



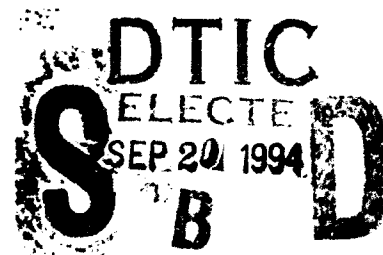
3 June 1994

Master's Thesis, 2 Aug 93-3 Jun 94

Eliminating Fratricide From Attack
Helicopter Fires: An ^{Army}Aviator's Perspective

Major James A. Towe, USA

U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, Kansas 66027-6900



Approved for public release, distribution is unlimited.

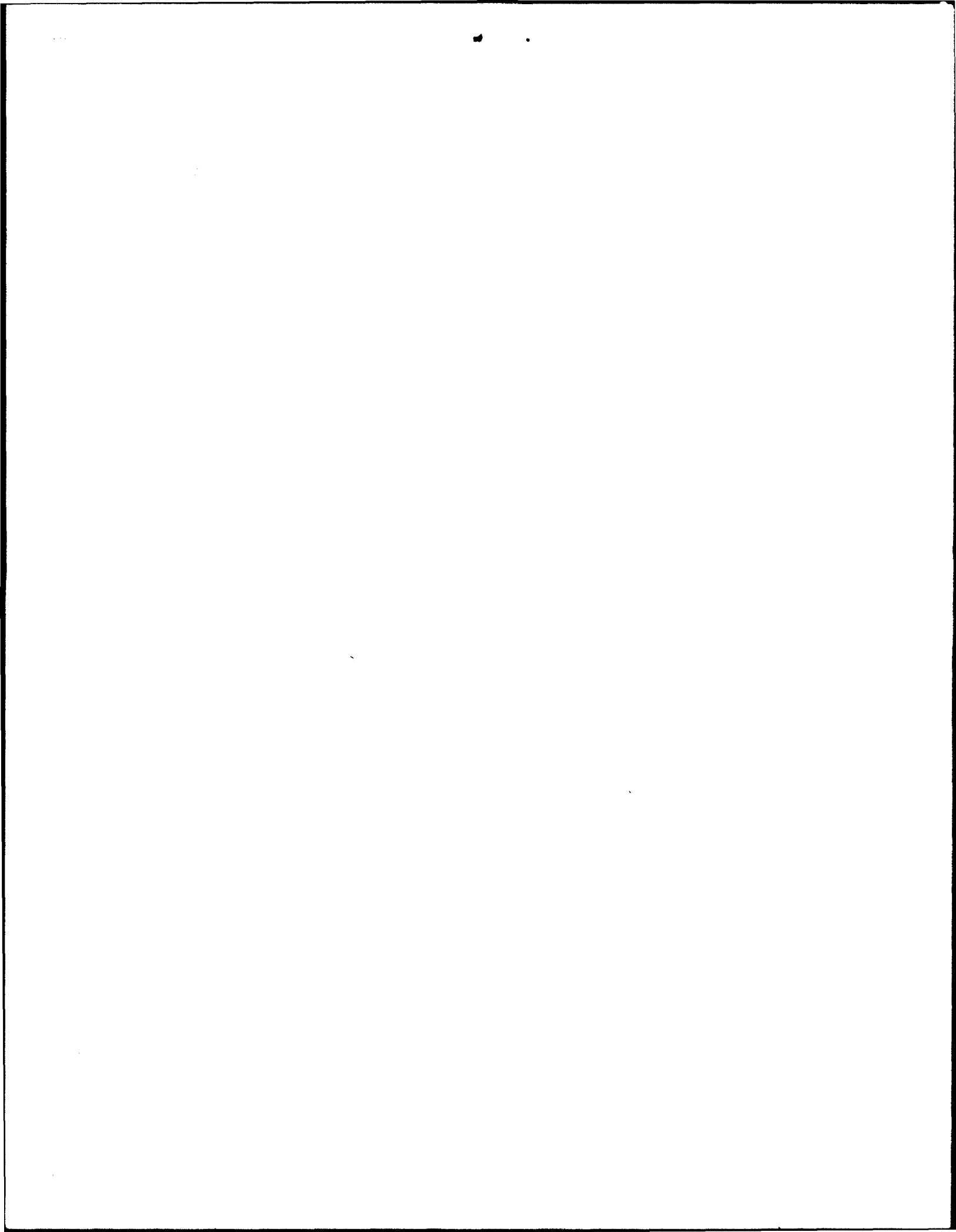
In the aftermath of the euphoria brought on by our military victory in the Persian Gulf War, is the realization that we still have much to learn. The Persian Gulf War appears to have validated the quality of U.S. doctrine, leadership and military prowess. It showcased the technical superiority of our equipment, and confirmed under fire the courage and competence of our soldiers, sailors, airmen, and marines. Yet, even in an overwhelming victory there are painfully hard lessons to be learned, or in the case of fratricide, relearned.

Perhaps no other aspect of our failures strike the military psyche harder than fratricide. This study will suggest that we do not have to accept the fratricide statistics of the past, however factual, as inevitable of future U.S. conflicts. It will propose that the facts of fratricide should be gathered not as a casualty prediction planning tool, but as a focus to design training and operational procedures, which in conjunction with advanced technology will work towards the significant reduction if not the elimination of fratricide from attack helicopter fires.

DTIC QUALITY INDEX

Attack Helicopter, Fratricide

133



ELIMINATING FRATRICIDE FROM ATTACK HELICOPTER
FIRES: AN ARMY AVIATOR'S PERSPECTIVE

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

JAMES A. TOWE, MAJ, USA
B.S., Northeast Missouri State University,
Kirksville, Missouri, 1979

94-30128



1458

Fort Leavenworth, Kansas
1994

Approved for public release; distribution is unlimited.

ELIMINATING FRATRICIDE FROM ATTACK HELICOPTER
FIRES: AN ARMY AVIATOR'S PERSPECTIVE

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

JAMES A. TOWE, MAJ, USA
B.S., Northeast Missouri State University,
Kirksville, Missouri, 1979

Fort Leavenworth, Kansas
1994

Approved for public release; distribution is unlimited.

DTIC QUALITY ASSURED 3

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Major James A. Towe

Thesis Title: Eliminating Fratricide From Attack Helicopter
Fires: An Army Aviator's Perspective

Approved by:

Dennis L. Barba, Thesis Committee Chairman
LTC Dennis L. Barba, M.A.

Roger J. Spiller, Member
Roger J. Spiller, Ph.D.

George E. Hodge, Member
MAJ George E. Hodge, M.S.

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
Branch	
Distribution	
Availability	
Date	

A-1

Accepted this 3rd day of June 1994 by:

Philip J. Brookes, Director, Graduate Degree
Philip J. Brookes, Ph.D. Programs

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

ELIMINATING FRATRICIDE FROM ATTACK HELICOPTER FIRES: AN AVIATOR'S PERSPECTIVE by MAJ James A. Towe, USA, 133 pages.

In the aftermath of the euphoria brought on by our military victory in the Persian Gulf War, is the realization that we still have much to learn. The Persian Gulf War appears to have validated the quality of U.S. doctrine, leadership and military prowess. It showcased the technical superiority of our equipment, and confirmed under fire the courage and competence of our soldiers, sailors, airmen, and marines. Yet, even in an overwhelming victory there are painfully hard lessons to be learned, or in the case of fratricide, relearned.

Perhaps no other aspect of our failures strike the military psyche harder than fratricide. This study will suggest that we do not have to accept the fratricide statistics of the past, however factual, as inevitable of future U.S. conflicts. It will propose that the facts of fratricide should be gathered not as a casualty prediction planning tool, but as a focus to design training and operational procedures, which in conjunction with advanced technology will work towards the significant reduction if not the elimination of fratricide from attack helicopter fires.

TABLE OF CONTENTS

	<u>Page</u>
APPROVAL PAGE	ii
ABSTRACT	iii
LIST OF ILLUSTRATIONS	v
LIST OF ABBREVIATIONS	vi
CHAPTER	
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	9
3. RESEARCH METHODOLOGY	18
4. HISTORICAL ANALYSIS	34
5. ATTACK HELICOPTER FRATRICIDE ANALYSIS	56
6. CONCLUSIONS AND RECOMMENDATIONS	103
ENDNOTES	115
BIBLIOGRAPHY	126
INITIAL DISTRIBUTION LIST	132

LIST OF ILLUSTRATIONS

Figure	Page
1. Comparison of NTC Fratricide Incidents	45
2. Comparison of U.S. Fratricide Incidents	48
3. Number of Fratricide Incidents by Type	50
4. Task Force 1-41 Screen Line, Rainbow Boundary, and Apache Helicopter Engagement	88

LIST OF ABBREVIATIONS

AAH	Advanced Attack Helicopter
AMRAAM	Advanced Medium Range Air to Air Missile
APC	Armored Personnel Carrier
ANGLICO	Air Naval Gunfire Liaison Company
AR	Army Regulation
ARVN	Army of the Republic of Vietnam
AVN	Aviation
BFV	Bradly Fighting Vehicle
CALL	Center for Army Lessons Learned
CAV	Cavalry
COL	Colonel
CTC	Combat Training Center
CTZ	Corps Tactical Zone
DOD	Department of Defense
FFAR	Folding Fin Aerial Rocket
FASCAM	Family of Scatterable Mines
FM	Field Manual
GAO	General Accounting Office
CSR	Ground Surveillance Radar
HARM	Highspeed Anti-Radiation Missile
HEAT	High Explosive Anti-Tank
ICAP	Improved Cobra Armament Package
IFF	Identification Friend or Foe
IR	Infra-red
JRTC	Joint Readiness Training Center

KIA	Killed in Action
LTC	Lieutenant Colonel
NATO	North Atlantic Treaty Organization
NOE	Nap of the earth
NTC	National Training Center
NVA	North Vietnamese Army
NVG	Night Vision Goggles
OTA	Office of Technology Assessment
PDF	Panamanian Defense Forces
PL	Phase Line
PZ	Pickup Zone
ROE	Rules of Engagement
SOF	Special Operations Forces
SOP	Standard Operating Procedures
SSG	Staff Sergeant
SWA	Southwest Asia
TAA	Tactical Assembly Area
TADS	Target Acquisition and Designation System
TC	Training Circular
TF	Task Force
TOW	Tube-launched, Optically-tracked, Wire-guided Missile
TRADOC	Training and Doctrine Command
U.S.	United States
USMC	United States Marine Corps
WDMET	Wound Data and Munitions Effectiveness
WIA	Wounded in Action

CHAPTER 1

INTRODUCTION

In the aftermath of the euphoria brought on by our military victory in the Persian Gulf War, is the realization that we still have much to learn. The Persian Gulf War appears to have validated the quality of U.S. doctrine, leadership and military prowess. It showcased the technical superiority of our equipment, and confirmed under fire the courage and competence of our soldiers, sailors, airmen, and marines. Yet, even in an overwhelming victory there are painfully hard lessons to be learned, or in the case of fratricide, relearned. Perhaps no other aspect of our failures strike the military psyche harder than fratricide. Fratricide has been a presence, if not a factor, from the battlefields of our Continental Army to the deserts of Southwest Asia. Some would have us believe that it has always been and always will be a part of warfare. A cursory evaluation of available statistics tends to bear that out. Simply looking at the numbers tells us we are not getting any better at preventing fratricide, in fact it has become more common. However, that assertion requires closer scrutiny.

This study will suggest that we do not have to accept these statistics, however factual, as inevitable of future U.S. conflicts. It will propose that the facts of fratricide should be gathered not as a casualty prediction planning tool, but as a focus to design training and operational procedures, which in conjunction with advanced technology will work towards the significant reduction if not the elimination of fratricide. The first step in that process is to establish the fact that fratricide does not have to be an inevitable consequence of future warfare, at least not from the perspective of Army Aviation.

Army Aviators are no different than their brethren in the various other branch specialties within the military service. They assume a professional responsibility to contribute, if they can, to the betterment of their branch, and in that respect to the betterment of the U.S. Army as a whole. Although branch parochialism tends to influence thinking, it is probably fair to assume that most Army Aviators tend to believe that aviation can potentially contribute more to the Army's success on the battlefield than any other component force. This belief may be founded in the fact that Army Aviation's ability to rapidly maneuver over great distances, over any terrain, and to quickly mass overwhelming firepower or concentrate troops cannot be similarly matched by any other maneuver arm. It is these inherently unique capabilities, in conjunction with its

versatility and agility, that provide Army Aviation its battlefield potential. However, this potential contribution cannot take place if ground maneuver commanders lack confidence in Army Aviation's abilities, or are hesitant to employ Army Aviation for fear of fratricide. It is this aspect of the fratricide problem that is the most difficult and most important to resolve.

Simply acknowledging fratricide's existence throughout the history of armed conflict would make for short work. Although the shroud of secrecy often pervades the topic, certainly every U.S. conflict has had its share of incidents as has every nation or military force that has prosecuted armed conflict. The question then becomes, is it inevitable?

Virtually every discussion, thesis, or study on the topic of fratricide has concluded that, taken in broad perspective, fratricide is an inevitable consequence of armed conflict. Fratricide's inevitability has led to various recommendations or proposed revisions in training, doctrine, and technological approaches in an effort to reduce rather than eliminate the inevitable problem. When evaluated in its broadest context fratricide does seem inevitable. But, when evaluated from a particular aspect of modern combat, from a specific type of weapons system, perhaps fratricide's inevitability can be challenged. The question for this study then becomes: Given the virtual all

weather, day/night, long range fire capabilities of Army Aviation, is fratricide on the future battlefield necessarily inevitable?

Within the construction of this thesis question is an attempt to limit the research to a manageable yet useful level of focus; thus the focus on Army Aviation fratricide in particular, and on attack helicopter fratricide specifically. Because of that focus this study will primarily be limited to the evolution of attack helicopters from the Vietnam Conflict, Grenada Invasion (Operation Urgent Fury), and Panama Invasion (Operation Just Cause), to the Persian Gulf War (Operation Desert Storm). Although this focus is primarily on U.S. Army Aviation, for contrast and comparison it will also address USMC Aviation from Vietnam to the Persian Gulf War.

Although the armed or attack helicopter was not introduced to the battlefield until the Vietnam Conflict, it is important to look back at least as far as World War II to gain an appreciation of the change fratricide has undergone in recent history. World War II is an appropriate beginning for two primary reasons. First, with the notable exception of the absence of attack helicopters, the battlefield conditions of World War II in Western Europe most closely replicate the maneuver warfare associated with the Persian Gulf War. Both World War II and the Persian Gulf War were characterized by the employment of large armor

and mechanized forces in close combat, as opposed to the predominantly dismounted operations of the Vietnam Conflict, Operation Urgent Fury, or Operation Just Cause. Second, a look back to World War II illustrates more clearly the transition of fratricide from indirect fire systems to direct fire systems.

This analysis will employ historical cases of attack helicopter fratricide incidents from the Vietnam Conflict through the Persian Gulf War as a means to evaluate causes, and to propose feasible solutions to reduce, or prevent, the occurrence of aviation-related fratricide on the American battlefields of the future.

The intent of this approach is that it will not only serve to validate the hypothesis, but that it will also stimulate professional exchange on the topic of fratricide and will offer preventative measures that can be applied in the aviation community today.

Although fratricide is not a new phenomenon of modern warfare, it has recently become a vogue topic both in military circles, and to a lesser extent in the media, presumably due to the unusually high rate of fratricide incidents during the Persian Gulf War. However, fratricide has always accompanied U.S. forces in combat, perhaps to a greater extent than we care to acknowledge. Accurate accounting and open source reporting of U.S., and to a lesser extent coalition, casualties during the Persian Gulf

War have given the appearance that fratricide accounted for an unusually high percentage of casualties. The Department of Defense (DOD) has acknowledged roughly 24% of U.S. personnel killed in action (KIA) and 17% of U.S. personnel wounded in action (WIA) during the Persian Gulf War were the result of fratricide incidents.¹ (According to the DOD all U.S. KIA's attributed to fratricide were the result of U.S. forces engaging other U.S. forces, as opposed to coalition forces engaging U.S. forces.)² However, the basis for the general acceptance of unusually high incidents of fratricide during the Persian Gulf War seems to be founded on a comparison to the often quoted but highly suspect 2% incidence of fratricide during previous U.S. conflicts.

Whatever the reasons, as an Army we are finally, albeit slowly, coming to terms with the problem of fratricide. It may even be reasonably suggested that it was the media attention of our problem that provided the final impetus for us to approach the problem of fratricide directly. Fratricide is now specifically addressed in the 1993 edition of FM 100-5, Operations. Avoidance of fratricide has been described as "the fourth component of protection."³ Although there is only one full paragraph and perhaps a few other references devoted to the topic of fratricide throughout the manual, it is a start. It is virtually impossible to even find mention of fratricide in previous editions of the Army's keystone warfighting

doctrinal manual. The topic of fratricide also appears for the first time in the 1992 edition of TC 1-210, Aircrew Training Program Commander's Guide to Individual and Aircrew Training.⁴ TC 1-210 has established fratricide prevention training as a mandatory annual training requirement for all aircrews throughout the aviation community, whether their primary airframe is an attack aircraft or not. Is annual training enough? Probably not, but again it is a start. This acknowledgment of fratricide in doctrinal and training manuals also indicates a shift from the previously held position that if units just trained properly and executed operations precisely, the problem of fratricide would take care of itself.

Therein lies the significance of this study. To date the U.S. Army has not only failed to adequately assess the significance of the problem, but has seemingly failed in attempts to reduce it. Having taken the essential first step of acknowledgment, now is the time to aggressively pursue the appropriate solution. The recent occurrence of fratricide during the Persian Gulf War, and the difficult acknowledgment of fratricide as a real U.S. Army problem, make research of this topic necessary, important, timely, and worthwhile.

This study will propose that the supposed inevitability of fratricide will not be overcome simply through a combination of revised doctrine, tactics,

training, and awareness, but through applied technology. This thesis has thus evolved from a professional as well as personal interest in first understanding what factors precipitate the incidence of fratricide; followed by what, if anything can be done to reduce, if not prevent, fratricide from occurring, short of not flying at all.

