control*, 16 February 2001; and (5) Joint Publication 3-56.1, *Command and Control for Joint Air Operations.*

The CAOC's basic organization and functions are laid out in Air Force Instruction 13-1 AOC, volume 3, *Operational Procedures--Aerospace Operations Center*. AFI 13-1 AOC states that, "The exact composition of offensive operations core team will be tailored to the contingency or exercise" (USAF 1999, 44). Thus, each theater will customize the CAOC OOT as required. AFI 13-1AOC is the primary procedural document for AOC operations.

CAOC-X, located at Langley Air Force Base, is a full-time AOC development facility used to ensure new technologies and processes are standardized and quickly delivered to all the US Air Force's AOCs. According Lieutenant Mark Hall, the Director

of Engineering for CAOC-X, “The OOT's concept of operations is continually evolving, especially in the time critical targeting (TCT) task” (Hall 2001). CAOC-X personnel are currently working on a draft “dash one” for the CAOC. “Dash one” is the term typically given to the pilot's “operator's manual” for a particular aircraft. Since the CAOC is an official weapons system, a dash one, which is officially termed Tech Order AN-USQ-163-1 Version 1, 1 December 2001, is being developed. Using these two sources primarily, and the other three mentioned above secondarily, the following CAOC OOT organization and tasks are surmised. It is important to realize that this list of personnel and tasks is by no means meant to be complete. The researcher will choose several key personnel positions and tasks to provide the framework for analysis for this study.

The OOT is responsible for monitoring and executing the offensive missions in the current ATO (i.e., “today’s war”). Combat operations assumes responsibility for the next ATO (i.e., “tomorrow's war”) as soon as the ATO is released, normally twelve hours prior to execution. Timely coordination between OOT and tasked WOCs is essential to the conduct of effective, efficient air operations. The ATO is written and disseminated based on intelligence estimates and other perishable data that may be as old or older than thirty-six hours. When the ATO is executed, changes in enemy (and friendly) capabilities, locations, and intent, along with weather and political conditions, may impact the planned operations. Within the offensive core team, there are multiple specialty and support teams that feed and enable offensive operations (USAF 1999, 40).

Liaison personnel are assigned to the OOT to coordinate and assist, as required, offensive air operations. Liaisons provide valuable insight into air, ground, and sea operations. Normally, the liaisons will act as the point of contact to their services or

countries to deconflict operations, resolve joint or combined problems, pass threat alerts, monitor common air taskings, and address other issues of interest.

## Offensive Operations Team Personnel

The senior offensive duty officer (SODO) is responsible for OOT operations. Only the OOT will be addressed in this study; however, it is important to mention the two positions that supervise the SODO, the director of combat operations (DCO) and the chief of combat operations (CCO). The combat operations division is typically divided into two core teams, offensive and defensive operations. The DCO is responsible to the CAOC director for the direction and supervision of combat operations.

The CCO monitors the current air situation and advises the DCO of dynamic mission requirements and the status of resources. When the situation requires an ATO change, the CCO summarizes the current air situation for the DCO who approves or disapproves adjustments to the published ATO (USAF 1999, 41). The following is a list of positions within the notional OOT.

### Senior Offensive Duty Officer

The SODO will monitor the current offensive air operations situation and advise the CCO of dynamic mission requirements and resource status, and recommend immediate changes to the ATO when the situation dictates with special emphasis on integrating all offensive and support operations (USAF 1999, 44). The SODO would be intimately familiar with the resources available, and liaison directly with the senior tactical command and control element (AWACS or Control and Reporting Center) on those resources' status at any given time. In the TCT environment, the SODO would work closely with the intelligence duty officer (IDO) in pairing resources with targets,

getting approval from the CCO and DCO, and communicating the solution back to the appropriate tactical command and control platform for actual task passage.

Offensive Duty Officers and Duty Technicians

Offensive duty officer (ODO) refers to duty officers responsible for fighter, attack, bomber, tanker, reconnaissance, CAS, electronic combat, and service unique aircraft and for coordination with subordinate units of the tactical air control system (TACS), such as ABCCC, air support and operations center (ASOC) and airborne command element (ACE). Expertise for each weapons system should be available in combat operations or shared between combat operations and combat plans depending on availability. The ODOs will follow strike packages and associated special missions from departure through recovery. ODOs must know the details of each package in which their aircraft participate, such as ordnance, primary target, secondary target, assigned prestrike and poststrike tanker(s), orbit(s), off load(s), and mission results. They also pass on critical information to and from their respective WOC(s) concerning air raid warnings, significant battle damage, unexpected changes, diverting aircraft, and airfield status.

Intelligence Duty Officer

The intelligence duty officer (IDO) assesses type and time of coverage for national assets. He also assesses intelligence preparation of the battlespace (IPB) data sources, ensures threat updates are passed to aircrews, and fuses all available data into usable intelligence.

Reconnaissance Duty Officer

The reconnaissance duty officer (RDO) manages all reconnaissance assets assigned or made available.

Space Duty Officer

The space duty officer (SDO) is "responsible to the CCO for directing space warfare operations, assessing space warfare effectiveness, and (integrates space support into Combat Operations)." The SDO will work closely with the IDO in the fusion of available data, as well as providing collateral liaison to higher classification sources.

The IDO, RDO, and SDO work very closely to ensure a well-integrated common operating picture (COP) is presented for all members of the CAOC.

Electronic Combat Duty Officer

Electronic combat duty officers (ECDO) coordinate the employment of all EC assets assigned or made available to support air operations.

AWACS Duty Officer

The AWACS duty officer (AWACDO) is responsible to the CCO for monitoring AWACS performance. The AWACDO recommends changes in AWACS tasking and coordinates with the system interface control officer and other joint service airborne elements to ensure an accurate, comprehensive recognized air picture (RAP).

Tanker Duty Officer

Tanker duty officers (TDO) provides air-refueling expertise.

Fighter Duty Officer

Fighter duty officers (FDO) provide specific fighter aircraft expertise.

Bomber Duty Officer

Bomber duty officers (BDO) provide specific bomber aircraft expertise.

Special Operations Liaison Element

The special operations liaison element (SOLE) resides in the AOC, and serves as the principle liaison between the senior element of the TACS, and special operations forces (SOF) on the battlefield.

Time Critical Targeting (TCT) Team

One of the most challenging tasks of combat operations is to rerole forces in reaction to enemy action, weather changes, critical supply and personnel needs, friendly forces becoming isolated, combat search and rescue, and to meet medical evacuation (MEDEVAC) requirements. This team is broken down into three basic sections: the ISR section, the surface tracking section, and the attack section. Simply put, there are hunters, trackers and killers. These sections coordinate the flow of assets to hunt, track, kill, and assess targets. Rapid, thorough coordination is required to successfully rerole forces and make the necessary changes to the ATO. This team is supported by expertise from specific ODOs as required.

Importance of the TCT Process

This notional OOT has literally hundreds of tasks and responsibilities. In order to limit the scope of this research, one major area will be addressed: the TCT process. This particular process was chosen for its emerging importance. General John Jumper, US Air Force Chief of Staff, alluded to the importance of the AOC in the time critical targeting mission, “The air and space operations center's primary job will be to put actionable, decision-quality battlespace information in front of the commander” (Grier 2001, 22). General Jumper added, “Synthesizing time critical information and quickly turning it into time critical target destruction will be the determinant of future success” (Grier 2001, 22).

Before the TCT process tasks are introduced, it is important to understand a few basics.

## Time Critical Targeting Function of the CAOC Offensive Operations Team

What is the difference between time critical targeting and time sensitive targets? This is an important question to answer as the two terms are often used interchangeably. According to Joint Doctrine Encyclopedia, 16 July 1997 Time Sensitive Targets (TSTs) are:

> Those targets requiring immediate response because they pose (or will soon pose) a clear and present danger to friendly forces or are highly lucrative, fleeting targets of opportunity. Time-sensitivity can play an important part in categorizing a target and determining its appropriateness as a special operations target. Time-sensitivity can be viewed from either a targeting or mission planning perspective or a combination of both, as in the case of personnel recovery missions. A target is time-sensitive when it requires an immediate response because it poses (or will soon pose) a danger to friendly forces or is highly lucrative, fleeting target of opportunity. Time-sensitive targets are usually mobile, such as a mobile intercontinental ballistic missile, or they may lose their value quickly, such as a bridge being used for an enemy advance or withdrawal. (1997, 704)

"Time Critical Targeting is an Air Force term that pertains to TST targeting processes, team specifics, and system processes" (Backes 2001, 8). "War fighters have long understood the difficulties associated with time sensitive targets. Operation Desert Storm and Operation Allied Force lessons learned indicate that our opponents strategy for survivability depends on limiting assets vulnerability to attack, in this case through increased mobility and short exposure operating cycles" (Backes 2001, 5). The same evasive tactic was used by Taliban forces and al-Qaeda terrorist network personnel in Afghanistan. The services have developed concepts for the TCT process. "The concepts are heavily dependent upon situational awareness and anticipation of emerging targets" (Backes 2001, I-5). To summarize, the basic concepts include: (1) knowing the adversary

by conducting joint intelligence preparation of the battle space, (2) anticipating where the adversaries targets will emerge based on integrated intelligence, surveillance, and reconnaissance, (3) establishing clear JFC guidance for target ID, tracking, interoperability, compatible communications hardware and software, authority levels, and engagement procedures crucial to successful decentralized execution, and (4) once a target is found that meets criteria established by the JFC it will be fixed (mensurated), tracked, targeted, engaged, and then assessed (Backes 2001, 6). The TCT process can be summarized by the "find, fix, track, target, engage, assess" process known as the "kill chain" (Backes 2001, 10). The tasks below will fall under one of the elements of the kill chain process.