In the final analysis it is imperative, if this study is to be of value, that it not take on an accusatory nature. This study will not attempt to defend or assign blame to any individual or organization for actions taken or not taken before, during, or after any particular fratricide incident. It will however suggest, that from an aviation perspective, fratricide does not have to remain an inevitable consequence of armed conflict.

CHAPTER 2

REVIEW OF LITERATURE

Volumes of information and materials on the topic of fratricide exist. Most focus on incidents during the Persian Gulf War. Sources include: Reports to Congress, magazine and newspaper articles (both military and other periodicals), books, research surveys, video documentaries, investigative reports, military after action-reviews, lessons learned, handbooks, and newsletters. Although a portion of the research materials available pertaining to the Persian Gulf War is classified, the majority is unclassified. This is not the case for Operation Urgent Fury or Operation Just Cause, in which the overwhelming majority of military source information is classified. There does exist a large assortment of books that accurately detail both invasions by first hand accounts and interviews, which provided the necessary detail and accuracy to successfully accomplish this study.

Significant data pertaining to fratricide trends at the National Training Center (NTC) at Fort Irwin, California, have been collected and made available through published studies and exportable view-graph presentations. However, a significant percentage of reported fratricide

incidents at the NTC is attributable to the unintentional movement of ground forces through previously employed friendly FASCAM (family of scatterable mines) mine fields. This situation has not been mirrored on the actual battlefield. In fact there have been no such incidents in combat. This situation highlights the need for caution when attempting to draw conclusions or compare training trends and results to those of actual combat. Additionally, the unintentional movement through previously fired FASCAM mine fields does not meet the criteria of a fratricide incident. Nevertheless, the NTC and other combat training centers provide valuable training and assessment mediums which can and should provide a means to evaluate our doctrine, training, tactics, and technology as it relates to fratricide reduction.

In order to complete this study, other research projects conducted at the Army Command and General Staff College, Army War College, Air Command and Staff College, and the Air War College were reviewed. These projects provided relevant historical data and differing viewpoints on the causes, effects, and potential solutions to the problem of fratricide. However, the commonalities among these projects as well as most works in the field of fratricide study are unmistakable.

The consensus tends to follow three basic premises, first and foremost, that fratricide is an inevitable result

of armed conflict. Second, that lack of situational awareness is the primary causative factor of incidents of fratricide, and third that additional training is the key to fratricide reduction.

As noted earlier, the first premise, when applied across the entire battlefield as opposed to fratricide from a specific weapons system, must reasonably be accepted as fact. The assertion of fratricide's inevitability has been established both by official government position and by recognized experts in the field.

In reviewing the following major source documents in relation to the inevitability of fratricide, it is important to note that only the authors of the Office of Technology Assessment, Congress of the United States, report Who goes there: Friend or FOE? felt compelled to note this inevitability as a state of probability rather than fact. The Office of Technology Assessment report states:

Friendly fire casualties, can probably never be eliminated, but several measures can reduce them. Fratricide has been, and probably will continue to be, a significant source of combat casualties. Combat is inherently dangerous and casualties are inevitable, and some of those casualties inevitably will be due to fratricide.¹

Major General Wesley K. Clark, Deputy Chief of the U.S. Army's Training and Doctrine Command at Fort Monroe, Virginia, was quoted in The Washington Post on 13 December 1991 as stating:

War is not a zero-defect operation, there is inherently risk involved, and so we've got to focus on the minimization...but recognize that we will never be able to prevent all instances of fratricide.²

In Lieutenant General Wilson A. Shoffner's forward to the Center for Army Lessons Learned Handbook Fratricide Risk Assessment for Company Leadership he states:

We expect our first-line leaders to make common-sense decisions on the battlefield every day, often under adverse or unexpected conditions. Mistakes by combat leaders can lead to tragic losses....History shows us action taken at company and platoon level has the greatest impact on reducing fratricide.... While fratricide cannot be eliminated, we must be constantly on guard for ways to reduce the risk.³

Perhaps the most quoted expert in the field of fratricide study is Lieutenant Colonel (Retired) Charles R. Shrader, who likewise acknowledges the inevitability of fratricide in his article "Friendly Fire: The Inevitable Price," which appears in the Autumn 1992 edition of Parameters.

Lieutenant Colonel Shrader states:

Military and civilian leaders must face the unpleasant reality that the total elimination of friendly fire casualties on the modern battlefield is not possible....Even after we have applied the full range of technological and human preventatives, friendly fire incidents will continue to occur. Some friendly fire incidents are simply unavoidable, and we should not deceive ourselves or the public that this is not so.⁴

Finally, Colonel (Retired) David H. Hackworth, a recognized expert in the field of military operations, states in his article "'Friendly Fire' Casualties," which appears in the March 1992 edition of the Marine Corps Gazette:

Friendly fire casualties or fratricide, as it is known in the Services, is a battlefield fact of life. Nothing will eliminate it as long as wars are fought by human beings and modern machines.'

The consensus in terms of causative factors and keys to fratricide reduction are less direct than the assertions of inevitability, yet they tend to follow a common direction. The consensus position reflects loss of situational awareness, in terms of human error to one degree or another, as the primary causative factor in most fratricide incidents. With human error as the causative factor, it only logically follows that the consensus solution would follow a modification of behavior, or training, in an attempt to solve the human problem. Although most studies recognize the merits of technology in reducing fratricide, they minimize its potential in relation to that of training as the most effective means of reduction.

The loss of situational awareness seems a fair yet broad assessment as to the primary cause of the majority of fratricide incidents. However, the contributing factors leading to the loss of situational awareness are so varied and so greatly influence any given fratricide incident, that it is at least as important to identify the contributing factors as it is their effect in any attempt to propose solutions. Just as no single solution, applied in isolation of others, will solve the problem of fratricide; no single factor, in isolation of others, leads to loss of situational

awareness. This study therefore accepts the consensus position of loss of situational awareness as the primary causative factor in the majority of incidents of fratricide, but attempts to further refine this premise through a closer review of the contributing factors.

It is in the third premise of the consensus position that this study truly takes an independent position. This thesis will propose that it is primarily in the application of technology that the reduction and potential elimination of fratricide must be pursued.

This study will approach the issue of fratricide from aviation fires in much the same way as the Office of Technology Assessment report, in that it acknowledges that as doctrine, tactics, training, and applied technology exist today, fratricide on the modern battlefield from aviation fires is probably inevitable. That is, given a certain duration, despite every effort to the contrary, incidents of aviation fratricide will occur. When viewed in its true context as an accident, which is ultimately what fratricide is, it becomes easier to understand why fratricide like any other accident probably cannot be totally eliminated.

If fratricide cannot be eliminated across the entire battlefield, then the effort should be focused on the combat system or systems with the highest probability for success. This thesis will propose that the attack helicopter is that combat system. It will also propose that the means to

correct the problem of aviation-related fratricide exists today. The key then is to identify and apply the appropriate collective means.

A chapter on literature review would not be complete without acknowledging the essential sources relied on to complete this study. First and foremost was Lieutenant Colonel Shrader's Combat Studies Institute Research Survey Amicicide: The Problem of Friendly Fire in Modern War. LTC Shrader's work provided an historical perspective and a comprehensive analysis of U.S. fratricide incidents from World War I through the Vietnam Conflict. Without this source, the study of Vietnam era fratricide would have been virtually impossible. LTC Shrader's work is by far the most comprehensive single source document on the study of fratricide available today. Although this thesis does not rival LTC Shrader's work in depth, scope, or quality, it is intended to be a narrower focused continuation of his work concentrating purely on attack helicopter fratricide.

Other essential sources include: Conduct of the Persian Gulf Conflict: Final Report to Congress (Sanitized Version); Urgent Fury: The Battle for Grenada, by Major Mark Adkin; Operation Just Cause: The Storming of Panama, by Thomas Donnelly, Margaret Roth and Caleb Baker; Fratricide Risk Assessment for Company Leadership, Center for Army Lessons Learned; Friendly Casualties From Friendly Fires, Vietnam Lessons Learned No. 70; Task Force 1-41 Infantry.

Fratricide Experience in Southwest Asia, by Lieutenant Colonel James L. Hillman; Operation Desert Storm: Apache Helicopter Fratricide Incident, United States General Accounting Office; and Crusade: The Untold Story of the Persian Gulf War, by Rick Atkinson.

As a consequence of the available literature the Vietnam Conflict and the Persian Gulf War will dominate this study. This is not only true because of the research materials available for those conflicts, but because of the unique characteristics each of the two conflicts possess when viewed from an aviation perspective. The Vietnam Conflict witnessed the emergence of the first attack helicopter, the UH-1B "Huey" gunship. As the longest period of sustained combat within the scope of this study Vietnam also produced the largest number of documented aviation related incidences of fratricide. At the other end of the spectrum, the Persian Gulf War displayed the attack helicopter at the height of its technology. Additionally, fratricide incidents occurring during the Persian Gulf War have been documented in greater detail than at any other time. Perhaps no other fratricide incident, certainly no other attack helicopter fratricide incident has had greater exposure in terms of publication than the incident involving the 1st Battalion, 1st Aviation Regiment, Battalion Commander in Southwest Asia. Source documents that focus on that incident alone include: Operation Desert Storm: Apache

Helicopter Fratricide Incident. United States General Accounting Office; 'Investigation of the death of two soldiers that occurred at NT 965247 on 17 February 1991. Memorandum for Commanding General, 1st Infantry Division, with accompanying AR 15-6 investigation;' and Apache Tape. Office of the Chief of Staff for Public Affairs.' Numerous other reports, accounts, and articles also cover that specific fratricide incident in varying degrees of detail.

The groundwork for a study of fratricide has been effectively established. There exists volumes of information on the subject of fratricide which have proved essential to this research. What makes this study unique from others in the field is that it has focused on fratricide by reference to a specific combat system; the attack helicopter. With this single focus study, the desired result is that the conclusions and recommendations offered provide specific recommendations in the pursuit of the elimination of fratricide fires from the attack helicopter.

CHAPTER 3

RESEARCH METHODOLOGY

Enroute to answering the primary thesis question, several secondary questions had to be addressed. Initially, a determination had to be made on what exactly were the causes of fratricide, and what if any common denominators existed in attack helicopter incidents. Additionally, this study would have to determine what measures have already been taken to minimize fratricide, and what further measures could be taken to potentially prevent fratricide from aviation fires. Some have suggested that the seemingly high percentage of fratricide casualties during the Persian Gulf War was simply an aberration not likely to be repeated.¹ Theories that the unprecedented speed and overwhelming combat power applied by coalition forces combined with the lack of Iraqi will, artificially reduced conventional casualties while contributing to an environment of potential fratricide.

Perhaps the most pressing secondary question is whether or not the percentage of fratricide incidents during the Persian Gulf War was in truth unusually high, as many have suggested.¹ The final question was to determine if historical precedence supports an opposing balance between

the number of conventional versus fratricide casualties in past conflicts.

In an effort to answer those questions within the scope of this study, several assumptions were necessary. The first assumption was that there are numerous tangible and intangible factors in every fratricide incident that will have significantly contributed to the occurrence, but are unmeasurable from a research standpoint. Physiological factors such as stress, fatigue, fear, boredom, confusion, carelessness, state of mind, and state of health are probably all relevant to one degree or another. Environmental factors such as terrain, climate, sun glint, shadows, temperature extremes, and visual obstructions may have been contributing but, unrecorded factors. Perhaps situational awareness factors such as task saturation, misorientation or fixation contributed to the fratricide occurrence.³

Although it is recognized that neither modern machines nor technology is required for fratricide to occur, this study will assume that the technology present had an impact either in the contribution to or prevention of a given incident. That is to say that technology is not a neutral factor when evaluating a fratricide incident.

Having established the primary and secondary questions, and required assumptions, the next step in this study's research methodology was establishment of the

evaluation criteria. Each incident of attack helicopter fratricide was evaluated to determine if that particular incident was due in whole or in part to deficiencies in rules of engagement (ROE), target identification, command and control, fire discipline, navigation, technology, doctrine, tactics, training, or equipment or ammunition malfunction. Additionally, an attempt was made to evaluate to what extent tactical constraints or quick fix measures employed by units due to the fear of fratricide were successful; and to review where possible each incident as it pertains to the detection, classification, decision, and engagement phases of the attack sequence.⁴ To further clarify the evaluation criteria, a brief discussion of each is provided.

In evaluating the potential effect of rules of engagement (ROE) on a particular fratricide incident it is important to apply the appropriate ROE, as each ROE differed in each conflict, and often changed several times within the same conflict. In simple terms, rules of engagement identify the criteria that must exist prior to a combatant's use of deadly force. For the purposes of this study, specific ROE were classified as restrictive, balanced, or permissive. It is acknowledged that a given ROE classification may be perceived differently based on one's own situation or point of view. A case in point: the strategic bomber pilots during much of the Vietnam Conflict

were under different ROE than the tactical crews that flew only in the south. In fact some claimed that their right of self defense had been taken away. Due to political sensitivities, the strategic bomber pilots' ROE prohibited them from striking known enemy surface to air missile sites for fear that either Chinese or Soviet advisors habitually located at those sights would become casualties. It was believed that a significant loss of advisors might lead to a more direct commitment of forces from either nation. Surprisingly, our pilots observed this ROE for the most part, and were forced to employ evasive techniques in lieu of attack for survival.⁵ Clearly this situation highlights the fact that ROE are developed with political as well as military considerations in mind.

Although failures in target identification might seem a universal characteristic in fratricide incidents, this is not always the case. It is possible that in a close combat situation a positive and correct identification of an enemy target had been made, but the intended target was missed and a friendly in close proximity was hit. Such an error could perhaps be classified as a training deficiency or error in marksmanship but not a target identification error. It has also been suggested that high velocity rounds may have actually hit enemy vehicles, passed through them and subsequently hit a friendly vehicle, possibly indicating a fire discipline error, however not a target identification

error. Therefore it becomes important when evaluating specific fratricide incidents to determine if a misidentification of the target actually took place. If so the target misidentification should be further classified as occurring due to either appearance, location, orientation, behavior, or recent experience.'

When assessing the impact of command and control, this study focused on airspace command and control, communications procedures, mission planning and coordination procedures, tactical awareness and information flow (particularly in relation to enemy and friendly situations), complexity and clarity of the commander's intent, the degree to which habitual relationships were considered in the task organization of units, leadership, and standard operating procedures (SOP).

To effectively assess the effects of fire discipline on a given incident, one must evaluate the weapon system selection to target mix in terms of proportionality, and the degree of expected weapons delivery accuracy against the selected target. The emphasis of this criterion centers on proportionality. Specifically, whether the weapon's effects were appropriate in volume and lethality to the target being engaged. Appropriateness is evaluated in terms of the minimum reasonable force required to accomplish the mission.

As previously noted, this study assumes that technology is not a neutral aspect in the occurrence of

fratricide. Technology was evaluated in terms of particular systems on a given model of attack helicopter and how that system may have contributed to, or minimized the effect of, a particular incident of fratricide. Generally speaking, one would expect that advanced technology would translate into advantage on the battlefield. In most instances that is probably the case. However there are instances where technology may have contributed either directly or indirectly to incidents of fratricide.

Such an assessment was expressed by LTC James L. Hilman in his personal experience monograph Task Force 1-41 Infantry: Fratricide Experience in Southwest Asia where he states:

Although fratricide is not a new battlefield phenomenon, improved technology has resulted in greater battlefield lethality at extended ranges without concurrent advances in friendly identification capabilities. This has exacerbated the problem of fratricide.⁷

This assessment is demonstrated in the M1A1 Abrams tank's ability to acquire targets and engage those targets at ranges in excess of 3,000 meters without the capability to identify those targets as friend or foe at the same extended ranges. The AH-64 Apache helicopter has twice the engagement range as that of the M1A1 tank. With a range of over 6,000 meters, the hellfire missile launched from an AH-64 Apache helicopter would, under most conditions, almost certainly place its aircrew in the same technological void between lethality, extended range, and identification

capabilities as that experienced by the M1A1 crew. Both the M1A1 and the AH-64 are considered world class, state of the art combat systems. Both systems performed remarkably well on the harsh desert battlefields of Southwest Asia, yet both systems exposed technological shortcomings in terms of long range target discrimination.

Another aspect of technology's potential contribution to fratricide is addressed in the 19 August 1991 issue of Army Times in a collection of articles under the title "Friendly Fire." Under the heading "Apaches saw radar as Iraqi air defense gun," LTC Roger Jones (Executive Officer for 2d Armored Cavalry Regiment during the Persian Gulf War) told Army Times of an unforeseen danger when Apache helicopters flew over the regiment's [ground surveillance] radars:

The computers on the Apache will pick that up and say it's a ZSU 23-4 [Iraqi air defense] gun. It's something nobody noticed until the war started. So anytime we had Apaches in the air we made sure our radars were shut down, and then we coordinated very closely.⁹

In another incident in what the OTA report concludes was a technology-dependent mistake, a radar-seeking missile lost track of the Iraqi radar for which it was intended and while attempting to reestablish a target track, locked on to a nearby U.S. radar.⁹ There were four such incidents involving HARMs (Highspeed anti radiation missile) during the Persian Gulf War resulting in one U.S. KIA, three U.S. WIA, and superficial damage to a U.S. ship.¹⁰ Although not a

factor in attack helicopter fratricide, the HARM missile incidents clarify technology's potential impact on fratricide occurrence.

This explains why technology appears as an evaluation criterion. As individual fratricide incidents are discussed later in this study, it will become clear that both the ability to see the target yet not identify it, and the onboard AN/APR-39 radar detector computer's misidentification of friendly ground surveillance radar (GSR) as an Iraqi threat system did in fact contribute to at least one of the Persian Gulf War incidents of aviation fratricide.

Navigation errors or positional errors are two fold: they include misorientation of one's own position or failure to accurately determine "target" location. Some may argue that positional awareness is in fact the basis for situational awareness, in that, if one becomes misoriented then they have lost situational awareness. Although it is always preferred to know one's precise location and that of one's enemy, in practice it is probably of greater value to be aware of your position in relation to that of the enemy's and other friendlies in order to maintain situational awareness, rather than simply knowing your precise location.

During the evaluation of doctrine, tactics, and training, this study focused on the correctness of application of each criteria in relation to current doctrine

and tactics, and proficiency as it relates to states of training. It should be noted that doctrine, tactics and training can not be evaluated in isolation from ROE.

The evaluation criterion, "malfunctions" is simply an attempt to determine if a malfunction in systems, munitions, or equipment contributed to a particular incident of fratricide.

As results were determined using the these criteria a reconstruction of a fratricide risk assessment matrix for each of the mission incidents was completed in order to classify each mission as either high risk, caution, or low risk. The format and criteria for the construction of the fratricide risk assessment matrix is found in CALL Handbook No. 92-3, Fratricide Risk Assessment For Company Leadership.

While establishing these evaluation criteria it became clear that a common understanding of terms would be necessary. With that aim in mind the following definitions are provided.

Attack Helicopter. For the purposes of this study all armed helicopters will be referred to as attack helicopters providing that the primary weapons system is controlled, aimed, and fired from the cockpit regardless of the original design purposes of the aircraft.

Aviation. Although totally in opposition to common usage, this study uses the term aviation to refer to U.S. Army helicopters. Unless specifically stated otherwise,

within the context of this study the terms aviation and U.S. Army helicopter are virtually interchangeable.

Environmental Factors. Environmental factors refer to the environmental conditions, such as temperature, illumination, weather, contrast, etc., that produce a physiological effect on the human body.

Fixation. Fixation occurs when aviators ignore orientation cues and fix their attention on another goal, object, or activity. Target hypnosis is a common type fixation. As an example an aircrew may become so intent on hitting a target that they fail to detect aircraft drift or sink rate and as a result strike a tree or contact the ground.

Fragging. The intentional killing of one's fellow combatant. Habitually perpetrated against those in a leadership position, or as retribution for a perceived injustice. The intent in a fragging incident is normally to disguise a murder under the conditions of combat. The term probably originated during the Vietnam Conflict; "fragging" being a slang term for fragmentation grenade.

Fratricide. In the context of this research the term fratricide will be used to describe the unintentional killing or wounding of one's fellow combatants, or the firing upon one's fellow combatant during an attempt to engage the enemy. Although other terms such as friendly fire, and amicide may ultimately be more correct,

fratricide will be the term used throughout this study primarily because of its common use in the doctrinal and training manuals which address the topic.

Friendly Fire. The intentional, but mistaken, use of weapons and munitions against friendly personnel or facilities believed to be enemy.¹¹ A friendly fire incident does not result in casualties, however an attempt at engagement is made. Therefore this study will evaluate friendly fire incidents within the same context as fratricide incidents.

Groupthink: The psychological drive for consensus at any cost that suppresses disagreement and prevents the appraisal of alternatives in cohesive decision-making groups. The process that takes over when decision-making bodies agree for the sake of agreeing and abandon their critical judgement.¹²

Inevitable. In the context of this study the dictionary usage is about right, (unavoidable, sure to come or happen).

However, the hypothesis that fratricide from attack helicopter fires on the future battlefield may not be inevitable does not propose a future guaranteed to be free from the occurrence attack helicopter fratricide for all time. It is simply to suggest that it is possible to conduct future combat operations at a similar intensity and duration as that of the Persian Gulf War without incidents

of attack helicopter fratricide occurring. If that potentiality can be accepted as within the realm of possibility, with a greater degree of probability that fratricide can be avoided as opposed to occurring; then it can reasonably be determined that fratricide from attack helicopter fires on the future battlefield is not inevitable. The selection of Desert Storm as the measure for intensity and duration is based on the belief that the fluid, high intensity, relatively short duration, war of maneuver represented by that conflict poses the greatest challenge to a fratricide free environment.

Physiological Factors. Physiological factors generally relate to the body's reaction to internal and external forces and the resulting effects of these applied forces as stressors. These physiological factors may initially manifest themselves as inability to concentrate, anxiety, confusion, or oversight of secondary tasks.

Situational Awareness. Situational awareness refers to one's ability to maintain positional reference relative to circumstance, and in relation to multiple, dynamic, and often conflicting perceptual indicators. The absence of preoccupation.

Switchology. Switchology refers to the correct sequencing and positioning of switches in order to effectually operate a specific system. Throughout this study it will generally relate to switch positioning of

helicopter weapons and targeting systems. The conduct of pre-fire checks are also included under this evaluation criterion, as are all cockpit checklist procedures.

Task Saturation. In the context of this study, task saturation refers to information or task overload in the cockpit. The demand on the crew to fly the aircraft, navigate, monitor systems, communicate on multiple nets, and to detect, classify, and engage targets, etc., may lead aircrews to unintentionally overlook secondary tasks. Task saturation can lead crews to miss radio calls, overlook system indications, transpose grid coordinates, confuse switchology, fixate, etc.

In the application of this research methodology a few strengths and weaknesses were revealed, and are worth noting. The first identified weakness results from an attempt to draw credible conclusions from a relatively small number of documented incidents of attack helicopter fratricide. This study has identified five attack helicopter incidents during the Vietnam Conflict, none during Operation Urgent Fury, two incidents during Operation Just Cause, and three incidents during the Persian Gulf War. This relatively low number of data points (incidents); coupled with the 25 year span in doctrine, tactics, and technology; and the differing characteristics of the enemy, terrain, political situation, and ROE, combine to make general comparisons of these incidents highly subjective.

Additionally, this study's deviation from assessing only officially acknowledged incidents of fratricide may prove confusing to some, and thus be considered a weakness. This deviation is based on acceptance of this study's definition of what constitutes a fratricide incident. Although that definition is essentially the same as that offered by U.S. Army Training and Doctrine Command¹³ (TRADOC), four incidents of fratricide which took place during the Persian Gulf War are not acknowledged in DOD press releases on fratricide or in the OTA report.

The first unacknowledged incident involved USAF A-10 aircraft firing maverick missiles against two British Warrior armored personnel carriers (APC), resulting in nine British soldiers killed and eleven wounded.¹⁴ The second incident involved two USMC Cobra helicopter gunships mistakenly firing on Saudi M113 APCs.¹⁵ The third incident occurred while Apache helicopters were attempting to identify vehicles positioned within proximity of known friendly positions, but emanating threat radar warning signals on the aircraft AN/APR-39 radar warning receivers. The friendly vehicles, as they were later determined to be, fired on the aircraft though no damage was sustained. The aircraft did not return fire.¹⁶ The fourth incident occurred when two Apache helicopters were on a reconnaissance mission, one of the Apache gunners misidentified a U.S. Bradley Fighting Vehicle (BFV) as an

enemy vehicle and fired a hellfire missile at it. The vehicle was not struck, apparently because the gunner had observed the target through the Target Acquisition and Designation System (TADS) but had mistakenly selected an alternate tracking choice. As a result, the missile followed an inaccurate line of sight." Although all four incidents meet the definition of fratricide, their exclusion may have been based on the fact that they did not result in U.S. casualties, or destruction of U.S. equipment.

Other deviations from that of officially acknowledged fratricide findings include an incident involving the premature detonation an artillery round," which has been classified in this study as an artillery incident as opposed to a ground incident; and the deliberate destruction of three damaged M1A1 tanks to deny potential enemy use" is not reflected in this study as a fratricide incident as it is in the DOD press releases and OTA report.

Perhaps the most glaring weakness within this study is not in the research methodology itself, but within the adequacy of documentation of many of the attack helicopter fratricide incidents. With one exception, the incidents are recorded in perhaps an anecdotal paragraph, or are recorded only to the degree of detail deemed appropriate by authors telling a larger story. Only the incident involving the 1-1 Commander has been captured in enough detail to fully apply the entire range of this study's research methodology.

In assessing the strengths of the applied research methodology, or the worth of this study, it would have to be concluded that, if any, they lie in its single focus. That of evaluating a single combat system, conducting that assessment throughout the evolution of that system, and recommending fixes for that system in an effort to defog the battlefield one piece at a time.

The analytical product of this research consists of an historical study of fratricide in general. It cites trends and patterns that indicate the types of operations, meteorological conditions, phases of conflict, and other conditions present in the occurrence of fratricide. It then focuses on specific incidents of fratricide involving attack helicopters from the Vietnam Conflict to the Persian Gulf War. With that focus it traces the advances in attack helicopter design, capabilities, and armament throughout its evolution to include, mission roles and employment techniques. From those findings, current preventative measures are evaluated and feasible alternatives to prevent future occurrence of attack helicopter fratricide are presented. Findings and conclusions are then offered to support the hypothesis that: Given the virtual all weather, day/night, long range fire capabilities of Army Aviation, fratricide on the future battle field is not inevitable.

CHAPTER 4

HISTORICAL ANALYSIS

From an historical standpoint, at least until the Vietnam Conflict, America's wars have generally been recorded as well planned, and well executed military undertakings. Although often bloody, the average American assumed that a degree of organization existed as belligerents exchanged blows to determine each battle's outcome. The fact that each side would sustain its share of casualties was simply a fact of warfare; an unpleasant but necessary aspect of even successful military operations.

World War II was such a war. Other than those who served, the only war most Americans knew was that which appeared on patriotic newsreel, radio broadcast, and in heroic print. Even of those who fought, few were ever aware of the degree to which fratricide prevailed on the battlefield. Many of the incidents that were known were believed to have occurred due to equipment malfunctions and such. Those who believed otherwise kept quiet, at least publicly; to do otherwise would be unpatriotic and serve no useful purpose. After all, the war was over and there would be no others. Despite numerous fratricide incidents, the

fallacy of an organized battlefield survived. By the end of the war no one wanted to believe otherwise.

Although no official means of documenting incidents of fratricide existed at the time, a study published by Lieutenant Colonel Charles R. Shrader in 1982 provides a detailed summary of fratricide incidents by type. Those findings for World War II indicate 77 incidents of air to ground, 34 incidents of ground to ground, and 48 incidents of artillery fratricide.¹ For the purpose of this study, all other categories of fratricide, ground to air, air to air, ship to ship and other variations, have been combined under the category of "other." Of World War II fratricides, those classified as other include 14 incidents.

During the course of American involvement in Vietnam, the realities of combat's confusion, and the realization that even American operations have their share of blunders slowly began to surface. As the confusion and disorganization of combat was relayed daily to American homes via media and newsprint, still there existed a common naivete of war's reality. Even after the accounting of mass casualties, mutual atrocities, and other horrors, it was still beyond comprehension as to how any American serviceman could be killed or wounded due to fratricide.

This common incomprehension, and the often accompanying suspicion associated with fratricide is exemplified in the extreme in C. D. B. Bryan's book Friendly

Fire. This book recounts an actual incident of artillery fratricide during the Vietnam Conflict involving 1st Battalion, 6th Infantry, 198th Light Infantry Brigade commanded by then LTC Norman Schwartzkopf. Although accurate in detail, the book focuses on the subsequent radicalization of Corporal Michael E. Mullen's family, their involvement in the antiwar movement, and their inability to accept the fact of their son's death due to fratricide.¹

Although now exposed as a rather more common occurrence in armed conflict, the actual magnitude of fratricide was in all probability still unknown to most. As LTC Shrader concludes:

The conditions of active combat in which cases of [fratricide] occur are scarcely conducive to thorough, accurate reporting of what at the time may seem relatively minor incidents. Furthermore, commanders at various levels may be reluctant to report instances of casualties due to [fratricide] either because they are afraid of damaging unit or personal reputations, because they have misplaced concern for the morale of surviving troops or the benefits and honors due the dead and wounded, or simply because of a desire to avoid unprofitable conflicts with personnel of supporting or adjacent units. In many cases, of course, the victim's commander may never know that a particular casualty was due to [fratricide].¹

Although most recognizable incidents of fratricide as well as unusual incidents involving casualties from any source were certainly investigated, the vast majority of fratricide incidents that occurred during the Vietnam Conflict were probably unknown and thus unaccounted. As in the case of World War II, there was no official means of documenting

incidents of fratricide during the Vietnam Conflict. However, LTC Shrader's study identifies 22 incidents of air to ground, 20 incidents of ground to ground, and 47 incidents of artillery fratricide. Only one incident recorded during the Vietnam Conflict is classified as other.⁴

What is interesting to note is that although a relatively good record of fratricide incidents was maintained during both World War II and the Vietnam War, the actual number of casualties due to fratricide was not.

Recognizing the absence of casualty data, LTC Shrader offered the hypothesis in his 1982 study that approximately 2 percent of all casualties have historically been attributed to fratricide.⁵ Although allowing for disagreement, LTC Shrader again offered "two percent of total casualties as a good working order of magnitude for [fratricide] casualties" in his 1992 article "Friendly Fire: The Inevitable Price", appearing in the Autumn 1992 edition of Parameters. In truth, as LTC Shrader points out, there is no way to tell. However, Colonel David M. Sa'adah, in his White Paper Friendly Fire: Will We Get It Right This Time? proposes convincing arguments to counter the 2 percent rate of incidence. COL Sa'adah presents data from several casualty surveys, studies, and autopsy analysis from both World War II and the Vietnam Conflict which all reflect fratricide casualties well in excess of 2 percent. The most

notable studies include the Hopkins Survey, and the Wound Data and Munitions Effectiveness in Vietnam Study (WDMET). The Hopkins Survey began as an independent study by Captain James Hopkins while serving in the China-India-Burma Theaters during World War II. Doctor Hopkins' particular interest was in body armor not fratricide, however the results of his findings led him to conclude that "higher command" was unaware of the large proportion of soldiers being killed by their fellow soldiers.⁶ The Hopkins Survey ultimately evaluated 370 casualties. Assessed against the current TRADOC definition of fratricide, the results were 13% of KIA, 14% of WIA, and 14% of total casualties over all within the sample were due to fratricide.⁷ The WDMET Study was conducted in Vietnam from 1967 to 1969, and was resourced with approximately 125 dedicated personnel over the course of the study. The mission of the WDMET survey teams was to study, by interview, collection of ordnance material, photographs, and real-time medical tracking, every casualty in battalion sized engagements. The mission proved impossible to sustain in the field, but the scope of the data collection in each individual case was accomplished.⁸ The Army WDMET accumulated 5993 cases from 1867 engagements, involving components of the 1st Cavalry Division, and 1st, 4th, and 25th Infantry Divisions. The WDMET Study assigned casualties to one of 18 types of weapons. Of these types, 4 were considered extremely unlikely to have been in enemy

hands; the M-16 rifle, the M-79 grenade launcher, artillery, and the Claymore mine. The study notes that these four weapons caused a total of 11% of U.S. casualties within the study.⁹ COL Sa'adah notes the study's conclusion as "an unknown fraction of the population, but almost certainly more than 10%, were victims of [fratricide]".¹⁰

Perhaps even more unsettling than fratricide is another combat phenomena that may cloud the validity of such a study as WDMET; that of fragging. As noted by George C. Herring in America's Longest War: The United States and Vietnam, 1950-1975, attacks on officers in time of war were not unique to Vietnam, but "fragging" reached unprecedented proportions in the Vietnamization period, more than 2,000 incidents being reported in 1970 alone.¹¹ Although not considered epidemic during the WDMET Study period, the M-16, M-79, and the Claymore conceivably could have figured prominently in incidents of fragging.

Finally, the Office of Technology Assessment report notes that while historians have frequently used two percent as a notional fratricide rate, the figure has been higher in all of those cases for which good data are available. A recent review of medical records from World War II, the Korean War, and the Vietnam War show fratricides to account for 12 percent and more of total casualties in those cases for which data are available.¹²

Perhaps the value in establishing an agreed upon percentage of occurrence would serve no other purpose than that of a means of comparison to other conflicts in which the data is known. As this study proceeds, it will become apparent that in America's proceeding three conflicts, we have progressively done a better job of recognizing, reporting and recording fratricide. It will also be noted that the average rate of occurrence during those conflicts was 11% of total casualties. Given that, the 12% rate of incidence proposed by the OTA report appears statistically the most feasible, therefore 12% of total casualties during World War II and the Vietnam Conflict is the figure that will be assumed correct for the purposes of this study.

The concerns over fratricide seemed to fade once again with American disengagement from Vietnam. Large scale structural and reorganizational changes were to take place in America's military. With less than a decade to reshape the now all volunteer forces, the United States once again entered combat, this time in Grenada. Although victory was swift, approximately 7 days, varying accounts as to operational successes and failures exist. Regardless of other operational problems, fratricide with the exception of one incident, was not. However, the direct result of that one incident accounted for 1 KIA, and 16 WIA. In terms of percent of total casualties that equated to 5% of KIA, 11% of WIA, and 10% of total casualties.¹³ The sole fratricide

incident during Operation Urgent Fury resulted from the strafing of a recently relocated command post by A-7 aircraft under the control of an Air Naval Gunfire Liaison Company (ANGLICO) team attempting to fire a target of opportunity against sniper positions. As the aircraft came in to engage, the ANGLICO believed that the aircraft were not on a correct bearing to the target and tried to abort the mission but it was too late. Before the attack could be broken off seventeen casualties had been sustained, three of them serious. One of those soldiers would later die as a result of wounds suffered.¹⁴ The sole fratricide incident of the invasion of Grenada is thus categorized as air to ground.

During the invasion of Panama, just six years later, U.S. forces would experience a sharp rise in fratricide incidents over that experienced in Grenada, however the resulting casualties due to those incidents were only slightly more tragic. Fratricide in Panama accounted for 2 KIA, and 15 WIA, totaling 9% of KIA, 5% of WIA, and 5% of total casualties.¹⁵ Although no incidents fit the artillery or other category, there were 3 air to ground, and 5 ground to ground incidents.¹⁶ Although the invasion of Panama had its critics, there was almost unanimous agreement that great strides in joint warfare had been achieved over that experienced in Grenada. Probably unrecognized at the time, Operation Just Cause, despite the number of fratricide

incidents, would produce what is probably the lowest percentage of fratricide casualties ever for U.S. forces, 5%. But, something else was different from wars past, ground to ground fratricides had become the most prevalent.