Offensive Operations Team TCT Tasks

The SODO is the leader of the OOT. One of his subordinate leaders is the TCT team leader. Many or all members of the OOT may be involved in various TCT tasks. This list is a limited sampling of tasks that have been generalized from the JEFX 2002 concept of operations, AFI 13-1AOC, and the CAOC "dash one" draft. The tasks are extremely oversimplified purposefully to limit the scope.

Find

Develop a common operating picture (COP) to track TSTs through use of integrated ISR assets and retask or reposition ISR assets, if necessary.

Fix

Detect, classify, identify, and provide coordinates for tracking.

Track

Ensure proper tracking assets are available to track target.

Sort available targets by priority in accordance with JFC's guidance.

Target

Retarget or retask JFACC assets to respond to changes in the friendly or enemy battlespace situation and assess consequences of re-tasking assets with respect to JFC's guidance, intent and priorities.

Coordinate with appropriate liaisons/ODOs to determine most appropriate asset to conduct attack.

Engage

Provide adequate targeting information to attack assets assigned to engage target.

Assess

Ensure appropriate ISR assets, SOF available to accomplish battle damage assessment (BDA).

Brief and Debrief the TCT Team

The TCT team chief will coordinate a pre-shift briefing to include an enemy situation update, a listing of ATO assets available for targeting, an ISR asset and system update, and expected contingencies (weather or maintenance issues). In addition, the TCT team chief will facilitate a debrief of the shift's events with respect to CRM concepts in order to provide lessons learned and improve team processes.

## CRM Addresses the Human Element of the CAOC System

A CRM training program addresses an aircrew as a system rather than isolated individuals. Similarly, CAOC Team coordination training must address all personnel and equipment as a system. As aircraft have become more technologically advanced, pilots and crews spend less time as manipulators of flight controls and more time managing information and making decisions. The digital battlefield will continue to demand that military command and control technology pump timely, mission-essential SA into the displays of soldiers, sailors, marines, and airmen at all echelons of the battlefield. The human element in the system must determine who needs what SA to make the tactical decisions required for the execution of mission tasks. The CAOC system serves as the operational level hub for the management and flow of information to ensure the right personnel get the right information at the right time.

A series experiments known as the Joint Expeditionary Force Experiments (JEFX) have taken place since 1998. The experiments are a series of annual field tests of advanced technologies and new operational concepts that evolve into the Expeditionary Air Force of the twenty-first century. Colonel Terry Thompson, director of the US Air Force Experimentation Office, summarized the AOC's concept of operations during JEFX:

> Because the JFACC has to run the air campaign and assimilate a lot of information, we had to develop what we call the AOC master caution panel, similar to the warning lights a pilot gets in the cockpit. We are trying to reduce the time it takes to make decisions. If we can get the right information to the right people to make the right decisions, we can better prosecute the war. What we are trying to do is develop the operational picture for the commander that allows him to make the right decisions. The warfighter may not need all of the information from the AWACS, Joint STARS and so on, that would be information overload. We have to determine what he does need, which may be different from what the

> air expeditionary wing commander needs to monitor the mission. Much of the sorting process will be automated, but some of the information must still be passed through a human filter. Technology has no compassion and doesn't always follow orders well, so you have to have the human filter involved. (Wilson 1999, 3)

This will demand that all warriors possess CRM-type skills to survive the fast-paced decision cycle in the battle space of the future, regardless if they are apart of an aircrew or a ground-based CAOC team.

## Fratricide Incident

Primary and secondary sources containing information regarding the Black Hawk fratricide incident are available. The bulk of the primary source information is in government documents including the Aircraft Accident Investigation Board Report US Army Helicopters 87-26000 and 8826060. Secondary source information is obtained from periodicals and books. A key reference in this review will be *Friendly Fire* by Lieutenant Colonel Scott A. Snook. US Army Lieutenant Colonel Snook has a doctorate in organizational and behavioral science, has combat experience in Grenada, and most recently has served as the Director of West Point's Center for Leadership and Organizational Research. Lieutenant Colonel Snook provides an excellent compilation of the volumes of data available on the facts of the shoot down from the perspective of an organizational and behavioral scientist.

## Summary

The importance of a well-integrated and synchronized joint force will continue to be absolutely critical to the US armed forces. The ability of the CAOC to provide the CFACC with timely accurate SA in order to speed up his decision cycle will be the decisive point in current and future operations. As the military and political leaders work

to determine the best way to organize and equip the objective joint force, a simple, easily executable training program for the personnel in this force will be required. The concepts of CRM currently used for tactical and commercial aviation may play a role in training the CAOC of the future. A review of the applicability of the USAF's core CRM skills to a nonaviation team and the analysis of the Black Hawk fratricide incident may provide some insight toward the applicability of CRM to the echelons above the tactical level of warfare, starting with the CAOC team.

# CHAPTER 3

# RESEARCH METHODOLOGY

## Introduction

This chapter describes the research methods used in this study. First, the research design will be explained so the logic behind the research plan's organization will be understood. Second, data collection and analysis will be addressed. The researcher's qualifications and potential bias will be addressed finally.

## Research Design

In order to determine the answer of the primary question, a number of subordinate questions will need to be answered. (The primary question is: Are CRM training concepts applicable to a CAOC Offensive Operations Team?)

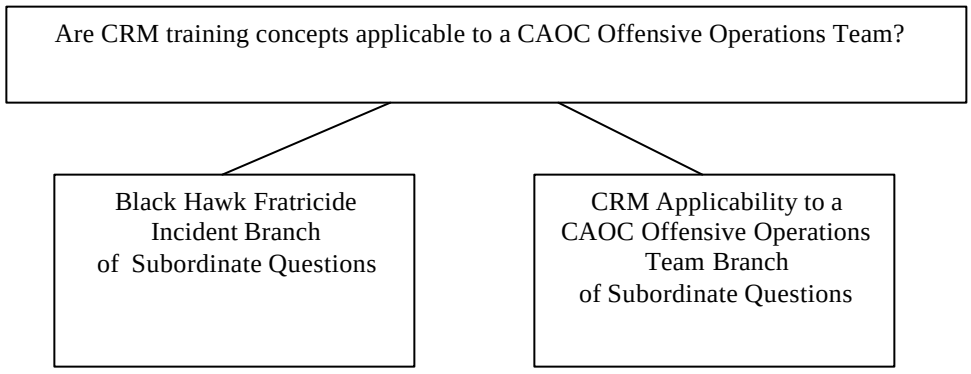


Figure 2. Visual Depiction of Subordinate Question Branches

The research design will be qualitative in nature and contain two branches as in figure 2. Just as the subordinate questions have two branches, so will the research design.

In the first branch of subordinate questions, the Black Hawk incident will be analyzed. The second branch of subordinate questions will address the CAOC team and its functions with respect to the CRM core skills. Several of the questions from each branch were answered in chapter 2 during the literature review.