In less than a year from the conclusion of Operation Just Cause, U.S. forces were building combat power in Southwest Asia in preparation for what would become one of the largest armor battles in history. The Persian Gulf War, like its two predecessors, was decided rapidly; lasting a total of 42 days, including the ground phase which lasted only about 100 hours. In terms of military success and the speed in which it was achieved, Operation Desert Storm may well be considered the most successful military operation of all time. Although the eventual outcome may never have been in doubt, the strategic, operational, and tactical objectives were all met ahead of the war plan's time table. U.S. soldiers, sailors, airmen and marines; and their military hardware performed admirably. The once seemingly fragile coalition was held together through superb statesmanship and leadership, and the massive logistical demands of the operation were thoroughly satisfied. If there were to be negatives assessed in evaluating Operation Desert Storm, the most damning would come in the specter of fratricide.

The Assistant Secretary of Defense (Public Affairs) recently provided an account of U.S. Persian Gulf War

[fratricide] incidents by type; 9 air to ground, 16 ground to ground, 1 ground to air, and 2 ship to ship incidents.¹⁷ This study has determined a more accurate account reflects 13 air to ground, 14 ground to ground, 1 artillery, and 4 incidents categorized as other.¹⁸

The overall U.S. casualties resulting from the Persian Gulf War, considering the scope, tempo, and lethality of operations, are by most accounts surprisingly low. America had been braced to expect casualties in the thousands.¹⁹ Not even the most optimistic estimates would have suggested that the U.S. would suffer only 615 casualties in such a conflict.²⁰ As unfortunate as any U.S. casualty or fatality is, by any reasonable military measure, given the magnitude of Operation Desert Storm, the 148 U.S. KIA and 467 U.S. WIA was an acceptable, almost welcomed casualty rate - acceptable until one considers that 24% of those KIA and 15% of those WIA were due to fratricide.²¹ By any measure those figures are too high, especially given the quality of our Armed Forces. Many would rightly ask what went wrong.

Several reasons have been offered for why the proportion of fratricide was so high during the Persian Gulf War. First it is suggested that because total U.S. losses were very low, the percentage of fratricides appeared abnormally high.²² For the statistician this is probably a valid assumption, however it implies that there might not

really be a problem, or if there is, it is really not as significant as it appears. Second it was proposed that the war was so short that U.S. troops did not have a chance to gain much experience, reduce fratricide, and get the average down.²⁹ A third assertion was that the near-absolute dominance of the battlefield by the U.S. meant that only U.S. rounds were flying through the air and if a soldier got hit by anything, it was likely to be from a U.S. weapon.³⁰ As with the first theory, the second and third appear more as attempts at rationalization rather than explanation. A fourth accounting is however based on facts. That account advances that the unique characteristics of many U.S. weapons, for example, the depleted uranium in the M-1 tank round, made the fratricide that did occur undeniable.³¹ The virtual total accounting of fratricide during the Persian Gulf War as compared to that of previous U.S. conflicts thus explains the increase in known occurrence. Instead of rationalizing the occurrence of fratricide, full accounting has highlighted the fact that fratricide is, and probably always has been, a more significant killer than imagined and thus requires immediate attention.

Before analyzing the data collected thus far from World War II to the Persian Gulf War, a quick review of recent National Training Center (NTC) and Joint Readiness Training Center (JRTC) fratricide trends might also prove beneficial.

Figure 1 reflects the adjusted comparison of fratricide incidents by type as cited by Observer Controllers at the NTC during FY 90 and FY 92. Original source material reflected a FASCAM fratricide rate of 28.9% and 30.2% respectively for FY 90 and FY 92. When questioned why the FASCAM data had been separated out from the artillery incidents, CPT Thomas Jucks from the Center for Army Lessons Learned (CALL) stated that those figures were the result of friendly forces maneuvering through areas that had been previously fired with FASCAM. That being the case, those incidents do not meet the criteria to be classified as fratricide and are thus not reflected in Figure 1.

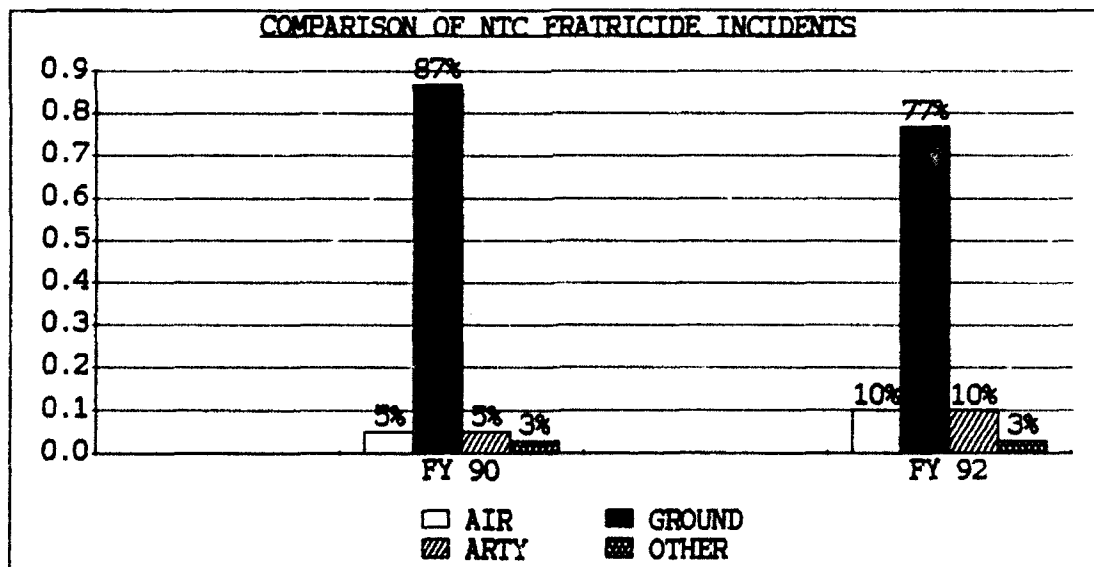


Figure 1. Comparison of NTC Fratricide Incidents.

Other data reflected in the Combat Training Centers (CTC) Exportable View-graph Take Home Packets indicate a reduction in the average fratricide rate per training

rotation from 29 in FY 90 to 18 in FY 92 at the NTC, and a reduction in fratricide as a percentage of total casualties from 8.6% in FY 90 to 6.7% in FY 92 at the JRTC. Combined data of FY 92 CTC results reflect combat identification failures as the most prevalent direct cause of fratricide incidents occurring in 22.6% of recorded incidents, and lack of situational awareness as the most prevalent contributing factor." Perhaps the most telling statistic is the high percentage of ground to ground incidents. Even using the unadjusted figures, that is, counting the FASCAM incidents as fratricides, ground to ground incidents accounted for 62% of all fratricide incidents in FY 90 and 54% of all incidents in FY 92.

However, fratricide is by no means purely an American combat phenomena; even a quick glance at military history shows that every army that has fired a shot has had to take into consideration hitting one of their own, or else quickly learn hard lessons."

At the outbreak of World War II, the Germans had the best developed system for air-ground coordination. The system worked well in the attacks on Poland until Polish defenses broke and the German army began a war of maneuver. The German 10th Panzer Division then reported "constant" attacks by friendly air. The same story was repeated on the Western front, the Germans introduced a system of safety lines (Sicherheitslinie) to avoid attacks on their own

troops; however, once a war of maneuver began deep in French territory, fratricidal attacks increased sharply."

In yet another World War II incident, a formation of Fairey Swordfish took off from the British carrier "Ark Royal" as part of the epic search for the German Battleship, "Bismarck." They soon spotted a large warship and launched torpedoes against it. However, it was the British cruiser "HMS Sheffield," not the "Bismarck," which they had engaged."

Even the vaunted Israelis have had their share of fratricide. COL Hackworth notes that the Pentagon has been aware of the ground identification problem since the 1973 Yom Kippur War revealed that a high percentage of Israeli armored losses were lost to their own air and tank fire." During Israel's invasion of Lebanon in 1982 fratricide would again take its toll. Though impressed with the attack helicopter's overall performance, both the Israelis and the Syrians experienced problems of fratricide. It was revealed that the Israelis suffered relatively high casualties to their ground troops from attacks by their own helicopters; the Syrians, although silent on this matter, no doubt experienced the same problem."

The collection of fratricide data by conflict and category, though significant, only apprises part of the fratricide account. It is through an historical comparison of the fratricide incidents throughout the various conflicts

that bring the trends of fratricide into focus. This comparison is particularly significant when attempting to determine trends within the American fratricide experience.

A review of Figure 2 indicates that from an historical perspective there appears to have been a significant transition in the type and frequency of fratricide occurrence.

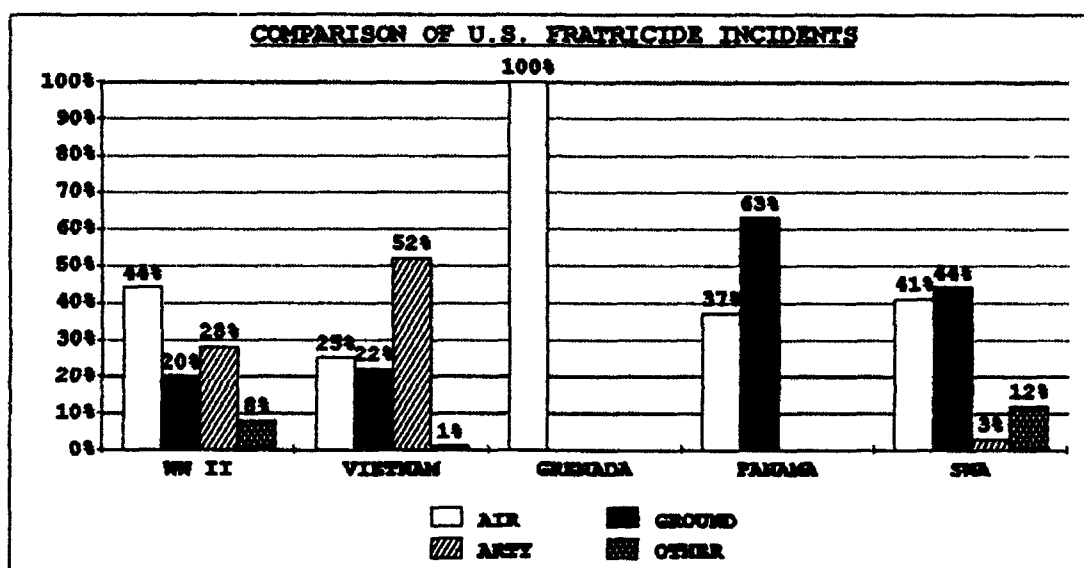


Figure 2. Comparison of U.S. Fratricide Incidents.

Ground to ground incidents have gradually become the most prevalent. Air to ground incidents have been consistently high, never accounting for less than 25% of all incidents, and averaging 37% of all incidents from World War II to the Persian Gulf War, even when excluding the Grenada experience to avoid skewing. Of note when evaluating air to ground incidents, although not considered indirect fire in the truest sense of the term, virtually all air incidents of

fratricide during World War II were the result of strafing or bombing operations in which the pilots had minimal or no observation opportunity of the target or target area. A high percentage of air attacks both in World War II and in Vietnam were made with free fall ordnance. Conversely, of the 13 air to ground incidents during the Persian Gulf War, in at least 12 of those engagements the pilots had direct visual or technology enhanced visual contact with the target, to include the single bombing fratricide incident. The technology enhanced visual contact ranged from state of the art forward looking infra-red, and thermal imaging systems to less advanced technologies such as night vision goggles and binoculars. But, the fact remains that in 12 of 13 air to ground fratricide incidents during the Persian Gulf War, the attacking aircrew physically observed their target vehicles in some manner. Perhaps this further supports the position that our technological capability to acquire targets has outstripped our technological capability to accurately identify those targets.

Artillery, which was a significant contributor to the incidence of fratricide during World War II and Vietnam, has virtually ceased to be a measurable fratricide problem. The 4% rate of occurrence for artillery reflected during the Persian Gulf War is in truth a single incident. That single artillery incident is the only artillery fratricide incident recorded during the past three U.S. conflicts. To further

clarify the data in Figure 2, Figure 3 translates the percentage of fratricide by type to the actual number of incidents recorded.

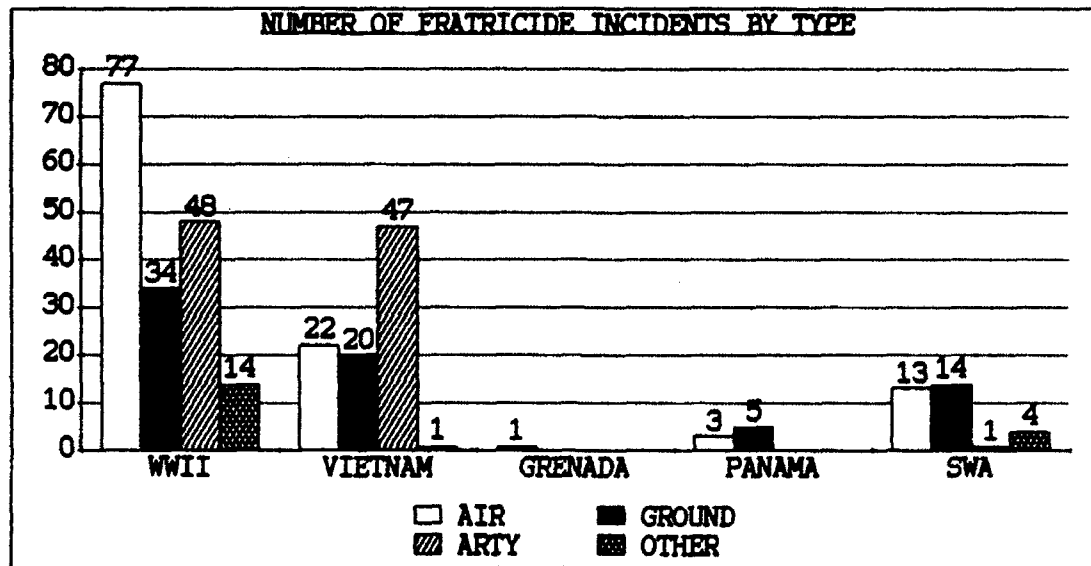


Figure 3. Number of Fratricide Incidents by Type.

The significance of fratricides transition then lies in proportionality. That is to say that the category in which the preponderance of fratricide incidents occur, has undergone significant change between World War II and the Persian Gulf War. Of specific note is the emergence of ground to ground incidents both in training and in combat as the most prevalent, and the decline in artillery incidents. With a total fratricide occurrence of one incident and eight incidents respectively in Grenada and Panama, perhaps the data is of little comparison value, unless one concludes that future U.S. conflicts will be of the short duration, dismounted operations, type. The preponderance of light

maneuver forces in those conflicts supported primarily by air power and attack aviation may also be reflected in the incidence of fratricide. That is to say that the forces most represented in a conflict are statistically, if not obviously, going to sustain proportional shares of casualties, to include those from fratricide. If not for the volume of U.S. artillery fired during the Persian Gulf War one might conclude that it was the nature of the conflicts that brought about its reduction. Others would suggest that the reduction has come about through employment techniques, not the least of which has been through digitization of the battlefield, or technology. What ever the case, ground to ground and air to ground incidents must somehow be similarly reduced.

A thorough review of data collated in Figure 2 and Figure 3 also reveals another interesting trend. With one exception, the fratricide category with the greatest number of fratricide incidents during each conflict, was the same fratricide category which produced the single greatest casualty producing incident in that conflict. In other words, when air to ground incidents were the most prevalent, it was also an air to ground incident that resulted in the highest number of casualties in a single incident. That trend is constant from World War II to the Persian Gulf War with the exception of the Panama Invasion.

During World War II the highest casualty producing fratricide incident occurred during Operation Cobra as part of the Normandy breakout. The first phase of the breakout was to be carpet bombing of the German positions. The attack was to start with 380 medium bombers hitting specific targets, followed by over 1,500 heavy bombers dropping over 3,300 tons of bombs. Tactics of that day called for the lead plane to sight the target and all others to release when the leader did. One lead plane had a broken bomb sight and released visually. Another bombardier thought he was on target but was orienting on the wrong landmarks. Succeeding flights would almost never be able to see their targets because of the dust raised by first salvos. Therefore, their attempts to bomb targets were really the bombing of dust clouds. Unfortunately, during the Operation Cobra bombings, wind blew the dust toward U.S. positions and every wave of bombers struck a little closer. The results of this misplaced bombing were deadly. The results of the two days of bombing were 111 KIA and 490 WIA. Among the dead was Lieutenant General Leslie McNair, Commanding General of the Army ground forces, and a strong supporter of air-ground operations. He had come to the forward area on the second day of bombing specifically to help morale after the short bombings on the previous day.²¹

In Vietnam artillery would be responsible for the largest casualty producing incident. One U.S. artillery

unit firing harassing and interdicting fires at night applied Charge 7 rather than Charge 4. The rounds landed in a U.S. base camp, killing 1 and wounding 37. The victimized unit initiated counterbattery fire that proved deadly accurate, and killed 12 and wounded 40 in the offending fire base. This dual lasted for twenty-three minutes, when it was over it had accounted for a total of 90 casualties, all the result of fratricide.³³

The single fratricide incident in Grenada as described earlier accounted for 1 KIA, and 16 WIA. Panama is the exception in that although ground incidents were the most prevalent, the single largest casualty producing incident of fratricide was the result of air attack. While assaulting La Comandancia (Panamanian Defense Forces Headquarters) in downtown Panama City 21 of the 26 members of one platoon became casualties as they assaulted in their M113 APCs. Initially the fires were thought to be that of enemy mortars; however those who had their ranks decimated were sure that it was U.S. AC-130 fire. The Spectre pilots later said that smoke and fire from La Comandancia may have obscured their targeting systems, but dismissed claims they engaged American troops.³⁴ An exact determination of who inflicted the casualties is still somewhat in doubt, however an investigation revealed that the 21 wounded soldiers were receiving both enemy mortar fire and friendly AC-130 fire.³⁵

Finally, the largest casualty producing incident of fratricide during the Persian Gulf War was a ground to ground engagement between multiple U.S. vehicles. During a night attack on February 27, a U.S. M1A1 tank came upon other U.S. tanks under attack by Iraqi infantry. Looking into the night through thermal sights that "see" heat images, the tank's gunner mistook the heat generated by the Iraqi fire for the hot flash of a tank firing its main gun and subsequently began to engage friendly vehicles. A five hour battle ensued, ironically the war's longest fire fight, in which six U.S. soldiers were killed, twenty-five wounded, and five M1A1s along with five BFVs were destroyed, all due to fratricide.³⁶

Beyond the numbers of killed and wounded, fratricide has a compounding effect on combat effectiveness. The Center for Army Lessons Learned lists among those effects, hesitation to conduct limited visibility operations, loss of confidence in unit's leadership, hesitation to use supporting arms, loss of aggressiveness during fire and maneuver, and general degradation of cohesion and morale.³⁷ More than the obvious loss of combat power, the psychological effects of friendly fire are always greater than that from similar enemy fire. Combatants expect to be engaged by the enemy, but being engaged by friendly forces, especially when that engagement results in casualties can be devastating, and the resultant effects spread quickly

throughout a unit.* However, in our efforts to avoid fratricide, we must avoid at all costs the reluctance to employ, integrate, and synchronize all the battlefield operating systems at the critical time and place.*

This view of fratricide's consequences and trends may raise more questions than it answers. What can be determined by the evidence is that it exists, and to a greater extent than previously believed. Every armed force that has had to resort to force of arms has also had to endure the consequences of that decision not only in terms of battle losses but in terms of fratricide. Fratricide is a complex combat phenomena not likely to be solved quickly. Our current technology does not provide us with the ability to identify targets at the same ranges that we can engage them. And finally, the effects of fratricide cannot be measured simply in the loss of the combat power of personnel and equipment involved.

CHAPTER 5

ATTACK HELICOPTER FRATRICIDE ANALYSIS

Vietnam

It has been suggested that the two most significant Army contributions to the Vietnam War were the Special Forces and the helicopter.¹ In the late 1950s and early 1960s, a few farsighted U.S. Army officers began integrating Army aviation into battlefield maneuver. Rooted in the airborne concepts and techniques of World War II and driven by advances in helicopter development during and after the Korean War, military planners created new principles that combined light infantry, supporting artillery, and aviation to generate maximum shock power and maneuver on the modern battlefield. These planners, as part of two boards, reviewed Army aviation requirements and developed concepts pivotal to the evolution of airmobile operations.²

Lieutenant General Gordon B. Rogers chaired the first board, the Army Aircraft Requirements Board. In addition to making recommendations on observation, surveillance, and transportation aircraft, the Rogers Board recommended an in-depth study be conducted to explore the concept and feasibility of air-fighting units.³ Even as the concepts of airmobility were being reviewed, the first two

helicopter transport companies arrived in Vietnam, in December 1961. Only twelve days later the two U.S. companies of H-21 Shawnee helicopters were used in combat to transport Army of the Republic of Vietnam (ARVN) Rangers in Operation Chopper. Over the next several months numerous aviation units were deployed to Vietnam, and soon after U.S. aircrews were becoming casualties. As the casualties mounted, it wasn't long before permission was granted to put weapons on the helicopters. The H-21s had two doors, and each had an air cooled .30 caliber M1919-A6 machine gun on an improvised mount which had been manufactured by the hangar crews.⁴ These became the first U.S. armed helicopters to engage in combat operations.

The second board, the U.S. Army Tactical Mobility Requirements Board, known as the Howze Board after its president, Lieutenant General Hamilton H. Howze, was formed in 1962. The Howze Board subsequently investigated, tested, and evaluated the organizational and operational concepts of airmobility as a continuation of the concepts first proposed by the Rogers Board. During 1963 and 1964 Army tests demonstrated that helicopters could successfully replace ground vehicles for mobility and provide fire support in lieu of ground artillery. The result was the creation in 1965 of the 1st Cavalry Division (Airmobile), the first such unit in the Army.⁵ With its deployment to Vietnam in September 1965, the 1st Cavalry Division (Airmobile) changed

the way U.S. forces conducted land warfare. The use of helicopters for reconnaissance, command and control, troop transport, attack gunships, aerial rocket artillery, medical evacuation, and supply was tantamount to a revolution in maneuver.⁶

The interest in armed helicopters grew concurrently with that of airmobility. The primary role of the armed helicopter in the new Airmobile division was that of airborne artillery. The Howze Board had recognized that such a division would suffer from a lack of fire support if forced to rely only on conventional artillery, thus the armed helicopters were equipped with 2.75 inch folding fin aerial rockets (FFAR) in large cluster pods which could substitute for conventional artillery in many roles. The armed helicopter also provided a means of armed reconnaissance, airmobile escort, close air support, and overhead cover for ground operations.⁷ Although the early airmobile division concepts did not seriously consider anti-tank requirements, the Army had been testing the helicopter in the anti-tank role since 1958, and by 1964 had determined the best mix was the UH-1A "Huey" helicopter armed with six French SS11 anti-tank missiles. This armament system was deployed to Vietnam in 1965 on board the enhanced UH-1B Hueys, and was first used operationally in October 1965.⁸ Due to the absence of enemy tanks, it was primarily used to attack bunkers and other small, hard targets.

The armed helicopter proved a successful adjunct to the use of the helicopter in the troop carrying role. The most common U.S. armed helicopters were the "Hogs," variants of the Bell UH-1 Hueys, which carried a variety of mini-gun, rocket, and grenade launcher systems.' Although effective, the Army wanted a dedicated gunship that would be capable of carrying both a rapid fire machine gun system and rocket pods, as well as carrying sophisticated sensors which would enable it to perform better than the UH-1 gunships at night and in poorer weather. Higher speed and maneuverability were also desired. The result was the Bell UH-1G Huey Cobra, subsequently designated the AH-1G Cobra. Accepted by the U.S. Army in March 1966, the Cobra entered service in May 1967, and the first operational units with Cobra attack helicopters appeared in Vietnam in September 1967.¹⁰ The Cobra soon became the mainstay of the U.S. attack helicopter fleet assuming the roles previously filled by the "Hogs." The terrain-avoiding radar installed in the new Cobra also gave aircrews the capability to safely fly at nap-of-the-earth altitudes at night and during poor weather, somewhat of a revolution in helicopter tactics.

Improvements in the anti-tank missile would soon follow in the form of the U.S. designed MGM-71 TOW (Tube-launched, Optically-tracked, Wire-guided) missile; indicating that perhaps the focus of armed helicopter development was not solely on unconventional jungle warfare.

Only two such equipped UH-1B Hueys were deployed to Vietnam and the TOW missile was yet to be fired from a Cobra.

When the North Vietnamese struck in April 1972, the U.S. Army was unprepared for the large number of tanks which took part in the offensive. Fortunately, a high explosive anti-tank (HEAT) rocket had been developed for the 2.75 inch FFAR used by the Cobra. While difficult to use, the rocket did give the Cobra a limited measure of anti-tank capability. On 13 April 1972 AH-1G Cobras of the 3d Brigade, 1st Cavalry Division scored the first recorded tank kill by helicopter when they knocked out four T-54A tanks near An Loc. The number of rockets required to destroy a tank varied from a minimum of 4 to a maximum of 56.¹¹ By the morning of 2 May, American advisors and ARVN troops were reeling back towards Kontum under the weight of the North Vietnamese Army's Easter offensive. As the NVA armor advanced, a single NUH-1B TOW armed Huey appeared just above the horizon. The gunner, Warrant Officer Carroll W. Lain, gathered the lead tank into the sights of his XM-26 airborne TOW fire control system and fired a single TOW missile. The missile struck the tank, gutting it in an enormous fireball. This was the first recorded case of a tank being destroyed in combat by a guided missile-firing helicopter.¹² A small number of SS11 missiles were still in the inventory in South Vietnam, and their launchers were hastily refitted to six UH-1M helicopters. The first kill of a T-54A tank with an

SS11 took place on 21 May 1972.¹³ The battle of An Loc marked the most intense fighting of the war to date, and lasted over two months. In the end the NVA attack was beaten back at a cost to the communists of three virtually destroyed divisions. Air power proved the decisive factor in the battle of An Loc, much of that coming from attack helicopter fires. The two TOW Hueys were credited with firing 81 missiles and destroying 26 tanks and 33 other targets including APCs, trucks, barges, bridges, and bunkers. The TOW had proven to be five times more effective than the SS11.¹⁴ The absence of attack helicopters would prove equally decisive as South Vietnam was over run and destroyed by NVA forces, crushing the last ARVN resistance on 1 MAY 1975.

The Vietnam War thus saw the dramatic evolution of the helicopter from a purely support role to that of combat maneuver and fire support. With the birth of the attack helicopter, the face of American combat would change forever. But despite the many great successes, the attack helicopter would also prove lethal to U.S. and well as other friendly forces in the form of fratricide.

As LTC Shrader noted in his 1982 study, the armed helicopter, used extensively for the first time during the Vietnam Conflict, offered significant advantages in mobility and accurate firepower, but it also for the first time became the instrument of fratricide. Many fratricide

incidents involving helicopters resulted from the causative factors commonly associated with fixed wing aircraft, not the least of which was mistaking friendly ground troops for the enemy.¹⁵ The dense jungles and rugged terrain of Vietnam also added to the problems of pilot orientation and target identification, as did the enemy tactic of "hugging" U.S. forces in contact to ensure that any form of air or artillery support would be "danger close." The communist hope was that with close proximity to U.S. forces in contact, those forces would be reluctant to call for fire support. As experience would demonstrate, U.S. forces habitually called for and received danger close fires throughout the conflict, which unfortunately did result in a number of fratricides.

In one incident of attack helicopter fratricide in 1968, one U.S. soldier was killed and nine others were wounded when their platoon was fired on by helicopter gunships. A U.S. infantry platoon conducting a mounted combat patrol had established an ambush position near a district headquarters compound and during the night became engaged with an enemy force. Gunship support was requested and upon arrival on station was directed by the subsector advisor to fire on the wood line north and west of the compound. The gunships fired on the friendly platoon as a result of a misunderstanding between the subsector advisor and the gunship crews as to the exact location of friendly

troops. Clearance to fire had not been given by the commander of the victimized ground troops."

This incident was attributed to poor coordination, and lack of situational awareness brought about by darkness and lack of accurate information on the position of friendly forces in relation to the directed engagement areas. No mention of "danger close" fires had been passed to the aircrews, indicating that perhaps the district advisor was unaware of the friendly platoon's exact location, but perhaps the most significant oversight in this incident was the violation of ROE; in that clearance to fire had not been given by the ground commander or unit in contact. A post-incident reconstruction of a Fratricide Risk Assessment Matrix indicates that this mission would have been classified as a high risk mission because of intermingled forces, passive or external fire control, expedient employment with a marginally effective, if even existent, means of combat identification, and the compounding difficulties of these factors occurring at night.

In another incident, gunships from D Troop, 1st Squadron, 4th Cavalry, 1st Infantry Division, operating in the III Corps Tactical Zone (CTZ) fired rockets that hit a friendly APC, killing two and wounding three. The gunships had found an enemy unit at night and the friendly ground forces were attempting to adjust the helicopter fires onto

the target, but in the adjustment process they caused the fires to fall on their own positions."

Here, helicopter fires were being adjusted by ground forces, which indicates that the aircrews did not have visual contact with the targets. However, had the aircrews had knowledge of all the friendly locations, especially the location of those forces adjusting the fires, they certainly would not have placed the fires where they did. With what little is known about this incident, it is nevertheless clear that a lack of situational awareness existed. The fact that the incident took place at night, with the ground forces apparently having visual contact with the enemy in terrain that is generally restrictive, and the enemy's predisposition to employ hugging tactics on those occasions when he chose to stay and fight, indicates with a high degree of probability that this was a danger close mission. Although lacking sufficient information to accurately reconstruct a matrix, one can assume, given the factors of night and uncertainty that are known, this mission was high risk.

A third incident took place in early 1968 involving gunships from the 187th Assault Helicopter Company. While operating in War Zone Charley the 187th gunships mistook friendly ground troops for the enemy and engaged a company sized force west-northwest of Go Da Hau. The personnel on the ground were unidentified, and a check with the base at

Cu Chi revealed that no friendly forces were reported in the area. The UH-1C gunships took the ground formation under fire and wounded several men before the ground force was able to identify itself as a unit of the 25th ARVN Infantry Division."

In this incident, as was often the case, the identification of uniformed ground troops from the air was difficult. Often it was the ground force's reaction to the presence of the helicopters that determined engagement, however in this incident the target of opportunity was engaged primarily due to the information passed to the aircrews indicating there were no friendlies reported in the area. Therefore, despite non-hostile actions, the uniformed force was assumed to be enemy. Without further attempts at identification, the aircrews apparently assumed that the responsible base had perfect situational awareness as to the location of its and adjacent units. The report of no friendlies in the area was interpreted by the aircrews as clearance to engage. This incident clearly shows that a breakdown in the attack sequence took place during the classification phase. The suspected target was visually identified by the aircrews, however they relied on external information as a means to classify the target as enemy as opposed to attempts to classify the target by means of their vantage point. Although the information provided by Cu Chi base certainly would be an important consideration in the

classification of the targets, it should not have been the sole means for that classification. Given that, it can be determined that the primary contributing factor in this incident was a failure in target identification to include misidentification, attack procedures, and possibly ROE in that the target was apparently assumed hostile until proven friendly. The lack of situational awareness on the part of the responsible base also contributed, albeit passively, to this incident.

Near Go Vap, five to ten kilometers north of Saigon on 3 March 1968, C Company, 4th Battalion, 9th Infantry, 25th Infantry Division, was caught in an NVA ambush on one side of a canal. Soldiers of the 3d Platoon, D Company, attempted to cross the canal to aid the embattled C Company. A UH-1 gunship attempting to support the friendly ground units inadvertently fired two 2.75 inch FFARs in the 3d Platoon area, wounding three men. The flight path of the gunship was perpendicular to the line of the canal and to the friendly troops, and the accident reportedly occurred when the helicopter hit an air pocket causing the nose of the aircraft to dip just as the rockets were fired.¹⁹

As with other incidents, the information surrounding this incident is sketchy. The emphasis placed on the perpendicular attack by the UH-1 gunships may imply that this approach to the target was in violation of either local ROE, employment tactics, or unit SOP. It has been

established that tactics dictated that fixed wing aircraft in the close air support role engage enemy forces parallel to friendly units to preclude short rounds/bombs from inadvertently striking or falling on friendly positions, however this study has not identified a similar specific or implied requirement for attack helicopters when engaging in a direct fire mode. Although environmental conditions can effect munitions placement, the buffeting of the aircraft at rocket launch as the causative factor is highly suspect. The fact that the 3d Platoon was moving in proximity of the engaged company; an error in target identification is a more probable explanation for the effective fire placed on the 3d Platoon. Had the enemy been the actual target, it is more likely that short rounds would have fallen on the engaged company rather than the flanking element coming to their aid. Such an analysis would lead one to conclude that the probable cause of this incident was misidentification of the target, possibly involving a violation of SOP in attack procedures. Although converging and intermingled forces raise the risk of fratricide, this mission took place in daylight under conditions of good orienting terrain, with adequate communications in place. This was a medium risk mission requiring caution.

In the fifth and final incident of known attack helicopter fratricide, helicopters of the 158th Aviation Battalion, 101st Airborne Division were called upon to

conduct an emergency extraction of a platoon of the 1st ARVN Infantry Division near Dong La Ruong Mountain, fifteen kilometers north of Khe Sanh in the northern I Corps Tactical Zone. During the course of the extraction, the pilot of a supporting Cobra gunship became confused and, believing the pickup zone (PZ) to be clear, made a firing run on the PZ wounding five of the six ARVN soldiers remaining on the PZ. The wounded soldiers were immediately picked up and evacuated to a hospital ship.²⁰

Several factors may be assessed as contributing to this incident of fratricide. A violation of ROE and SOP appears almost certain. The responsibility of accompanying gunships during an extraction is escort enroute, and overwatch at the PZ providing either supporting fires for the ground forces or suppressive fires for the extracting aviation element. Therefore, unless responding to fire direction, or immediate suppression of the enemy, accompanying gunships are virtually under a weapons hold criteria in the PZ. Meaning that, in the absence of a fire mission from the air mission commander, or ground maneuver commander, weapons are not to be fired except in self-defense. Further, until designated clear by the supported ground maneuver element, PZs are assumed occupied by friendlies. The contributing factors here are not only related to violations of ROE and SOP, but also indicate a lack of command and control, situational awareness, and fire

discipline. In terms of the Fratricide Risk Assessment Matrix, this operation was designated as a medium risk mission requiring caution. Although assessed as a complicated mission executed under expedient conditions (designated as an emergency extraction), other factors associated with high risk missions appear to be nonexistent. Forces were not intermingled: in fact it appears that the ground forces were not in direct contact during the extraction. The operation took place during day light, and clarity of the situation, visibility, friendly force identification, and communications were all in place. Of all the attack helicopter fratricide incidents evaluated, this one clearly should have never happened.

LTC Shrader identifies five additional helicopter fratricide incidents in his 1982 study.²¹ Each involves fratricide from helicopter door guns which were not aimed or fired from the cockpit, but are manned by designated door gunners. Such incidents are not classified as attack helicopter incidents within this study and therefore are not reviewed in this study.

Of the five incidents evaluated in this study, lack of situational awareness was a factor in each. Target misidentification occurred in three of the five incidents, with all misidentifications occurring during daylight operations. During both night incidents the helicopter fires were adjusted or directed by ground forces or advisors

on the ground, as opposed to the aircrews physically identifying and engaging targets. Violations of ROE or SOP were present or suspected in four of the five incidents, and the aspect of danger close fires or intermingled forces were present in three of the incidents. In the reconstruction of the Fratricide Risk Assessment Matrices, none of the missions were classified as low risk. Both night missions were high risk, and the others were medium risk, requiring caution.