## Methodology Relating to the Black Hawk Fratricide Incident (Branch One)

The first branch of the research design will chronologically identify errors at the operational level of the CTF of OPC and classify them by error type. A previous work provides an ideal framework for this type of research. A similar study by Dr. Tony Kern was accomplished in 1995. This study will use some elements of Dr. Kern's research model. Dr. Kern is a noted CRM expert and is widely published in the field of military and civil aviation. Dr. Kern's Master of Military Art and Science thesis, "A Historical Analysis of US Air Force Tactical Error in Operations Desert Shield and Storm," identified and analyzed tactical aircrew error in the Gulf War. His analysis identified four error types that occurred in over 25 percent of the incidents addressed. These error types were decision-making errors, situational awareness errors, procedural errors, and crew coordination errors (Kern 1995, 55). These error types relate directly to the CRM core skills applied in this study. Notably, Dr. Kern's military experience in the CRM field also includes a tour as the Chief of CRM Plans and Management at the USAF Air Education and Training Command where he was influential in the development of a comprehensive CRM training program (Kern 1997, 1). Dr. Kern's research model is applicable to this study as it provides a relevant framework for error analysis. This research is significantly different from Dr. Kern's study in two ways: (1) this study

addresses errors not by aircrew members, but by personnel in the JOIC (the JOIC in OPC accomplished the AOC mission), and (2) this study addresses errors at the operational level, not at the tactical level. This research is similar to Dr. Kern's in that it requires an error classification model. Using Dr. Kern's research model as a starting point, the researcher made modifications as required. The three subordinate questions below were answered during the literature review and will not be addressed in this chapter.

1. What is the definition of tactical error?
2. What is the definition of operational error?
3. Can a line be drawn between the tactical and operational levels? If so, where?

These three questions sought to limit the scope of analysis to the operational level. For the purpose of this research the operational level will be defined as any communication, decision, action, or event that takes place at the CAOC. This includes any information that is passed to the subordinate wing operations centers. Thus, the line between the operational and tactical level will be drawn just above the wing operations centers. Error classification was also determined in chapter 2. Errors will be classified as either perception, decision, or execution.

The following two questions will be the focus of "branch one" methodology. The first is: What errors occurred at the operational level, and how did they influence tactical aircrew execution in the Black Hawk fratricide incident with respect to: situational awareness, crew coordination, flight integrity, communication, risk management, decision making, task management, mission planning, and mission debriefing?

Using the Aircraft Accident Investigation Board Report US Army Helicopters 87-26000 and 8826060 as a primary source, the events at the operational level will be

scrutinized for the specific types of errors that were committed (perception, decision, or execution). Once the error type is identified, the researcher will compare specifics of each event as they may or may not relate to the established definitions (from chapter 1) of each of the nine core skills. An error matrix similar to one used by Dr. Kern will be used. An example this matrix is shown in table 2. Once all operational level events are classified by error type and CRM core skill, the data will be analyzed for frequency of occurrence. This data will enable the second question of this branch to be answered. The second question is as follows: Which of the nine core skills are applicable at the operational level to a CAOC Offensive Operations Team?

Table 2. Error Matrix (Blank)

| Error Type | Perception | Decision | Execution |
|---|---|---|---|
| Situational Awareness | | | |
| Crew Coordination | | | |
| Flight Integrity | | | |
| Communication | | | |
| Risk Management | | | |
| Decision-making | | | |
| Task Management | | | |
| Mission Planning | | | |
| Mission Debriefing | | | |

Once the types of CRM skills that are or are not applicable to the Black Hawk fratricide incident are documented, the first branch of subordinate questions will be answered. The second branch of subordinate questions will be addressed next.

## Methodology Relating to Applicability of CRM Concepts to CAOC Offensive Operations Team (Branch Two)

The second branch of research will address the CAOC Offensive Operations Team's tasks as they relate to the nine core CRM skills. Three subordinate questions were answered during the literature review in chapter 2.

Are CRM-type concepts and skills currently applied to teams other than aviation teams? The literature review has shown that CRM-type concepts and skills are currently applied to a wide variety of nonaviation teams including medical and health care teams, law enforcement teams, and US Army tank crews. This shows that the potential exists for the use of this type of training to teams involved in professions other than aviation.

Who are the primary members of the CAOC Offensive Operations Team? What are the CAOC's Offensive Operations Team's primary tasks? These two questions were answered in chapter 2. The notional CAOC Offensive Operations Team and its tasks were established in chapter 2 in order to provide a CAOC framework to which the nine core CRM skills could be compared. Using this framework, the remaining two questions will be answered. The first question is: What notional CAOC tasks involve elements of the nine core CRM skills listed in AFI-11-290 (situational awareness, crew coordination, flight integrity, communication, risk management, decision making, task management, mission planning, and mission debriefing)? Each one of the CAOC Offensive Operations Team's basic tasks will be addressed with respect to the nine core skills. Each task will

be scrutinized to determine which, if any, of the nine core skill areas apply to that particular task.

The second remaining question to be answered is: Are there any other CRM or team skill sets that would be of value to a CAOC team-training program? This question will be addressed as each of the CAOC Offensive Operations Team's tasks are reviewed for CRM core skill applicability. If any CRM-type skills exist that are currently not listed in the list of nine skills dictated by AFI 11-290, then those skill sets will be addressed.

## Researcher's Qualifications

The researcher is qualified to conduct this study based on an in-depth study of the subject and operational experience. The researcher is well versed in the USAF CRM program as it relates to the fighter community as a result of previous research. The researcher accomplished a thesis entitled, "An Examination of the Current Air Combat Command Crew Resource Management Training Program and Its Applicability to the USAF Weapons School Single Seat Fighter Divisions" during completion of a Masters of Science degree from Embry-Riddle Aeronautical University, May 2000. While assigned as an F-15C instructor pilot and flight commander at the USAF Weapons School at Nellis Air Force Base, the researcher consulted with CRM contract instructors as a subject matter expert to improve the CRM courses taught to the Combat Air Forces.

The researcher's AOC background is a result of independent research, and operational and training experience. The researcher participated in Operation Southern Watch during two separate rotations in 1992 and 1994 as an F-15C instructor pilot and mission commander, mission planning cell member, and as temporary Joint Task Force-Southwest Asia Guidance, Apportionment and Targeting shop member. The researcher

is a F-15C USAF Weapons School graduate and an instructor pilot with 1950 hours in the F-15C.

## Research Bias

As a result of the researcher's experience with the USAF CRM program, some degree of bias could reasonably be expected. The researcher believes that CRM principles properly incorporated into a training program are beneficial. However, the researcher has no particular relationship with the USAF CRM training program or its personnel. The researcher has no particular bias with respect to the Black Hawk fratricide incident. Although the researcher is an F-15C pilot, he has no acquaintance with any personnel involved in the incident, thus no bias is expected. Furthermore, the scope of this research specifically states that the purpose of this study is not to find fault or place blame on any particular individual or organization.

The researcher accepts the risk of possible bias resulting from a single individual accomplishing this study. The researcher will attempt to limit that bias and increase internal validity by comparing information obtained in literature with information obtained in personal interviews with current subject matter experts in the contemporary fields of CRM and CAOC training and development.

## Summary

The research design used in this study is qualitative and follows two basic branches of subordinate questions. The first branch addresses the operational-level errors in the Black Hawk shoot down. A previous work by Dr. Tony Kern will provide a usable model for error classification. The second branch addresses the nine core CRM skills and their applicability to the tasks of the CAOC Offensive Operations Team. Several of the

subordinate research questions were answered in chapter 2. This was necessary to provide the framework for an analysis for both branches: the fratricide incident branch and the CRM relevancy to the CAOC team branch. The researcher's qualifications and experience demonstrate a possibility of bias with respect toward the USAF CRM program; however that risk is accepted.

Using this methodology, the researcher aims to determine the answer to this hypothesis: If CRM-type errors are evident in a real-world incident at the operational level of war and if CRM-type skills are shown to be evident in an analysis of several CAOC Offensive Operations Team processes, then it can be presumed that CRM training may enhance the capability of a CAOC team.

# CHAPTER 4

# ANALYSIS

## Introduction

The chain of errors that led to the Black Hawk fratricide is indeed long and involved. Several people at all levels of command, supervision, and execution made seemingly small errors that ultimately led to the death of twenty-six personnel, to the loss of two valuable UH-60 Black Hawks, to thousands of man-hours spent on the investigation and to extreme embarrassment for the US military. In short, it demonstrated a tragic failure in joint US military operations. Chapter 4 shows the types of errors committed at the operational level and their effect on execution at the tactical level. CRM concepts are the common thread that binds the fratricide incident to the CAOC team. Taking the CRM-type lessons learned from the fratricide and applying them to a current command and control scheme of operations, the CAOC, shows that CRM-type team training is applicable to the CAOC team.

Logic dictated that several of the subordinate questions be answered during the literature review in chapter 2. Thus, only four subordinate questions remain to be addressed. The primary question and remaining subordinate questions are restated below:

### Primary Question

Are CRM training concepts applicable to a CAOC Offensive Operations Team?

Remaining Subordinate Questions

1. What errors occurred at the operational level, and how did they influence tactical aircrew execution in the Black Hawk fratricide incident with respect to: situational awareness, crew coordination, flight integrity, communication, risk management, decision-making, task management, mission planning and mission debriefing.

2. Which of the nine core skills are applicable at the operational level to a CAOC offensive operations team?

3. What notional CAOC tasks involve elements of the nine core CRM skills (as shown in question one above) listed in AFI-11-290 ?

4. Are there any other CRM or team skill sets that would be of value to a CAOC team-training program?

These questions will be addressed sequentially as laid out in chapter 3. The subordinate questions took on two branches. Branch one subordinate questions address the fratricide incident. Branch two subordinate questions address the applicability of CRM concepts to a notional CAOC team.

Black Hawk Fratricide Incident Analysis (Branch One)

Branch one questions will be addressed in the following sections. The operational level "error events" that influenced the tactical execution will be divided into two categories: command guidance and helicopter operations integration. These two broad categories will be analyzed with respect to the three error types defined in chapters 2 and 3: perception, decision, and execution. Once the "error event" is placed in one of these

three categories, the researcher determined which of the nine core CRM skills applied to each particular event.

### Command Guidance and Helicopter Operations Integration

The two categories of command guidance and helicopter operations integration were chosen based on the AAIB president's summary in a press conference 13 July 1994. Major General James G. Andrus, the AAIB president, summarized the causes of the accident on 13 July 1994 during a news briefing providing a good overview of the operational level errors that took place:

> As I mentioned in the beginning of this briefing, the accident was caused by a breakdown in command guidance, supervision, and the misidentification of the Black Hawks. I will now summarize the causes of the accident. They are divided into three separate areas--command, AWACS, and F-15s. There were two principal causes in the command area. There was a breakdown in guidance from the combined task force to component organizations, including the Headquarters staff, the Combined Force Air Component, and the Military Coordination Center. At the time of this accident there was no clear understanding among task force participants regarding their responsibilities for helicopter flight activities
>
> Second, component organizations did not fully integrate Black Hawk flights with other air operations in the tactical area of responsibility. Over three years of Provide Comfort operations, fixed wing and helicopter activities had developed into two essential separate operations.
>
> The Provide Comfort operations plan published in 1991, set out the various task and responsibilities of the CTF headquarters and each component organization. By the fall of 1991, both the operations and the organizational structure had changed; however, the plan was not updated to reflect the changes or reassign responsibilities. By the time of the accident, senior leaders in the command were unfamiliar with contents of the plan and their particular responsibilities for coordination and control of Black Hawk helicopters.
>
> The operations plan required AWACS warning and control for helicopters operating in the no-fly zone. However, the command routinely permitted the Black Hawks to operate in the area without AWACS coverage.
>
> There was not a clear understanding regarding the application of the Airspace control orders to the Black Hawks. The orders directed that no aircraft would enter the tactical area before fighters had searched the no-fly zone for Iraqi aircraft. However, the command allowed the Black Hawks to enter the area before the fighter sweep.

> The air tasking order for 14 April did not list specific times or routes of flight for the Black Hawks operating in the area. Although the information was available in the task force headquarters, it was not tasked to the AWACS or to the F-15 pilots. (Andrus 1994c, 8)

Scott Snook's analysis in *Friendly Fire* highlights the failure to integrate the Black Hawks into the CTF flight operations started at the organizational level. He highlights that the rest of the problems resulted from, issues of organization and structure--those formal coordinating mechanisms designed to synchronize complex actions of multiple subgroups within the CTF (Snook 2000, 69). He summarizes the CTF's failure to adequately integrate the Black Hawks into its air operations as well as the failure of its leadership to notice such a serious disconnect (Snook 2000, 69).

The breakdown in guidance from the CTF to component organizations will be addressed in the "Command Guidance Error Events" section. The failure of the component organizations to fully integrate Black Hawk flight operations with other flight operations in the TAOR will be addressed in the "Helicopter Operations Integration Error Events" section. The two categories allow for a method for discussing particular error events and how they fit into the "series of avoidable mistakes" mentioned by General Shalikashvili in the opening paragraph of chapter one. However, the researcher found that, in many cases, these events and their consequences were often related.

Command Guidance Error Events

Command guidance issues will be addressed in this section. A major command guidance issue stemmed from the fact that an obsolete operations plan, OPLAN 91-7, remained in effect at the time of the accident. Some personnel realized it was out of date and disregarded it. Some were unaware of its existence (Andrus 1994a, 11). This led to

an overall lack of understanding with respect to integration of rotary-wing aircraft into flying operations of OPC.

Error Event 1: Failure to Provide Adequate Update to OPLAN 91-7

Error Type. Perception

CRM Concepts Applicable. Situational awareness, communication, mission planning

Background Information. OPLAN 91-7, dated 20 July 1991, was developed to delineate the command relationships and organizational responsibilities within CTF OPC. In September of 1991, the bulk of ground forces were withdrawn from OPC. All that remained of the ground component was the MCC. Consequently, the CTF Ground Component Commander position was vacated. Although an effort was begun in late 1991 to revise OPLAN 91-7, no evidence could be found to indicate that OPLAN 91-7 was updated to reflect the change in command and control relationships that resulted from the CTF Ground Component Commander's departure (Andrus 1994a, 7). This is significant because OPLAN 91-7 directs that the CTF Ground Component Commander was to coordinate rotary-wing flights within the fixed-wing flying window. After his departure, no one was assigned responsibility for this coordination (Andrus 1994a, 7).

Root Cause for Error. Responsibility for rotary-wing coordination was never reassigned after the CTF Ground Component departed. As a result, key leadership personnel within the CTF staff and CFAC staff remaining did not consider coordination of MCC helicopter operations to be a part of their respective responsibilities. The responsibility for this coordination just “fell through the cracks.” Perhaps a timely update

to the OPLAN would have more clearly delineated this coordination responsibility, thus personnel would have more accurately perceived the importance of this coordination.

How Did This Influence the Tactical Execution? General Andrus, the AAIB president, in his statement of opinion contained in the AAIB volume two said, "The 14 April 1994 shoot down of two US Black Hawk helicopters was caused by a chain of events which began with the breakdown of clear guidance from the CTF to its component organizations" (Andrus 1994a, 46). This lack of clear guidance set the stage for widespread misunderstanding and lack of communication throughout the component organizations of the CTF. As a result of this confusion, key personnel did not realize the importance of passing critical information on the flight plans, departure times, and route specifics of the Black Hawks to build the situational awareness of the F-15C pilots. This situational awareness could have made the F-15C pilots aware of the possibility that friendly helicopters would be encountered upon entering the TAOR. Armed with this information, the F-15C pilots may have begun the visual identification intercept with a mind-set that the unknown helicopters were most likely friendly (Andrus 1994, 43).

Error Event 2: Newly Assigned Personnel Failing to Understand Their Responsibilities

Error Type. Execution

CRM Concepts Applicable. Situational awareness, communication, crew coordination

Background Information. The AAIB report made reference to frequent personnel rotation and their training as a factor. The AAIB specifically mentioned the Army Liaison Officer (LNO) assigned to the CTF. The Army LNO attached to the MCC helicopter detachment at Zakhu and assigned to Incirlik AB was new on station and was

not fully aware of the relationship of the MCC to the OPC mission (Andrus 1994a, 11). As a result of the perceived obsolescence of OPLAN 91-7, newly assigned personnel were typically unaware of a centrally located source of written guidance and usually were "brought up to speed" by unit briefings, on the job training during "overlap time" with the person they were replacing, and review of applicable read files containing memorandums and guidance from commanders. In the absence of specific written guidance on helicopter integration, coordination was often haphazard (see Error Event 3). The chain of command was fragmented between the MCC and the CFAC. Thus, information that the MCC personnel referenced was often not consistent with that of CFAC personnel. (One example of this inconsistency will be addressed in error event 6.) A common, up-to-date command and organizational framework in the form of an updated OPLAN could have possibly provided a single "sheet of music" for all personnel to reference.

Root Cause for Error. This error of execution was linked to the perception error mentioned in error event 1. Poor written guidance in the form of an outdated OPLAN contributed to the component commanders' and personnel's perception that coordination of rotary-wing/fixed wing in the TAOR was taken care of by some one else. Based on this perception, subordinate commanders failed to emphasize appropriate training for new personnel. In Scott Snook's *Friendly Fire*, he used the common cliche "when everyone is responsible, no one is responsible" several times to summarize a mind-set that occurs in groups when there is not a single, centralized responsible party.