Just as LTC Shrader concluded in his 1982 study of all air to ground fratricide incidents during the Vietnam conflict; confusion and disorientation, or lack of situational awareness, appears to be the most prevalent contributing factor in these incidents of fratricide.²²

Attack Helicopter Modernization

The proven utility of the armed helicopter during the Vietnam Conflict seemed to provide the impetus for the further development of the machines, their armament and tactics. Attack helicopter successes in an anti-armor role at An Loc certainly had application to the Central European Theater where the disproportion of forces between NATO and the Warsaw Pact caused growing concern.

In 1973 and 1974, the U.S. Army conducted controlled field tests in Europe using the AH-1G Cobras and simulated Soviet tank formations to evaluate potential exchange ratios. The Cobras maneuvered against German Leopard I

Tanks which simulated Soviet tank formations and mimicked Soviet tactics.²⁴ These tests suggested that expected exchange ratios would vary from 3:1 in favor of the helicopters up to more than 14:1, depending on the size of the attacking helicopter force. The trials suggested that a formation of five helicopters was dramatically more effective than a single machine, and also revealed that a helicopter operating at nap of the earth (NOE) altitudes reduced its vulnerability, since it was nearly impossible to detect by radar. The tests further stressed the need of electronic countermeasures to baffle enemy air defense radars, and infra-red countermeasures to protect against the new generation of man-portable infra-red guided anti-aircraft missiles like the Soviet SA-7 Grail.²⁵

Both the combat performance of attack helicopters in Vietnam and the field testing in Europe, kept modernization of the attack helicopter an Army priority. Modernization of the AH-1G Cobra took place in a number of phases. The AH-1Q improvement incorporated an upgraded engine, and the Improved Cobra Armament Package (ICAP) with TOW launchers and a helmet mounted sight. This program included both modification of 93 existing AH-1G Cobras and production of new AH-1Q helicopters, taking place from 1973 through 1977.²⁶

The AH-1Q, despite its improvements over the AH-1G, was still under powered and lacked the desired maneuverability. Furthermore, the primary weapon system,

the TOW missile, was a clear weather, daylight system only. The next upgrade, the AH-1S which began production in 1976, had an enhanced engine and power train, but the most significant improvements came in the aircraft electronics, and in a fully stabilized daylight sighting system.²⁶ The AH-1S would undergo two additional improvement programs. The AH-1S Step 2, also called the Up-Gun AH-1S, incorporated a new universal turret, and a wing stores management system making both systems operations and systems maintenance easier. Finally, the Step 3, also called the Modernized Cobra, included fire control improvements, a Doppler navigation system, an Identify Friend or Foe (IFF) transponder, an infra-red (IR) jammer to counter enemy IR anti-aircraft missiles, an IR suppressor over the engine exhaust, and secure voice communications. Production of 99 Modernized Cobras was completed for the U.S. Army in 1981, but an additional 55 were ordered for the U.S. Army National Guard in 1983.²⁶

Grenada

It was primarily the U.S. Army's Modernized AH-1S Cobra and its USMC counterpart, the twin engine AH-1T Sea Cobra, that would undergo combat in Grenada in 1983.

The U.S. operations in Grenada also served to verify the existence of U.S. special operations aviation forces. Witnesses, photographs, and film documented both the presence and some of the activities of the AH-6, MH-6, and

Hughes 500 Defender special operations attack helicopters.²⁸ Described as a multimission combat helicopter the "Little Birds" performed offensive operations with a variety of armament kits. Those operating in Grenada were armed with various combinations of TOW missiles, 2.75 inch FFARs, 7.62 millimeter mini-guns, .30-caliber chain guns, and even the M-56 mine dispensing system.²⁹ The Little Birds were specifically designed for night operations, being equipped with infra-red night flying devices.

The NOE tactics first developed in Vietnam proved essential to helicopter survival once again. The improvement in helicopter systems, the incorporation of infra-red night flying systems in selected aircraft, and the development of night vision goggles (NVGs) gave the attack helicopters in Grenada a true night fighting capability that further enhanced aircrew survivability, but potentially made target identification more difficult.

The attack helicopter once again proved its worth under combat conditions. Of the 29 attack helicopters deployed to Grenada, two were lost to hostile fire during the 4 day conflict.³⁰ There were no incidents of attack helicopter fratricide during Operation Urgent Fury.

The Advanced Attack Helicopter

As was originally recognized in 1976 when the Cobra was first deployed to Vietnam, the U.S. Army viewed the Cobra only as an interim attack helicopter until a more

specialized aircraft could be developed." The successor to the Cobra would eventually be the AH-64 Apache.

Just prior to the development of the new Advanced Attack Helicopter (AAH) came a shift in design focus. The anti-armor needs of the European Theater was of primary concern during the developmental and testing period of the AAH. No longer was an airborne artillery fire support aircraft which could attack targets at high speed, overhead from an altitude of several hundred feet with rockets and gunfire required. The AAH was envisioned primarily as an anti-tank helicopter, attacking its targets from several kilometers away from a low hover. Thus the emphasis was shifted to the development of a stable launch platform with improved survivability features. This included much more strenuous requirements for protection against small arms fire, reduction of IR and radar signatures, and the incorporation of electronics and infra-red countermeasures systems. Also central to the design of the new AAH was the Hellfire missile, a third generation anti-tank missile using semi-active laser guidance."

In December 1976 the Hughes YAH-64 was selected as the winner of the AAH competition, and designated the AH-64 Apache. The Apache was nearly cancelled in 1978 during budget battles in the U.S. Congress, and again in 1981 its future was in question. In 1981 it was proposed that an anti-tank version of the UH-60 Blackhawk utility helicopter

could meet the Army's anti-tank requirements. The U.S. Army's position was that the Blackhawk alternative was deficient in terms of speed, mission endurance, vulnerability to ground fire and other factors, and that it would not save the Army significant costs through time. In spite of its high cost, 11.9 million per aircraft in 1984, the Army succeeded in winning approval of the program. The first production AH-64 Apache helicopters were delivered in 1985.³³ The USMC found the Apache cost prohibitive, and chose instead to continue to modernize its Cobra attack helicopter fleet.

With the delivery of the AH-64A Apache, it was apparent that it was designed so that the helicopter and its crew would be protected as much as possible. A thick glass blast panel separated the front seat of the cockpit from the back seat. Although the pilot could easily see through it, the laminate was designed to stop small arms and anti-aircraft munitions.³⁴ Additionally armor was placed around the pilot and copilot seats, as well as other critical areas of the aircraft. The main and tail rotor blades were designed to withstand hits from heavy machine-gun fire, and the gearboxes and other drivetrain components were designed to withstand hits that would be fatal to earlier helicopters.³⁵ The AH-64A was also designed as a night fighter, incorporating a built in pilot night vision system, and thermal and IR targeting systems.

Panama

Just Cause marked the first exposure to actual combat for the Apache. Designed primarily as a tank killer, the Apache was used in Panama for a variety of missions in support of both Special Operations Forces (SOF) and conventional force operations. Armed with Hellfire missiles, 2.75 inch FFARs, and 30mm chain gun, Apaches were used to destroy buildings housing Panamanian Defense Forces (PDF), provide standoff reconnaissance and supporting fires of landing zones, escort troop-carrying helicopters on air assaults, and provide suppressive fire against heavier weapons encountered at some of the objectives.²⁴ In addition to the eleven Apaches deployed to Panama in support of Operation Just Cause, four AH-1 Cobras and up to twenty SOF Little Birds were also deployed to provide attack helicopter fires at various objectives.²⁵ While many of the attack aircraft received damage from small arms fire, none of the attack helicopters supporting conventional forces were downed, and of those supporting the SOF objectives, three of the Little Birds were lost to hostile fire.²⁶ U.S. Army helicopters would ultimately be involved in two incidents of fratricide and two incidents involving civilian casualties before all the objectives of Operation Just Cause would be achieved.

Some of the heaviest resistance encountered by U.S. forces during Operation Just Cause would take place in

downtown Panama City at La Comandancia, the main PDF headquarters. Although La Comandancia had been an H-Hour objective and had been pounded with 152mm Sheridan tank fire and AC-130 Specter gunship fires, by 3:45 PM La Comandancia was still not firmly under U.S. control. Almost fifteen hours after the battle for La Comandancia had begun, the second phase of the clearing plan was initiated. The second phase called for two AH-64 Apaches to fire Hellfire missiles and 2.75 inch FFARs into La Comandancia, hopefully inducing the PDF holdouts to surrender. The Apaches were to arrive late. At approximately 3:45 PM 20 December 1989, hovering over the Bay of Panama about two miles away, the Apaches launched Hellfire missiles and 2.75 inch FFARs at the rear of the PDF La Comandancia facility. The Hellfire missiles proved accurate, but two 2.75 inch FFARs missed their target, and slammed into nearby buildings igniting them in flames. The effect of one of the stray rockets stripped the skin off the back of a U.S. soldier who was in the process of escorting a PDF prisoner to a collection point near the Company Command Post. The errant rockets were reportedly fired at a PDF V-300 armored car moving behind La Comandancia, but exploded into the side of a building just above a U.S. Company position.³⁹

In evaluating this incident it appears that all criteria for a successful attack were considered. One might question the firing of 2.75 inch FFARs from a distance of

approximately two miles into a target area that is known to have friendlies present, but the clearing plan apparently called for such techniques. Although an effective and relatively accurate weapon system, the 2.75 inch FFAR can hardly be classified as a precision munition. Given the distance, target, high probability for collateral damage, and especially the proximity of friendly troops, the employment of 2.75 inch FFAR should be assessed as a poor decision either in planning or in execution. If in fact the victimizing Apache was engaging a moving armored car, a more appropriate choice would have been a Hellfire missile or even the 30mm chain gun. That the Apaches were late probably played no contributing role in the fratricide incident since U.S. troops did not breach the outer wall of La Comandancia until the Apaches had finished their attack.⁴⁰ Of note, two of the three air to ground fratricide incidents took place at La Comandancia.

This should have been a low risk mission. The engagement range and fields of fire for employment of the 2.75 inch FFARs given the proximity of friendly forces was evaluated as marginally effective thus placing the mission as executed into the caution range.

In another example of the confusion of battle, a squad of the 75th Ranger Regiment moved forward of the designated front line trace and into a line of supporting fires. At H-Hour, a Ranger Task Force composed of soldiers

from the Regimental Headquarters, 2d Battalion, and 3d Battalion (-), 75th Ranger Regiment, made an airborne assault on the Rio Hato airfield and military reservation, the garrison area for the 6th and 7th PDF Rifle companies as well as an NCO Academy. Rangers engaged PDF forces as they systematically cleared the airfield and surrounding buildings. The fight continued into the early morning hours. As first light approached, a platoon of Rangers clearing buildings in sector were fired upon by PDF soldiers. The Platoon Leader, through his fire support officer, called for close air support from the helicopter gunships overhead. Two helicopters made a gun run on the PDF position, and at the same time a squad leader taking advantage of the suppressive fire, aggressively moved his squad forward into a tree line closer to the objective. Unbeknownst to the squad leader, the fire support officer then authorized a second gun run. The squad was now in front of the rest of the platoon and was unaware of the approaching second gun run because the fire support net was on a different frequency than the squad radios. On the second gun run, the helicopter aircrews picked up the squads movement in the tree line, and not seeing any glint tape due to the approaching daylight, opened fire. Two Rangers were killed and four wounded.⁴

A combination of breakdowns occurred in command and control, situational awareness, and target identification.

During the initial stages of this mission the Rangers were virtually fighting in 360 degrees. Forces were intermingled immediately after the paradrop due to darkness and the PDFs rapid response to the assault. The fighting was intense and violent, but the Rangers quickly gained control and were systematically clearing the northern area of the Rio Hato compound when the incident occurred. At this point of the operation the Rangers were using their front line trace in effect as a phase line in an effort to employ procedural control measures for the employment of suppressive fires from their supporting air assets. The well intended aggressiveness of one squad leader led to the breakdown in command and control resulting in that squad's movement forward of the current established front line trace. The result of this early and undetected movement led to the breakdown of what had been throughout the most difficult hours of the operation almost perfect situational awareness by both the supporting elements and the ground force commanders and leaders. Detecting movement forward of where friendlies were expected (and possibly briefed) to be, combined with the inability to detect the glint tape through the aircraft night viewing systems, caused the aircrew to misidentify the troop movement as enemy and engage.

This was a high risk mission. Despite the assessed experience, competence, and high level of soldier and leader preparedness, this mission took place at night with high

densities of intermingled forces initially involving several independent fire fights. Friendly recognition and markings initially relied on glint tape for air to ground recognition, and "rag top" kevlar helmets and a running password to distinguish friendly from enemy ground forces.⁴³ The terrain around the Rio Hato compound consisted of numerous ravines, ditches, and man made features to include guard towers, buildings, and bunkers, which provided the withdrawing PDF forces with virtually unlimited, and in many cases mutually supporting defensive positions. Additionally, heavy fire power was available to the defending PDF forces in the form of ZPU-4 anti aircraft guns, rocket propelled grenades, and mortars. These factors combined to make this mission very high risk in terms of potential fratricide. With the exception of the fratricide incident, given the tenacity of the PDF defense, this mission was among the most successful during Operation Just Cause. In seizing Rio Hato, the Rangers killed 34, wounded an undetermined number, and captured an additional 362 PDF soldiers. The Rangers lost four dead, eighteen wounded, and suffered an additional twenty-six injured during the jump.⁴⁴

Although the ROE in effect during the invasion of Panama emphasized restraint, there were two incidents involving civilian casualties due to helicopter fires. In one incident in the vicinity of Tocumen International Airport a U.S. helicopter opened fire on a fleeing car

containing three local employees of Eastern Airlines, all three were killed.⁴⁴ In another unfortunate incident a Panamanian woman and child were killed in a high-rise apartment building in Colon. An AH-1 Cobra helicopter gunship, hit by what was thought to be 7.62mm sniper fire from the high-rise, fired back, blowing a large hole in the side of the building killing the woman and child.⁴⁵

All things considered, Operation Just Cause was a military success. Many of the problems encountered in Grenada with Joint Operations had been resolved, the U.S. casualty rates were about one third of that predicted in terms of KIA,⁴⁶ the military's new hardware performed as advertised, and the all volunteer forces performed with distinction.

Southwest Asia

The invasion of Panama officially ended on 31 January 1990, and the last of the U.S. invasion force returned to the United States in February of that year.⁴⁷ Six months later, on 2 August 1990, Iraq invaded and subsequently occupied Kuwait. On 6 August Saudi Arabia requested U.S. assistance, and on 7 August Operation Desert Shield officially began.⁴⁸ Over the next six months U.S. and Coalition Forces would continue to build combat power in preparation and anticipation of war with Iraq. The U.S. attack helicopters deployed to Southwest Asia would differ very little from those employed in Panama just fourteen

months earlier. The only significant upgrade for the AH-64A Apache helicopter would be the new AN/APR-39A(V)1 Radar Warning Receiver (Voice Warning) which had been installed on the Apaches a few weeks before the aircraft were deployed to the Persian Gulf.⁴⁰ The new system used an electronic voice, instead of tone, to warn crew members of enemy radar and gun tracking of their aircraft. However, it was only after the Apaches were deployed on combat missions that it was learned that the AN/APR-39A(V)1 misinterpreted signals from U.S. Army Ground Surveillance Radars (GSR) as enemy signals.⁴¹ Some of the USMC Cobras deployed to the Persian Gulf were upgraded AH-1W model Cobras which were configured to carry a wide variety of ordnance such as Sidearm (air to air) missiles, Hellfire, TOW, and the Advanced Rocket System. Unlike the Army's Apache, the AH-1W Cobra required another aircraft, usually a modified UH-1 Huey, to laser designate the target for a Hellfire engagement.⁴²

On 17 January, 1991 Operation Desert Storm began with what has been termed the air campaign. 24 February would mark the beginning of the ground phase of Operation Desert Storm. This phase, despite its place in history as one of the largest armor battles ever fought, would last a mere 100 hours.⁴³ Surprisingly, the three incidents of attack helicopter fratricide that occurred during the Persian Gulf War all took place prior to the initiation of the ground offensive.⁴⁴

The first incident of attack helicopter fratricide took place on 30 January during the battle for Khafji. Two USMC Cobra gunships coming to Saudi aid mistook a Saudi M113 APC for Iraqi armor and knocked it out, wounding seven Saudi soldiers."

Although short on detail, the USMC attack helicopter fratricide incident described by COL Hackworth was confirmed by a Saudi Officer attending the U.S. Army Command and General Staff College, Class of 1994. Although wishing to remain unnamed, the Saudi Officer claimed to have been in Ras al-Khafji on 30 January (but not at the site of the fratricide incident). He recalled that three such incidents occurred during the battle for Khafji. He thought one from "Army" helicopters, and possibly two from fixed wing aircraft. He also thought that more than one vehicle was hit and that they were not M113s but Saudi command and control vehicles which he described as "like V-300s." He also said that he was convinced that "the Americans did not recognize these [Saudi vehicles] and thought they were Iraqi." The Saudi Officer further thought that a U.S. ground controller assigned to work with the Saudi units in Khafji may have directed the air attacks against the Saudi vehicles but he was not certain."

Given both COL Hackworth's and the Saudi Officer's account of this incident, it was determined that target misidentification occurred, possibly on the part of the

forward air controller, but certainly on the part of the air crews. Two additional factors served to complicate this mission: intermingled forces and a lack of habitual relationship between the supporting and supported units.

The second attack helicopter incident, by definition a friendly fire incident, took place on 15 February. That morning a task force element from the 1st Battalion, 41st Infantry Regiment (TF 1-41) began breaching the berm marking the Iraqi Saudi border. The battalion sized force then moved north across the border into Iraq and established an initial "front" to allow the 1-4 Cavalry (1-4 CAV), which was to the west of TF 1-41, to move forward. While waiting for the 1-4 CAV to move through the berm, TF 1-41 reported several sightings of enemy vehicles but did not engage. That afternoon, Apaches from 1-1 Aviation (1-1 AVN) received reports of enemy sightings, and two aircraft were sent forward for reconnaissance.