How Did This Influence the Tactical Execution? The Army LNO failing to understand the relationship between the MCC and the OPC mission directly influenced

his ability to assist in rotary-wing coordination. Consequently, he had no idea of his potential responsibility to provide this link to the CFAC through timely communication. As a result, he was unable to facilitate a timely flow of information between the MCC and the CFAC. This lack of "crew coordination" between the MCC and the CFAC deprived the F-15C, AWACS, and Black Hawk crews of important SA on relative positions of friendly aircraft.

The command guidance shortfalls obviously influenced the rotary-wing operations nonintegration into overall flight operations in OPC. The error events mentioned in the following section can, in many cases, trace their roots back to command guidance failures.

Helicopter Operations Integration Error Events

Helicopter operations integration error events will be analyzed in this section. Each error event will be categorized by type and CRM concepts applicable will be listed and explained. These events are not necessarily listed in order of importance.

Error Event 3: Haphazard and Inconsistent Flow of SA to Subordinate Units

Error Type. Decision

CRM Concepts. Decision making, mission planning, communication, situational awareness, crew coordination

Background Information. One of the sources for the F-15C pilots' mission planning was the ATO. (More details on the ATO will be discussed in error event 4.) Basically, the ATO laid out what aircraft would be in the AOR, when they would be there, and where they planned to be within the TAOR. Typically, this gives the F-15C pilots a basic idea of friendly aircraft that may be encountered during the mission, thus

increasing their level of SA. The ATO for 14 April listed two flights of two Black Hawks, Eagle 01/02 and Eagle 03/04 with no amplifying data with a takeoff time "as required" and route of flight only listed as from Diyarbakir to the TAOR. There were no specifics about route or duration within the TAOR. Although the MCC would contact the JOIC with some general information, there were no procedures for passing Black Hawk mission specifics to any of the tactical commanders or personnel (Andrus 1994a, 12). None of the information was passed to the CFAC scheduling shop, the ground-based mission director, or the Airborne Command Element on board the AWACS (Andrus 1994a, 12). The MCC would call the JOIC duty officer the night before the mission to "activate" the Black Hawks' flight plan. However, other than planned takeoff time and time planned to enter the TAOR, no other details regarding route of flight or duration were passed (Andrus 1994a, 12). The CFAC and the F-15C unit never received details of Black Hawk flight operations, but the F-16 squadron did (Snook 2000, 161). It is unclear where the F-16 squadron got specific details. When asked why the F-16s were briefed and not the F-15Cs, the F-15C flight lead said,

> I believe the reason was twofold: one is the F-16s, from what I heard, had a fear of having a close pass with the friendly helicopters because they did low altitude training, something we didn't do. They put in a request to get the specific flight plans for the helicopters. I also know from talking to the intelligence officer that he made several requests to get the flight plans on any unknown or friendly aircraft and never got any type of response. His request included helicopters. (Snook 2000, 161)

This statement shows that personnel at the tactical level wanted information to build their SA on friendly aircraft in the TAOR for deconfliction. However, somewhere in the chain, the importance of this SA to the tactical aircrews was not made known the personnel in the CTF or the JOIC who had the information.

Root Cause for Error. Failure of operational level link between the fighter squadrons and the helicopter unit, the JOIC duty personnel, failed to realize the importance the timely passage of helicopter mission specifics to the fighters. The JOIC duty personnel's decision to not request specifics from the MCC and thus not pass specifics to the F-15C squadron appears to the error here. However, the true problem can be traced back to the perception error mentioned in error event 1. In other words, the JOIC duty personnel, just like the Army LNO in error event 2, were apparently unaware of their potential role in helicopter operations integration.

How Did This Influence the Tactical Execution? Operational level command and control, planning, and operations organizations and personnel are responsible for setting conditions for subordinate tactical units. In this case, a tactical unit, the F-15C unit, attempted to get information about another tactical unit, the Black Hawks, and was unable. This lack of information was a contributing factor to the F-15C pilots' mind-set upon entering the TAOR with low SA with respect to the presence of friendly helicopters.

Error Event 4: JOIC Supervision Failure to Understand Role in Passing SA Between Incirlik (Fixed-Wing Air Base) and Diyarbakir (Helicopter Operations Base)

Error Type. Perception

CRM Concepts Applicable. Situational awareness, crew coordination, communication, mission planning

Background Information. The JOIC was responsible for coordinating all coalition aircraft in OPC. Coalition fixed-wing aircraft operated from Incirlik Air Base. Army rotary wing assets operated from the MCC at Diyarbikar, Turkey (about 300 miles

northeast of Incirlik) and also had an additional forward deployed MCC in Zakhu, Iraq within the United Nations Security Zone (Watkins 1995, 16). That geographic separation between US Army and US Air Force commanders made the JOIC vital to maintaining sound communications between the helicopters, the AWACS, and the fighter aircraft intended to protect them. Playing a major role in the lack of communication between the US Army and the US Air Force was the director of plans and operations for OPC. He was responsible for the coordination of all OPC's aircraft, including helicopters. He was also in charge of the JOIC, whose job it was to communicate helicopter flight information to the fighter and AWACS crews (Watkins 1995, 15). MCC personnel were given a high degree if independence in helicopter operations. Neither the CTF staff nor the CFAC staff requested or received timely, detailed flight information on planned helicopter operations in the TAOR (Andrus 1994a, 46). Army helicopter crews often changed their flight plans due to the inherent flexibility required in their mission. The director of plans testified after the incident that he seemed to be unclear about what to do with the flight plan change information.

> On 8 April 1994, the MCC weekly schedule was provided to CTF C3 through the JOIC. That schedule showed a two ship, MCC helicopter "administrative flight" on 14 April. On 12 April, the MCC Commander requested approval for a 14 April flight outside of the Security Zone. The requested flight of two helicopters was to proceed from Zakhu to the towns of Irbil mad Salah ad Din, Iraq. The CTF CG approved the written request on 13 April, and the JOIC transmitted approval to the MCC. This information was not passed to the CFAC. At 1538Z on 13 April, the MCC contacted the JOIC duty officer and activated the ATO line for the accident mission. A takeoff time from Diyarbikar of 0520Z on 14 April was requested. No takeoff time or route of flight beyond Zakhu was specified. None of the information was passed to the CFAC scheduling shop, the ground-based mission director, or the ACE on board the AWACS. (Andrus 1994a, 12)

At the bottom of the command structure were the fighter and AWACS crews who were often without a clear picture of other aircraft they would encounter.

Root Cause for Error. Perception error is the primary cause for this event. The commander in charge of the JOIC did not understand the importance of his role in passing critical helicopter flight plan change information to the AWACS and fighter units through timely dissemination of this information through the JOIC. This information was critical to the mind-set of the F-15C pilots.

How Did This Influence the Tactical Execution? Since the JOIC duty officer was not aware that helicopter flight plan specifics were critical to the F-15C pilots SA, he did not request this information from the MCC and evidently did not make it a priority to pass it to the F-15C squadron. Therefore, the F-15C pilots had no idea where or when the Black Hawks might show up.

Error Event 5: Lack of Tactical Communications Between the UH-60s and F-15Cs

Error Type. Perception

CRM Concepts Applicable. Mission planning and crew coordination

Background Information. Since the Black Hawk mission and the F-15C mission were widely perceived by the preponderance of the CTF personnel as separate missions, they never coordinated a communications plan. On 14 April, the F-15Cs and the Black Hawks were on separate frequencies at the time of the accident. Even if they had closely coordinated, it would not be unusual for them to be on separate frequencies. It is a common technique for separate flights with different mission focuses to monitor separate frequencies while talking with AWACS. This “discrete frequency” can prevent communication saturation by too many folks with different mission-driven

communication priorities on a single frequency. For example, the F-15C pilots might have decided that listening to the Black Hawks' transmissions could detract from their use of radio time to do their primary job; to sanitize the TAOR of Iraqi aircraft in order to protect the Black Hawks and ground personnel from air attack.

If properly planned and coordinated, the AWACS would normally be the common link responsible for the passing of pertinent information between aircrew on separate frequencies. Coincidentally, the AWACS crew was talking to the Black Hawks on one frequency and the F-15Cs on another frequency. The AWACS crew had continuous radar tracking information on the F-15Cs and continuous communications with them. The radar track and communications with the Black Hawks was intermitant. During the investigation, it was detemined that there was confusion amongst the AWACS crew. They did not have a clear understanding of their responsibilities to provide support to MCC helicopters (Andrus 1994a, 46). The information that the Black Hawks were in the TAOR was available on board the AWACS. As a result of poor crew coordination and task prioritization, the AWACS crew failed to inform the F-15Cs of the helicopters presence.

Root Cause for Error. Since the Black Hawks and the F-15Cs perceived themselves as separate missions, in their minds, there was little or no reason to coordinate a communication plan. The AWACS crew did not perceive that it was important to pass information between the F-15Cs and the Black Hawks. They did not inform the F-15Cs of the Black Hawks' presence. This perception was directly influenced by the fact that no one person or commander was clearly responsible for coordination between the two.

How Did This Influence the Tactical Execution? Normally, during mission planning and coordination briefings, these details would be discussed by the aircrews and the AWACS crew could be informed of their role and priorities as the communication link. However, since, from the top down, in the OPC CTF, MCC helicopters were perceived "doing their own thing," this critical coordination never took place. Thus, in the end, perceptions of the tactical crews (the F-15Cs pilots, the Black Hawk crews and AWACS crew) brought about by disconnects at the operational level contributed to separate mission planning, poor or no package coordination, and a lack of communication at the tactical level.

Error Event 6: Misunderstanding of Requirements to Enter TAOR: Fighter Sweep Requirement Prior to Helicopters Entering TAOR

Error Type. Perception

CRM Concepts Applicable. Mission planning, situational awareness, communication

Background Information. The Black Hawk crews and the F-15C pilots had different interpretations of the requirements to enter the TAOR. The F-15C pilots mind-set was as follows: based on the ACO requirement for a fighter sweep to "sanitize" the area before other OPC aircraft could enter the TAOR, and the ATO of 14 April 1994 which did not show any OPC aircraft scheduled into the TAOR before the first F-15C flight, the F-15C pilots believed there would be no friendly aircraft in the area (Andrus 1994a, 42). This contrasted from the perception of the Black Hawk pilots. Although no Black Hawk crews survived the incident, testimony from other Black Hawk pilots from

the same unit indicated that they did not believe that a fighter sweep was required before the helicopters could fly within the TAOR.

Root Cause for Error. Since the MCC helicopter operations and the fixed-wing operations had grown into separate entities over time, they both had different understandings of the procedures for entering Iraq. The lack of coordination that pervaded the entire command structure goes back to the lack for one centrally designated, clearly defined party responsible for this coordination.

How Did This Influence the Tactical Execution? Since the F-15C pilots assumed that all other OPC players would follow the procedures in the ACO, they drew the conclusion that the helicopters they saw were more likely to be enemy than friendly. This mind-set was further reinforced due to a lack of friendly symbology on their F-15C's air-to-air interrogator display. (It was determined that the Black Hawks had erroneously set their equipment to transmit the incorrect identification code, thus, the absence of a friendly symbol on the F-15C's display.) These circumstances influenced the F-15C pilot's mind-set during the intercept.

Lack of Specifics Regarding Helicopter Flight on Air Tasking Order

Although not classified as an error event, the lack of Black Hawk mission specifics listed in the ATO is worthy of discussion. Extreme flexibility was a mission requirement for the Black Hawks. It was not usually until the night before a mission that takeoff time, routes, delays on the ground at various Kurdish camps, or flight durations could be determined. Many of the missions the Black Hawks flew involved the transportation of personnel to meetings in the local Kurd settlements. The length of these meetings was almost impossible to predict. Therefore, mission details were impossible to

include on the ATO as it was published well before these details were known. So, the problem was not the lack of information on the ATO, but the lack of a procedure to ensure the timely flow if this information to build the SA of those tactical crew members who needed it. This is where CTF leadership and organization failed. As mentioned in several of the error events preceding, this information did not make it to those who needed it. This timely efficient flow if information is critical to command, control, and coordinate tactical elements in a synchronized plan. General Chuck Horner, the CFACC during Desert Storm initially mentioned this problem in the early days of his air campaign.

Many criticized that the ATO cycle needed to be shortened. It was too inflexible. Horner mentions that the ATO cycle of two days is a good compromise; much shorter and planners do not have time to make a plan. The problem was not the ATO cycle, but developing a timely method for communicating changes (Clancy 1999,371). It is this timely "ATO update cycle" that is the one of the goals of the CAOC. The passing of information horizontally and vertically within the task force to increase situational awareness allows a rapid decision cycle in a rapidly changing environment.

## Summary of Operational-Level Error Types and CRM Concepts in the Black Hawk Fratricide

The CRM concepts that applied at the operational level in the Black Hawk fratricide were situational awareness, crew coordination, communication, decision making, and mission planning.

Table 3 shows the type of error occurrences and frequency of CRM concepts present.

Table 3. Error Matrix (Results)

| Error Type | Perception | Decision | Execution |
|---|---|---|---|
| Situational Awareness | 3 | 1 | 1 |
| Crew Coordination | 2 | 1 | 1 |
| Flight Integrity | | | |
| Communication | 3 | 1 | 1 |
| Risk Management | | | |
| Decision-making | | 1 | |
| Task Management | | | |
| Mission Planning | 3 | 1 | |
| Mission Debriefing | | | |

## Summary of Black Hawk Fratricide Incident Analysis

The classification of error events at the operational level in this case study have shown that the bulk of the errors addressed were perception errors. These perception errors were primarily a result of poor or incomplete command guidance in the OPC CTF which in turn contributed to the perception that MCC helicopter operations and fixed wing operations were separate. In this case study, the CRM concepts of situational awareness, crew coordination, communication, decision making, and mission planning are applicable at the operational level of warfare. Thus, these concepts could be useful in a "CRM-type" training program for a CAOC Team. Since this is but a single case study,

limited in scope, other case studies may show that additional CRM concepts are applicable to a CAOC Team.

Notional CAOC Team and CRM Applicability Analysis (Branch Two)

The TCT process, players, and tasks have been previously defined. Recall the TCT "process" can be referred to as the "kill chain" including the find, fix, track, target, engage, assess steps. The TCT "players" include personnel organically assigned to the TCT team and various ODOs and liaison officers attached on an "as required" basis. The TCT Team has three basic groups of coordinating personnel: hunters, trackers, and killers. These operational level groups of coordinators work to ensure that tactical level assets are optimally used to accomplish TCT goals. The "hunters" include TCT Team ISR personnel, intelligence, reconnaissance, and space duty officers. Once the hunters find a TST, they hand it to the trackers. The "trackers" provide the link between the hunters and the killers. The tracker team includes a surface track coordinator and a target engagement data coordinator. Once the TST meets engagement criteria, it is handed to the killers. The "killer" team includes a target attack coordinator organic to the TCT Team and applicable ODOs. ODOs and liaison officers with fighter, bomber, AWACS, tanker, special operations, electronic combat expertise are consulted for coordination if their assigned assets are involved. Finally, each of these teams must work together to accomplish the required tasks within each step of the kill chain process.

TCT Task CRM Concept Analysis

The generalized list of tasks established in chapter two for the find, fix, track, target, engage, and assess steps of the kill chain will now be analyzed for the presence of

"CRM-type" skill sets. Remember, this is an extremely over-simplified sampling of tasks.

Find

The task addressed in the find phase is: Develop a common operating picture (COP) to track TSTs through use of integrated ISR assets and retask or reposition ISR assets, if necessary.

The COP is a source of SA for every team in the CAOC. This big picture will theoretically provide decision makers and executors within the CAOC situational awareness with respect to the friendly and enemy forces. This horizontal and vertical flow of the COP will be a result of a "constellation" of ISR assets including national, theater, and tactical level assets (Backes 2001, 19). These assets may include Predator and Global Hawk unmanned aerial vehicles, Joint Stars, Rivet Joint, special operations forces, and space assets. Since these assets are finite resources, the TCT Team's need to focus certain assets during TCT operations may reduce overall COP accuracy. This retasking of ISR assets critical to TCT success is summarized by Lieutenant Colonel Backes in the *JEFX 2002 Concept of Operations*:

> When TCT is directed in the ATO, assignment of surveillance and reconnaissance assets must occur. When designated by the CFACC, specified surveillance and reconnaissance assets will be controlled for the duration of TCT activity. These assets will be integrated and coordinated to provide constant stare and constant dwell for the specified battlespace. Required cross-queuing and other intelligence collection duties/target requirements will be required by the ROE and daily CFACC's Guidance Letter. Normally TCT operations will require a significant mix of ISR assets to provide the required "picture" development and assessment for TCT. Without direct control of significant levels of surveillance and reconnaissance by the TCT Team, TCT is difficult and could result in degraded operations. (Backes 2001, 18)

Risk of a degraded overall COP must be balanced with the TCT Team's need for ISR asset control. The SA of the entire CAOC may be sacrificed during TCT operations. If the CFACC's intent and priority of effort is the execution of TCT operations, then the CAOC OOT members must understand this. CAOC OOT personnel must focus their communication, coordination, task management, and decisions toward the commander's overall aims. A CRM-type training program may provide a vehicle to articulate the commander's intent and priorities to a CAOC team.