While on this mission, one of the Apache gunners visually misidentified a Bradley Fighting Vehicle (BFV) as an enemy vehicle and fired a Hellfire missile at it. The aircraft was on a northeast compass heading, in daylight, with clear visibility. The BFV was not struck apparently because the gunner had observed the target through the Target Acquisition and Designation System (TADS) but had mistakenly selected an alternate tracking choice, the Integrated Helmet and Display Sight System, that used a

sighting mechanism in the helmet for the laser-guided missile to follow. As a result, the missile followed an inaccurate line of sight.⁵⁷ In simple terms a switchology error caused the gunner to lose control of the missile. A fortunate error in this case, especially for the BFV crew. An informal investigation confirmed that the incident had resulted from the copilot/gunner's error in misidentifying the BFV.⁵⁸

This mission was assessed as moderate risk requiring caution. The enemy situation was unclear, and TF 1-41 and 1-1 AVN had yet to build the cohesion normally established through habitual relationship. TF 1-41 was not an organic unit of the 1st Infantry Division and therefore did not routinely train with 1-1 AVN. Although the incident occurred during daylight under conditions of clear visibility, navigation in the desert was, at best, moderately difficult. The range of the engagement was not provided, however given the vehicle and aircraft orientation, and the other prevailing conditions, combat identification should have been under near optimal conditions.

The third and final attack helicopter fratricide incident occurred shortly after midnight on 17 February, 1991; following suspected enemy sightings by ground troops, three Apaches from 1-1 AVN were launched on a reconnaissance mission to locate and destroy the suspected enemy targets.

At approximately 1:00 a.m. on 17 February, an Apache copilot/gunner (the 1-1 AVN Commander) fired Hellfire missiles that destroyed two friendly vehicles, killing two U.S. soldiers and wounding six others. The Apache copilot/gunner fired, believing that the vehicles were enemy, because he had mistakenly read and reported the vehicle's position as that of an earlier enemy sighting."

The subsequent AR 15-6 and General Accounting Office (GAO) investigations of this incident were thorough, and represent the most detailed account of any attack helicopter fratricide incident to date. Possibly, no other single fratricide incident has undergone such scrutiny, and if so certainly not in open source material.

Task Force Iron[®] crossed the berm marking the Saudi Arabia and Iraqi border on 15 February on a counter-reconnaissance mission, and pushed north into Iraq. The Task Force's forward line of advance was halted at Phase Line (PL) Minnesota (the 25 east-west grid line), about five kilometers north of the berm, because of concern that forward elements would be cut off from reinforcements in the event of an Iraqi attack. To cover the expansive terrain, approximately 50 kilometers wide, the task force deployed BFVs and M1A1 Tanks along PL Minnesota, forming a screen line facing north. Vehicles from 1-4 CAV were deployed approximately 20 kilometers along the screen line to the west, while vehicles from TF 1-41 were deployed

approximately 30 kilometers along the screen line to the east, twice the normal frontage assigned to a force this size.⁶

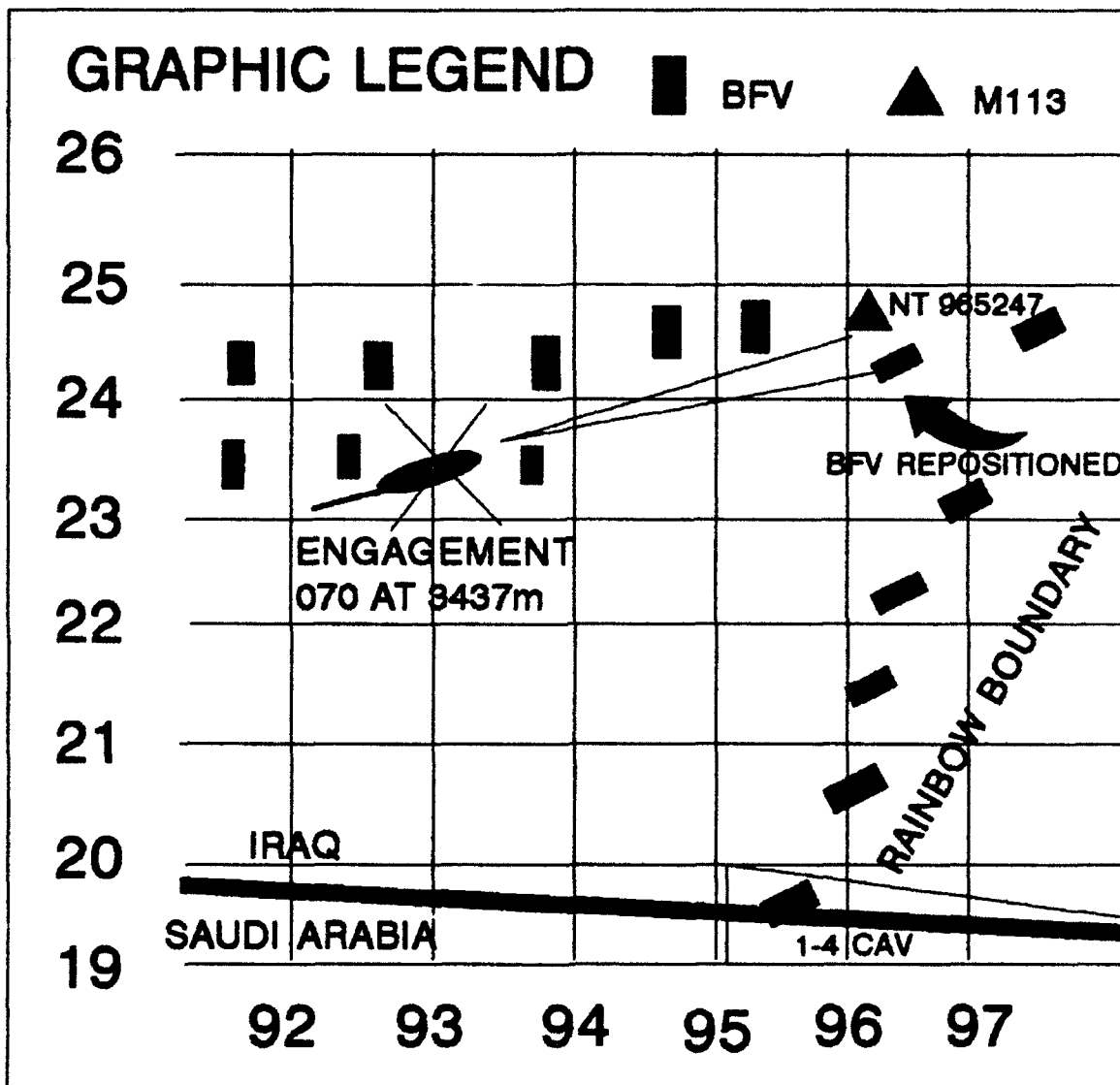


Figure 4. Task Force 1-41 Screen Line, Rainbow Boundary, and Apache Helicopter engagement.

The TF 1-41 Commander protected the right flank by taking advantage of the terrain, creating a "rainbow boundary" that formed an arc of scout vehicles from north to

south. The scout platoon leader, who commanded the scout vehicles along the task force's right flank, estimated that more than 2 kilometers were between his vehicle in the northeast corner of the boundary and the eastern most company vehicles, C Company of TF 1-41, along PL Minnesota at the 25 east-west grid line. The scout platoon leader further estimated that his first platoon vehicle was located 1 kilometer north of the berm and that each of the five remaining scout vehicles was positioned along the right flank facing northeast. The vehicles were positioned about 700 meters north and 200 meters east of each other, forming the rainbow boundary that linked TF 1-41's right flank with the left flank of the 1st Cavalry Division (1st CAV).^a Note that the southern most BFV in Figure 4 is in the 1-4 CAV.

The TF 1-41 Commander acknowledged that he, his Operations Officer, and the Brigade Operations Officer had concluded that the vehicles in the northeast corner of the task force boundary were at risk of being fired upon by the 1st CAV positioned below the berm. As a result, they had discussed their concerns with the C Company Commander, whose troops were at the greatest risk. In addition, TF 1-41 ground forces rehearsed the counter-reconnaissance mission at least five times while at Tactical Assembly Area (TAA) Roosevelt. The Apache pilots were not included in the mission rehearsals because TF 1-41, which was part of the 3d Brigade based in Germany, had no Apaches attached to it, and

the Apaches from 1-1 AVN, based in Kansas, were not expected to be part of the counter-reconnaissance mission. However, about a week before the mission the Commanders of 1-1 AVN and TF 1-41 had met to discuss possible utilization of Apaches. In an attempt to prevent possible incidents of fratricide the commanders agreed that the 1-1 AVN Apaches would fly around TAA Roosevelt so that the pilots could view the tanks and BFVs through their sights, while the ground gunners viewed the aircraft through their sights. Although the TF 1-41 Commander was especially concerned about potential fratricide along the rainbow boundary, he did not discuss his concerns with the 1-1 AVN Commander at their meeting. However, the 1-1 AVN Commander was given a copy of TF 1-41 map graphics at that time, which showed the rainbow boundary.⁶

On 16 February when gunners began detecting targets at a range of about 3 kilometers, the TF 1-41 Commander and TF Iron Commander began discussing what appeared to be clusters of Iraqi vehicles working their way from west to east, which was consistent with what the U.S. forces expected. The TF 1-41 Commander became convinced that these sightings were something more than camels or 50-gallon barrels, which had earlier caused similar false target "sightings". The TF 1-41 Commander refrained from engaging the enemy vehicles with artillery because of reports of lost 1st CAV vehicles forward of the 25 east-west grid line.

Later that evening, the 1st CAV reported that all their vehicles were now accounted for and were behind the berm. It was at this point that C Company reported spotting three vehicles to the north of the screen line. The C Company Commander requested permission to engage and subsequently fired at the targets with a TOW missile. No secondary explosions were reported, and it was not clear if the targets were hit, or that they existed. TF 1-41 lost sight of the targets, and requested assistance from the Apaches in relocating them."

Prior to receiving the launch order, the 1-1 AVN Operations Officer telephoned the 1-1 AVN Commander advising him that suspected enemy vehicles had been located in front of the TF 1-41 screen line and that the Apaches would probably be ordered to fly in support of the ground troops. The 1-1 AVN Commander was concerned about launching the aircraft because of the severe weather conditions, which included winds in excess of 30 knots and blowing sand; the lack of moon illumination; and the close proximity to friendly forces. Also he questioned the use of the Apaches, since the M1A1 tanks on the screen line could engage enemy vehicles at the reported ranges." The 1-1 AVN Commander requested that his concerns be relayed to the 4th (Aviation) Brigade Commander. The Brigade Commander responded to his concerns by telling the 1-1 AVN Operations Officer to get the Apaches airborne and advising him that they would deal

with the problem "up there." Further, the Brigade Commander told the 1-1 AVN Commander that the mission had to be attempted and to "launch the aircraft."

When the launch order was received, the 1-1 AVN Commander informed his pilots that the Apaches had been ordered to fly a reconnaissance mission. He indicated that he was sending Blue Team, which consisted of two of his more experienced crews, but he intended to lead the mission because of the bad flying conditions that night and his concern over the two previous friendly fire incidents. The 1-1 AVN Commander and his pilot had difficulty locating their aircraft because of the blowing sand and lack of moon illumination. The conditions were such that one of the three Apaches almost crashed on takeoff because of the high winds."

Shortly after midnight at approximately 12:10 a.m. on 17 February, three Apache helicopters took off from their assembly area and began their flight to the designated target area. The lead aircraft was flown by the 1-1 AVN Commander, a Lieutenant Colonel, acting as copilot/gunner, and a Chief Warrant Officer 3, as pilot, under the radio call sign "Gunfighter 6." The second aircraft, the Blue Team leader, was flown by a Captain, Company Commander, as copilot/gunner, and a Warrant Officer 1, as pilot, under the radio call sign "Blue 6." The third aircraft was flown by a

Chief Warrant Officer 2, as copilot/gunner, and a Warrant Officer 1, as pilot, under the call sign "Blue 5."*

Apache crew members generally received detailed premission briefings regarding their assignments, which included a thorough discussion of such topics as intelligence summaries, weather, battle plan, and status of radios. That was not the case on the February 16-17 mission since it was launched in direct response to reports of enemy vehicles in the area and time did not allow a detailed mission briefing. Before takeoff, the pilots had been provided the primary target grids reported by the ground units. Each gunner manually entered the data into his respective Fire Control Computer using a Data Entry Keyboard. Enroute the pilots were advised that two enemy vehicles were apparently moving from west to east in the vicinity of grid coordinate NT915270 and that one of the vehicles was thought to have been hit by a TOW missile. This information was also entered into the Fire Control Computers.*

As the aircraft approached the area, they observed friendly vehicles facing north, deployed along an east-west line, which they identified as the screen line. No targets were observed at the first reported target coordinate so the aircraft began moving east toward the 91 north-south grid line. The crews were scanning with their FLIR thermal optical equipment in an attempt to locate the reported enemy

vehicles at the NT915270 grid. At this point the aircrews activated their aircraft gun tape recorders (video and audio). This recorded what was seen through the TADS and what was heard over all radios to include the aircraft intercom. Repeated warnings of possible enemy presence were indicated by the AN/APR-39A(V)1 Radar Warning Receiver.⁷⁰

Blue 6, flying northeast on a 050 degree compass heading, spotted six vehicles that Gunfighter 6 advised were "friendly Bradleys oriented north." Turning to a 068 degree compass heading, Blue 6 continued to search the area, and spotted two targets "about 6,000 meters off my nose," which he estimated to be on the 29 east-west grid. Iron Duce 6 (TF Iron Commander), who had overheard the Apache crews communications, then advised Stalwart 5 (TF 1-41 Executive Officer), "Looks like they are getting ready to engage. It looks like around 9229 grid square." Apparently, none of those listening to the radio traffic realized Blue 6's miscalculation, namely, that if the Apaches were positioned on the 9123 grid lines at a 068 degree compass heading, targets 6,000 meters directly in front of them would be at approximately the 25 east-west grid, not the 29 east-west grid.⁷¹ Gunfighter 6 apparently spotted the vehicles; and using the Target Acquisition and Designation System (TADS), he lased and stored the coordinates of the targets. The TADS identified the target location by measuring their distance from the aircraft with a laser beam. This

information was then stored in the Fire Control Computer, which computed the target locations by comparing their distance and heading with the Apache's location. The computer stored up to 9 grid coordinates (numbered 0-8) that the gunner could recall and view on a 3.5 inch screen. The screen displayed three positions at a time, but the data could be scrolled to view any of the grids stored in the computer.⁷

The Gunfighter 6 gun tape indicates that Gunfighter 6 recalled the first three grid coordinates in the system. He observed the following readout:

```
0 38R NT 95592445 A+10608
1 39R NT 91502700 A+1024
2 38R NT 91302910 A+1101
```

He thought he was reading the grid coordinates for the vehicles he was seeing 6,000 meters away on the 070 heading, which were stored in position 0. Instead, he read the search coordinates given to him at the beginning of the mission, which he had manually input and stored in position 1. The display screen does not distinguish between search coordinates that are input manually and those of actual targets that are lased and stored automatically.⁸

Gunfighter 6 advised Iron Duce 6, that he had located "two big APC sort of vehicles, grid NT915270" that did not appear to be part of the screen line. (The 1-1 AVN Commander later confirmed that the physical proximity of the vehicles had become his primary focus, while the grid

coordinates had become secondary.) Not realizing that Gunfighter 6 had misread the target coordinates, Iron Duce 6 confirmed that the coordinates were "exactly where we shot the last vehicle. Looks like we killed one of them. Those are enemy. Go ahead and take them out."

Gunfighter 6 then checked the system and again misread the coordinates, saying "915270. Looks like one vehicle is pulled up to another one there. They may be transloading people." This information was consistent with the scenario presented by the ground commanders in which one of the two vehicles had been struck by a TOW missile. Again Iron Duce 6 authorized the Apaches to "take them out." Gunfighter 6 then requested Blue 6 to verify the target's position. Blue 6 then asked Blue 5 if he could verify the target, commenting, "My target NAV's [navigation system] not working right. When I NAV and store it, I get it greater than 9524 vicinity. It doesn't-it's not coming out right." Gunfighter 6 commented, "Yeah, and it's over behind the right of this Bradley right here. They may have shot themselves."

In the meantime, Blue 5 lased and stored the target and advised Blue 6 that the targets appeared to be on the 25 east-west grid line. Although Blue 5's transmission is recorded on the Gunfighter 6 gun tape, the 1-1 AVN Commander had not heard Blue 5's communication on the night of the incident. At this point, Gunfighter 6, which was

approximately 4,750 meters from the target, moved ahead of the other two aircraft, and stopped 3,437 meters from the targets. Gunfighter 6 then radioed Iron Duce 6 saying, "You have a Bradley at 946245 and he's oriented north on the screen line. He's got an APC near him also. Then, off to his right [emphasis added] are these two vehicles that I see, and those are the vehicles at 915270 (again misreading the coordinates displayed on the screen). Your Bradley is not even looking anywhere near them. Over." Iron Duce 6 replied, "Roger. I ain't worried about that. Can you still engage those two vehicles at the 270 grid line?" Clearly, the ground commanders did not realize that the aircrews were viewing targets to the east, not to the north, of the vehicles on the screen line, despite the contradictory information provided by Gunfighter 6."

Stalwart 6 (TF 1-41 Commander) then came on the net and added that the targets were "consistent with the type that was fired earlier." He told Gunfighter 6 to "go ahead and shoot those." Gunfighter 6 commented that his aircraft was "at the 233 [grid] and we're heading 070 [degrees]. Okay. Firing gun." His 30mm jammed, and Gunfighter 6's pilot suggested that he "Go missiles."