CRM skills Applicable. Situational awareness, crew coordination, communication, risk management, decision making, task management

Fix

The task addressed in the fix phase is: Detect, classify, identify, and provide coordinates for tracking.

Once a possible TST is detected, it must be classified. It must be classified into a specific target set (i.e., tank, missile launcher, etc.). Next, the prospective target must be identified. It must be determined whether the detected object(s) or associated events are friendly or hostile (Backes 2001, 28). During the “fix” process, information from several ISR assets must be fused to verify target characteristics and location. Finally, the target must be referenced to a specific geocoordinate system (Backes 2001, 28). Many ISR assets must be coordinated to accomplish this task. General John Jumper, US Air Force Chief of Staff, gave a good explanation of the coordination capability that needs to take place in an AOC. Examples from his speech to the Air Force Association, 16 November 2001, will be used in the following scenario.

The commander has determined that in order to engage and destroy a target, a 95 percent confidence level must be met. The CFACC has at his disposal several sources of information to verify the target. He may have space assets, manned or unmanned aerial assets, and ground assets. A space-based asset can determine that a certain signal originates from a certain area. That asset can determine that the signal may either be from an SA-11 (surface to air missile) or a Scud (tactical ballistic missile). However, by itself, that particular asset can't tell which one it is. An unmanned ISR asset is in the area and its sensor can be cued to the area pointed out by the space asset. The imagery may suggest that it is not an SA-11, but is not clearly a Scud. Intelligence personnel, however, through their terrain study have determined that this would be a likely place the enemy may place a tactical ballistic missile. With each piece of information, the confidence level increases. In order to meet the required confidence level threshold, the CFACC may request special operations forces in the area to verify that the target is indeed a tactical ballistic missile. Once the special operations personnel locate and confirm the target is a Scud, the confidence level is met, and the target may be subsequently tracked, targeted, engaged, and assessed.

Each asset is able to fill the commander's “SA bucket” to increasingly higher levels through coordination and integration of assets. The coordination, communication, and ISR asset management of TCT team members will allow an increase in SA to allow a decision to be made by the commander's designated engagement authority. Once this target is confirmed, it may now be handed off to the trackers. The trackers will monitor the targets status and location until attack assets can be allocated and cleared to engage.

CRM skills Applicable. Situational awareness, crew coordination, communication, risk management, decision making, task management

Track

The first task addressed in the track phase is: Ensure proper tracking assets are available to track the target.

"To track a target is to point continuously a target locating instrument at a moving target" (Backes 2001, 28). Certain assets may be better suited to track certain types of TSTs. For example, an unmanned aerial vehicle may be better suited to monitor a moving vehicle than a space asset. These decisions will have to be made by the trackers based on their knowledge of platform capabilities and their knowledge asset availability. Therefore, the trackers of the TCT team ISR section must be able to dynamically retask ISR assets.

The second task addressed in the track phase is: Sort available targets by priority in accordance with JFC's guidance.

With limited assets to "stare" at multiple TSTs, the trackers must prioritize which are the most important TSTs to track and assign the most appropriate ISR assets to monitor them. Therefore, the trackers must task prioritize the use of available ISR assets to maximize tracking capability of the highest number of TSTs. A clearly defined list of TST priorities is required for decisions to be made regarding the dynamic re-tasking of ISR assets.

CRM Skills Applicable. Situational awareness, crew coordination, communication, risk management, decision making, task management

Target

The first task addressed in the target phase is: Retarget or retask JFACC assets to respond to changes in the friendly or enemy battlespace situation and assess consequences of re-rolling assets with respect to JFC's guidance, intent and priorities.

"The attack section of the TCT team provides support to the TCT team chief through management of attack assets capable of conducting the TST mission" (Backes 2001, 38). The "killer" coordinators of the attack section match up TSTs to shooters. They manage attack assets available for use on TSTs. Attack assets may include air force or naval air assets, army rotary-wing attack assets, ground forces, or special operations forces. These attack assets maybe "preplanned TST" assets awaiting a TST tasking or they may be assets already tasked with a different mission via the ATO. If there are no appropriate pre-planned TST shooters with the required weapons effects, the attack section may decide to rerole an attack asset. If the attack section retasks an asset, they must weigh the priority of the TST mission with the pre-planned or "fragged" ATO mission to ensure the commanders targeting intent is met.

The second task addressed in the track phase is: Coordinate with appropriate liaisons and ODOs to determine most appropriate asset to conduct attack.

The attack section must work with the various liaisons and ODOs to ensure a smooth flow of information and support to prospective shooters. For example, if a flight of F-15Es are the only assets airborne with the desired weapons to attack a specific TST, the fighter ODO with F-15E expertise would be consulted. The F-15E ODO could then advise the attack section on any additional tanker, suppression of enemy air defenses (SEAD), fighter escort, or terminal weapons guidance support that may be required. The

attack section, in turn would be responsible for coordination of all required assets to support the F-15E flight.

CRM Skills Applicable. Situational awareness, crew coordination, communication, risk management, decision making, task management

Engage

The task addressed in the engage phase is: Provide adequate targeting information to attack assets assigned to engage target.

The attack section must act as an "SA clearing house" to ensure that all the pertinent information received from the trackers is directed to the shooters and their support teams. Only mission essential information must be passed so as to not "clog the information pipeline." Thus, all personnel responsible for passing this information must be aware of what is "need-to-know" information versus what is "nice-to-know" or extraneous information. Thus, in a time-compressed scenario, TCT team members must know which tasks must prioritized and who needs what information first.

Information on friendly forces in the area, collateral damage risk, target coordinates, target movement, target description, target area weather, desired weapons effects, and possible sources of terminal guidance queuing must be passed to the shooters.

CRM Skills Applicable. Situational awareness, crew coordination, communication, risk management, decision making, task management

Assess

The task addressed in the assess phase is: Ensure appropriate ISR assets, SOF available to accomplish battle damage assessment (BDA).

While dynamically retasking ISR assets to find, fix and track TSTs, the ISR section must also allocate limited assets for BDA. Therefore, critical decisions must be made with respect to allocating limited ISR assets to accomplish multiple tasks. Just as more than one source may required to initially find and fix a target, assessing an attack's degree of success may require multiple sources. Thus, unity and economy of effort are very important to operations within the ISR section.

CRM Skills Applicable. Crew coordination, communication, risk management, decision making, task management.

TCT Team Mission Planning and Debriefing

Efficient mission planning and briefing will set the stage for success of any team. Many of the tasks and responsibilities within various CAOC teams will be “standard operation procedure” resulting from any number of regulations, official instructions, and command guidance. Therefore, it will not be necessary to regurgitate these many items in a daily pre-shift briefing. However, certain items that will specifically impact the missions for a particular shift undoubtedly should be highlighted to the team. The team chief may be able to use CRM tenets to emphasize critical communication and coordination tasks for the team. Various examples of CRM concept usage have been addressed previously in this chapter. Planning and coordination not only need to take place within the OOT, but there must also be a solid link between the planning process and operations.

It is vitally important that mission planners in the combat plans division of the CAOC coordinate closely with those in the combat operations division to ensure a seamless transition of all aspects of the operation between plans and operations. ODOs

and LNOs can provide this link as they are often tasked to support both divisions. Operations division personnel must also provide feedback to the planners and support teams in the form of a debriefing.

A simple scenario can illustrate the use CRM concepts in a debriefing context. Let's say that a flight of F-16s are designated in the ATO by planners to be “on call” for TST tasking during a certain period. During that period, the TCT team targets the flight on a column of vehicles. The vehicle column is the top priority on the commanders TST list. The TCT team passes all target specifics to the F-16 flight via AWACS. However, one small coordination item is missed. The target has entered an area where 2 F-18s are flying a defensive counter air mission to protect a nearby orbiting E-2C Hawkeye. Unaware of each other, the F-16s and the F-18s in the same piece of airspace spend valuable time and effort to identify each other as friend or foe. As shown in the Black Hawk incident analysis, it only takes one or two more mistakes to snowball and result in a tragedy. The F-16 and F-18 crews need to report the incident and forward it up the chain of command so the root cause for this coordination error can be determined. This will make operational level planners and coordinators aware of the error and make an effort to prevent a future occurrence.

CRM Skills Applicable. Mission planning and debriefing

After the analysis of this task list, it is apparent that several CRM core skills are applicable to the CAOC OOT Team in its TCT function: situational awareness, crew coordination, communication, risk management, decision making, task management, and mission planning and debrief. All skill sets except Flight integrity were evident.

## CRM-Type Concepts Not Listed in the Nine Core Skills That May Apply to a CAOC Team

In this section the researcher will answer the remaining question: Are there any other CRM or team skill sets that would be of value to a CAOC team-training program? Flight integrity does not seem to be a term that fits. However, three concepts not specifically mentioned in AFI 11-290 may be worth considering for a CAOC team. Assertiveness, mutual support, and asset allocation might be appropriate CRM-type concepts to include in a CAOC Team training program.

Advocacy and assertion as mentioned in the flight integrity section of chapter 2 might have a place in CAOC team training. As in the Black Hawk fratricide incident analysis, many times members of large teams tend to think, "Someone else is responsible." Assertiveness is knowing when to speak up when you may be the only one on the team who has a piece of critical information that the entire team needs. Assertiveness must be tempered with judgment. Knowing when to keep quiet so as not to degrade the whole team's situational awareness and detract from its performance is also an important skill.

The meaning of "mutual support" may differ from an individual's perspective. Mutual support according to Joint Pub 1-02 is, "That support which units render each other against an enemy, because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities" (JP 1-02 2000, 308). Mutual support to a fighter pilot is similar. Mutual support to members of a CAOC team may be as simple as the catch phrase, "you check my six and I'll check yours." Mutual support may take place between teams or between individual team members.

Finally, asset allocation may be a worthwhile training bullet for the OOT in its TCT function. Allocation of limited assets in a time compressed environment can be challenging for OOT members as the operational level managers of limited ISR and attack assets. In addition to knowing capabilities and limitations of those tactical assets, OOT members must be able to leverage the correct communication assets to facilitate the most efficient flow of information to the tactical level combat employment elements.

## Summary

This chapter has addressed all subordinate questions laid out in chapter 1. The operational level analysis of the Black Hawk fratricide incident shows four of six error events were attributed to perception errors and that five of nine CRM skill sets were applicable to that incident. Eight of nine CRM core concepts were shown to be present in a small sampling of CAOC OOT tasks in its TCT function. Finally, the concepts of advocacy and assertion, mutual support, and asset allocation may be ideas for additional CRM skill sets applicable to CAOC team training.

# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

## Introduction

The goal of this thesis was to determine if a CRM training program, currently used for aircrew training at the tactical level, could be used as a model for a CAOC team coordination training program which operates at the operational level of warfare. This chapter will provide a brief synopsis of the study's logic flow and construct, provide the conclusions of the analysis and their significance, and finally make recommendations for further study.

The study followed a logical flow. If it could be shown that operational level CRM-type errors in a real-world incident contributed to a tactical failure, then there may be reason to consider the importance of such a training program at the operational level. The current doctrinal operational level organization for command, control, and coordination of theater air operations is the Combined or Joint Air Operations Center. If it could be shown that the CAOC team's tasks included CRM-type skills, then it is reasonable to assume that training of this sort could increase team efficiency and mission effectiveness. Thus, by establishing that CRM-type errors occurred in a real-world incident and proving that CRM-type skills are relevant to a CAOC teams tasks, the primary thesis question could be answered.

## Thesis Question

Are CRM training concepts applicable to a Combined Air Operations Center (CAOC) Offensive Operations Team? To answer this question, the subordinate questions followed two separate branches.

The first branch addressed the fratricide of two US Army Black Hawk helicopters by two US Air Force F-15Cs in 1994 during Operation Provide Comfort. Specifically, this incident was analyzed for errors committed at the operational-level of the command, control and coordination element, the JOIC. In turn, these errors were reviewed for the presence of CRM-type failures. The US Air Force CRM training program established in AFI 11-290 served as the framework. In the end, the goal was to determine which, if any, of the CRM concepts used for tactical aircrew CRM training could be found in the incident.

The second branch of subordinate questions sought to study a sampling of CAOC team tasks for the presence of CRM-type concepts or skills. Since the CAOC is a very large organizational element with potentially hundreds of personnel and thousands of tasks, limiting the scope of the CAOC team's tasks was deemed appropriate. To that end, one of the more dynamic and recently most important CAOC functions was chosen: the time critical targeting function of the CAOC Offensive Operations Team. To make this analysis manageable, a simplified and generalized notional TCT team and tasks were surmised from current US Air Force instructions, doctrine, and literature. These tasks were then analyzed for the possible relevance of CRM-type skills. Again, AFI 11-290 provided a consistent framework for CRM skill analysis.

## Conclusions

As this study had two main branches, so do the conclusions. First, the Black Hawk fratricide incident analysis shows that operational-level errors contributed to the failure of tactical units to properly coordinate, which, in turn contributed to the loss of twenty-six lives, two helicopters, and a huge expenditure of assets during the

investigation. As a result this incident provided an embarrassing example of poor coordination during US military joint operations. These errors did, indeed, include CRM-type skills. Secondly, it was shown that in a small sampling of tasks performed by a specific CAOC team, CRM-type concepts were applicable.

When leaders provide an insufficient organizational framework for subordinate element integration and unclear command guidance, subordinate leaders are left to determine these critical issues for themselves. Inconsistent procedures will develop within subordinate organizational stovepipes, and the end results can be best described as haphazard at best. So was the case in the Black Hawk fratricide incident. Poor command guidance and an overall failure to properly integrate helicopter operations with fixed wing operations in OPC were major factual findings in the accident investigation. Consequently, personnel from separate component organizations within the CTF had different perceptions of their roles in the overall OPC mission. These errors of perception led to the preponderance (four out of six error events) of the operational level errors that directly contributed to the tragic fratricide. Within these error events, several of the CRM skills were evident. The concepts of situational awareness, crew coordination, decision making, communication, and mission planning. The CRM concepts know as flight integrity, risk management, task management, and mission debriefing were not found to be evident in this analysis.

Findings from the notional CAOC team CRM applicability analysis section show that several CRM core skills are applicable to the CAOC OOT Team in its TCT function: situational awareness, crew coordination, communication, risk management, decision making, task management, mission planning, and mission debrief. All skill sets except

Flight integrity were evident. Finally, the concepts of advocacy and assertion, mutual support, and asset allocation may be ideas for additional CRM skill sets applicable to CAOC team training.

## Recommendations and Areas for Further Research

This study makes two recommendations. First, it recommends that the US Air Force CRM program manager and CAOC-X training program developers conduct their own study as to the applicability of CRM training concepts. As the CAOC "weapons system" is currently in its infancy, it is suggested that a training program for CAOC mission specialists include CRM concepts from the start. The inclusion of this CRM cultural mind-set during the development of a training program will allow for a seamless integration of CRM concepts into the CAOC's cultural identity. Attempts to force feed CRM concepts (widely perceived as for "flyers only") to a "nonflying" team late in their training program will undoubtedly have mixed results. This research of limited scope hopes to serve as a catalyst for such a research consortium.

Second, since this study was limited in scope, the applicability of CRM training concepts to other "real world" incidents and other CAOC teams is uncertain. Thus, additional case studies must be accomplished to provide a library of knowledge from which to draw CRM-type lessons learned for use in training scenarios or vignettes.

## Final Summary

As a result of the recent tremendous leaps in communication and information technology, command, control, and coordination operational concepts are continually evolving. As America's "War on Terrorism" continues today, General Tommy Franks, Commander in Chief of Central Command, has drawn criticism from remaining at

Central Command's headquarters in Tampa, Florida while the campaign in Afghanistan is executed. These critics fail to see that as a result of this previously unheard of leveraging of technologies, this is the best place to most efficiently carry out his task.

General John Jumper, US Air Force Chief of Staff, continually describes his operational level vision of the "sum of information" that must culminate at the AOC. In a recent speech to the Air Force Association on 2 February 2002, he summarized this challenge, "The integration of manned, unmanned, and space assets is critical to get decision quality information to the commander. This will be achieved when machines will communicate at the digital level instead of humans at the end of stovepiped operations so that the sum of wisdom of our assets will allow the curser to be placed on the target" (Jumper, 2001). Just as important as these machine interfaces are the teams of people who must interface to carry out these tasks. Better integration, automation of systems, and machine-level communication will transform the CAOC team from a group of information gatherers and interpreters into a decision-making team. As this transformation occurs, the pace of operations will continue to accelerate and CRM-type skills will become more and more important. The coordination of these teams and the technological integration of multiple information sources is what allows a seamless operation to unfold.

Without appropriate team training, it is only a matter of time before seemingly small errors at the operational level snowball into catastrophic results at the tactical level with strategic consequences. People will continue to make mistakes. CRM-type training for teams of the CAOC may be at least one way to mitigate these mistakes.

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