Gunfighter 6 rechecked the coordinates but again mistakenly read the search coordinates that he had input enroute to the area instead of the coordinates of the target he was viewing. The gun tapes reveal that Gunfighter 6

requested backup confirmation, reviewing in detail his position, heading, distance to the target, and target location. This was all verified by Blue 6 (who had believed his navigation systems to be inoperable). Blue 5 had previously correctly identified the targeted vehicles along the 25 grid line but believed Gunfighter 6 had better information as to enemy locations and did not challenge the pending engagement. The Blue 5 pilot discussed the confusion with the Blue 5 gunner over the aircraft intercom stating "Keep an eye on them. For some reason, I get the idea that these are supposed to be bad guys-something-'cause of the way he said. "I think they're shooting at each other." Gunfighter 6 launched two Hellfire missiles and destroyed both target vehicles. Blue 6, and Blue 5 engaged personnel moving in the vicinity of the targets with 30mm fire. Almost immediately Stalwart 6 reported that "friendly vehicles may have been hit" in the NT965247 vicinity "from the rear"; and a cease-fire was ordered. the time was approximately 12:56 a.m. on 17 February."

During the night of 17 February, B Company (B/1-41) reported intermittent sightings of possible enemy vehicles at 3-plus kilometers; but Apache support was not requested. On 18 February, TF Iron was ordered to withdraw. By noon, the task force had withdrawn through the berm and had relocated at TAA Manhattan."

In its analysis of this fratricide incident, the GAO investigation cited human error as the primary cause. Specifically, the 1-1 AVN Commander's misidentification of the target vehicles' exact location.¹¹ It further identifies a number of contributing factors: the deployment of the task force's expansive screen line; an unusual boundary on the right flank; the decision not to include the Apaches in the counter-reconnaissance mission rehearsals; and difficulties encountered by the ground troops in tracking and identifying numerous reported enemy sightings.¹²

Additionally, the GAO report notes that although the Apaches' radar warning receivers were known to misidentify signals from U.S. ground radars as enemy signals and may have contributed to the confusion on the night of the incident, this was not a cause of the incident.¹³ However, the transcript from the Apache gun tapes indicate 12 audio warnings that the aircraft were being tracked or locked on to by threat guns, radar, and in one instance fixed wing aircraft all within the approximately twenty minute period immediately proceeding the fratricide engagement.¹⁴ Further, all friendly radar that might confuse the aircraft radar warning receivers were reported to have been turned off due to the Apaches approach. This fact, coupled with the pilots' statements indicating various degrees of concern over the voice warnings, should reasonably lead one to

classify the radar warning activity in the cockpits as a contributing factor.

The factors of fatigue and environmental conditions also contributed to this incident. Battalion and Brigade logs indicate that the 1-1 AVN Commander was active throughout the day on 16 February, and although on a night crew rotation, probably had less than three hours rest by his own account.¹⁵ The winds, blowing sand, and zero percent illumination were such that the OH-58C Scout aircraft normally employed with the Apaches were not flown. The gun tape transcripts indicate three separate incidents, prior to the fratricide engagement, where a pilot on the aircraft controls mentions having difficulty in flying due to the winds.¹⁶

The AR 15-6 investigation cites a breakdown in proper application of SOPs and pre-fire check procedures as the proximate cause of engaging friendly forces.¹⁷ The investigation further notes that Apache missions in close proximity to friendly troops are difficult when there is a clear enemy presence. When the situation is such that the AH-64 is looking for one or two elusive vehicles the mission is extremely dangerous with concomitant risk of fratricide.¹⁸

Finally, the aspect of target identification as a contributing factor in this incident is not thoroughly addressed in either investigation. Both discuss procedural controls, however visual target identification, either

through aided or unaided means, is virtually always a factor in direct fire engagements. Pilot statements indicate that it is virtually impossible to distinguish target characteristics through the TADS at ranges greater than 1,500 meters under normal conditions. This is substantiated by the Office of Technology Assessment report.⁹ The engagement range during this incident was approximately 3,437 meters, under poor conditions. Further, targets are rarely classified by appearance alone, but also by location behavior, and recent experience.¹⁰ When the Apache crews detected the target vehicles, the vehicles appeared to be forward of the friendly screen line; one appeared to have been disabled (the GSR equipment positioned around the M113 was thought to be debris from the reported TOW engagement); and the 1-1 AVN Commander believed that what he saw fit the target description. Therefore, target identification, or the inability to identify the target was a significant contributing factor.

This was a very high risk mission. Many of the high risk factors were voiced by the 1-1 AVN Commander prior to the aircraft launch. Given the weather, illumination, lack of adequate briefings and rehearsals, use of night vision systems, and the unclear situation, a basic point A to point B mission would be assessed as a safety risk, to be undertaken only in instances involving life or limb. Added to basic flight safety considerations, these crews were

faced with the additional fears and uncertainties described as the fog of war. That is not to suggest that this mission should not have launched; certainly those commanders present assessed the risks of execution against the risks of inaction. It merely suggests that the chain of command asked a lot of these crews.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Each conflict had its own unique conditions and characteristics. Vietnam was characterized by short violent clashes with a well led, highly motivated, militarily competent, and elusive enemy; fought primarily at the times and locations of his choosing. Thus the enemy usually held an immediate local advantage in engagements occurring in jungle or mountainous terrain. Panama's terrain was similar to that of Vietnam, however the majority of the fighting took place in an urban environment against an enemy significantly less well led, skilled, or motivated.

Vietnam, Grenada, and Panama were characterized by primarily dismounted operations. By contrast, the Persian Gulf War was characterized by mounted operations in a stark desert environment against a well equipped, combat seasoned, and potentially lethal enemy.

The similarities in the occurrence of attack helicopter fratricides are nevertheless undeniable. In each instance, the attack helicopters were responding to an actual or perceived immediate enemy threat. Due to the immediacy of the mission the aircrews' knowledge of the situation was generally incomplete. A fluid condition of

converging or intermingled forces was the rule, and with few exceptions, the aircrews independently identified and engaged the suspect targets.

Lack of situational awareness and target misidentification appear as the primary causative factors in the incidence of attack helicopter fratricide. A profusion of contributing factors can be cited as distractors which in and of themselves did not directly cause the incident, however, the cumulative effect of these factors significantly influenced the outcome. That is to suggest that a reduction in the contributing factors, although not the direct cause of the incident, may potentially reduce the probability of occurrence by providing a greater opportunity to focus on what is actually critical to successful engagement.

These conclusions are not strikingly different from those offered by LTC Shrader in 1982. However, LTC Shrader categorized these factors primarily as incidents of human error noting that:

While advanced technological devices may certainly be of significant value in reducing [fratricide] by better location and identification of friendly troops and equipment and by improved communication and coordination, they cannot provide a total solution to what is essentially a problem of human frailty.¹

LTC Shrader also prophetically noted in 1982 that:

There is every reason to suspect that the advance of military technology has increased rather than reduced the problem of [fratricide]. As the use of technologically sophisticated weapons systems has

increased, the limits of human ability to control such destructive forces have been approached. With respect to the problem of [fratricide] it may be suggested that the optimum point of matching the capabilities of men and machines may have been passed and the gap between the capabilities of machines and the human ability to control them adequately is increasing. The implications of this gap for [fratricide] in future war are clear: [fratricide] may be a greater problem on the future battlefield than ever before, both in terms of frequency and the number of casualties produced thereby.¹

Following LTC Shrader's lead, most who address potential cures have focused primarily on training, followed by improvements in navigation and communications equipment. IFF for air to ground or ground to ground has been considered nice to have but cost prohibitive, despite the general acknowledgment that technology to identify friend or foe has not kept pace with changes in modern warfighting and weaponry.¹

In contrast to those arguments, the navigation and communications equipment available to our soldiers in Southwest Asia, although improvable, was very adequate. The level of soldier individual and collective training was the best in this nation's history, yet fratricide still occurred. That then should indicate that something else, beyond training, navigation equipment, and communications, is needed if the occurrence of fratricide is to be reduced on the future battlefield.

An analysis of the problems inherent in the incidence of fratricide continue to point to loss of

situational awareness, and ultimately to misidentification of the target. The desired net effect of good communications, accurate navigation, and real time combat intelligence is to aid in the maintenance of situational awareness. But, the truth of the matter is that there will never be perfect situational awareness in combat. First and foremost, the enemy is doing everything within his control to ensure that we don't maintain situational awareness, just as we attempt to disrupt his. But more importantly it should be recognized that there will always be a degree of breakdown in situational awareness due to the nature of combat operations. There will never be perfect communications. Either through equipment failures, a breakdown in message traffic, or in the form of a misunderstood message passed or received, somewhere on the battlefield there will be a lapse in communications. Navigation will never be perfect. Either by virtue of equipment failures or simple misorientation, some friendly element will appear on the battlefield where they are not expected. That is part of the fog of war. Further, once contact is made, a combatant's focus will naturally transition from orientation on terrain to an orientation on the enemy. That is why target identification is, in the final analysis, the most critical aspect in fratricide avoidance for direct fire weapons systems.

CALL Newsletter No. 92-4 notes:

Vehicle commanders, gunners and attack pilots cannot distinguish friendly and enemy thermal and optical signatures near the maximum range of their weapons systems. However, our tactics lead us to exploit our range advantage over the enemy. During limited visibility or in restricted terrain, units in proximity can mistake each other for the enemy due to short engagement windows and decision time. We do not have a means to determine friend or foe, other than visual recognition of our forces and the enemy's.⁴

Training can and has made a difference in avoiding fratricide; however, training has its limits. CALL Newsletter 92-4 provides the following vignette:

Upon a report of two enemy vehicles, a task force commander gave a fire command to initiate a 2,700 meter engagement. His gunner, SSG Michael Duda, exclaimed over the intercom, "Sir, there is something wrong here!" His commander immediately transmitted a cease fire. Fortunately no one engaged the vehicles. SSG Duda had recognized the "hot" roadwheel thermal signature characteristic of the BFV. Quick investigation confirmed this was a misoriented Scout section from the adjacent battalion, out of zone and almost 4,000 meters forward of reported positions. SSG Duda terminated an almost certainly lethal engagement as a result of his excellent experience and training.⁵

This incident is remarkable for two reasons. First it attests to the value of good training. Second, SSG Duda was able to identify vehicles through thermal sights, avoid a potential fratricide incident, at almost twice the range most crews acknowledge as the thermal sight systems identifiable limit, that of 1,500 meters. Given that, it is imperative to continue to stress training in our efforts at long range target identification. However, it must be noted that given the present thermal sight systems installed in

the AH-64 Apache, no amount of training will enable a gunner to positively identify a target at the extended ranges of the Hellfire missile system; 6,000 plus meters.

If it is acknowledged that perfect situational awareness is not possible and that positive target identification is critical, yet also impossible at extended ranges; then the solution to fratricide avoidance from attack helicopter fires must lie in improved thermal sight capabilities or an Identification Friend or Foe (IFF) system.

IFF would probably provide the greatest impact in fratricide reduction because the application of such a system on ground vehicles could potentially reduce fratricide from both air to ground, as well as ground to ground systems.

The aspect of "better training", though necessary as demonstrated in the SSG Duda vignette, is only part of the overall solution to fratricide avoidance. As noted, the U.S. Army during the Persian Gulf War was probably at its zenith in terms of training and readiness, but it is virtually impossible to adequately train for the uncertainties known as the fog of war. The fear, anxiety, confusion, and friction associated with the fog of war cannot be realistically replicated in a training environment.

If the level of effective leadership and training alone were enough to prevent fratricide, then the 17 February, 1991 incident during the Persian Gulf War would have never happened. In reviewing that incident it should be noted that it involved both a battalion commander and company commander in the cockpits. It involved two brigade commanders and a battalion commander monitoring the situation and providing specific guidance from TOC locations. All were experienced, highly trained personnel. While it can be said that those in the TOC were relying on incorrect information provided by the aircrews, some key information was overlooked. Two transmissions, had they been assessed properly, could have led those in the TOCs to identify the inconsistencies and terminate the engagement. Those in the TOCs were focused on the grid information and missed the opportunity to correct the situation. The aircrews were focused on the target description and missed the target location error. The fog of war neutralized the significant state of training of all these officers. Even the Blue 5 crew who had the correct grid information was swept up by the confusion generated that night. All were, to a degree, victims of groupthink. Once the confusion took hold, training, navigation and communications were not going to prevent this incident from happening. At that point only an IFF system could have cut through the fog, and prevented this incident. Orange panels and inverted Vs were not

effective in World War II and they were not effective in Southwest Asia.

As noted by Rick Atkinson, author of Crusade:

The U.S. government had spent \$3 trillion rebuilding the American military in the 1980s. Yet the search for a simple safeguard to avoid unleashing that new-bought firepower on our own soldiers came down to a desperate week of testing in the Arizona desert when the gulf war was nearly over. DARPA scientists, poring over their sixty proposals, cobbled together a battery-powered beacon that could be seen through night vision goggles five miles away. A few DARPA lights arrived in theater on 26 February, by which time the friendly fire toll had tripled. It was too little and it was too late.'

Referring back to a 1968 Rand Study evaluating ground to ground fratricide at the National Training Center (NTC) it was concluded that one-sixth of the [fratricide] cases involved the killing of a friendly vehicle while close to opposing force elements. In this class, only an Identification Friend or Foe (IFF) device could provide the information necessary to positively avoid fratricide.'

Presently the Army has three programs addressing the fratricide problem. The "Quick Fix" program is charged to get something in the troops hands immediately. This consists of DARPA Lights, Budd Lights, thermal tape, and a Thermal Identification Device. A "Near-Term" program focuses on a five year outlook, and the "Mid and Far Term" solutions are intended to provide a more permanent solution in seven or more years.'

As COL Hackworth notes:

From the point of view of the safety of the men and women who are actually going to experience combat, the military's greatest shortcoming is its lack of institutional memory. It hasn't developed protections against fratricide, because no one stays in one place long enough to remember.¹⁰ The key question that should haunt us all is this: Will the sense of urgency that is now going on fall through the cracks? It's the duty of those who will never forget the loss of a Soldier or Marine killed by their own fire to ensure that it doesn't.¹¹

Looking back on the Persian Gulf War, consider the potential impact of just the DARPA lights had they been available sooner. Now consider the impact of an IFF system not only in terms of air to ground fratricide but also in terms of ground to ground fratricide. Potentially all, but certainly more than half of the air and ground fratricide incidents would have been prevented.

Given the virtual all weather, day/night long range fire capabilities of army aviation, is fratricide on the future battlefield necessarily inevitable? If an IFF system is implemented, the answer is no; fratricide on the future battlefield from attack helicopter fires will not be inevitable. Attack helicopter pilots will be able to operate their aircraft and combat systems to the fullest of its capabilities without the fear of inflicting casualties among their own forces. If IFF is not implemented, then our efforts toward fratricide reduction in other areas will be of little significant value. IFF is not going to solve the problem of fratricide independently; but in conjunction with

our current leadership, training and equipment initiatives, the addition of IFF will make the elimination of fratricide a real possibility as opposed to a unobtainable goal. IFF is not a new idea, nor is it beyond fiscal or technological reality. In terms of cost benefit ratio, IFF is the only alternative to fratricide on the future battlefield.

Postscript

As this thesis was drawing to a close, the U.S. Army suffered an additional catastrophic fratricide incident over the United Nations imposed northern no-fly zone in Iraq. Although only preliminary investigations have been completed as of this writing, it appears that the critical error in this incident was target misidentification.

The facts to date indicate that two U.S. F-15 fighters mistakenly shot down two U.S. Army Blackhawk helicopters over Iraq's northern no-fly zone, killing 26. All on board the two helicopters were killed including 15 Americans, 5 Kurds, 3 Turks, 2 Britons, and 1 Frenchman.¹² According to a preliminary account, an Airborne Warning and Control System (AWACS) aircraft detected the helicopters and asked the F-15Cs to take a closer look. The F-15Cs flew by and informed the AWACS that the aircraft were Iraqi MI-24 Hind helicopters. The AWACS asked the F-15Cs to check again, and they again flew by the helicopters, apparently reconfirming their initial report. The AWACS then cleared the F-15Cs to fire. The F-15Cs fired two missiles; a

Sidewinder heat-seeking missile and an AMRAAM radar-guided missile, bringing both helicopters down. The incident took place in broad daylight, under good weather conditions." Additionally, it was reported that a mission rehearsal had been conducted and that the identification devices on the Blackhawks could not be read by the fighters that attacked them." It has not been reported whether the Blackhawks were "squawking" mode 2, a military encrypted identification friend or foe (IFF) code; mode 3/A, a civil/military (non-encrypted) transponder code; or not "squawking" at all.

When asked to comment on the recent Blackhawk incident in Iraq, and on air to air fratricide in general, LTC (Ret) Shrader offered the following:

Air to air incidents appear to have been relatively rare since World War II. I believe, however that there were several such incidents in Korea and perhaps a few in Vietnam. I suspect that the introduction of IFF on aircraft, and their use for a considerable period of time now, has been a factor in limiting such incidents. I understand that in the recent incident in Iraq the Blackhawks were interrogated but did not return a "friendly" signal. I have two general comments on the Iraq incident: 1. modern weapons are becoming increasingly difficult to control (speed of aircraft; complexity of AWACS; etc.) and 2. the most persistent cause of friendly fire incidents is human error....This incident also reminds me of the numerous incidents I encountered in my study in which a major contributing factor to [fratricide] incidents was faulty coordination. The F-15 pilots should have known that the Blackhawks were flying in that area; so should the AWACS. Overall, I think this incident is *suigeneris*; a lot of things went wrong all at the same time."

Although helicopters were the victimized as opposed to the victimizer in this incident of U.S. fratricide; this

incident nevertheless serves as a powerful reminder that the search for a solution to fratricide can not wait. The price for inaction is too high.

ENDNOTES

Chapter 1

¹U.S. Congress, Office of Technology Assessment, Who Goes There: Friend or Foe?, (Washington, DC: U.S. Government Printing Office, 1993), 26.

²Ibid., 17. U.S. casualty totals of 35 KIA and 72 WIA due to fratricide are all accounted for by U.S. attacks as described in Table 2-3.

³U.S. Army, FM 100-5. Operations, (Washington, DC: Department of the Army, 1993), 2-11.

⁴U.S. Army, TC 1-210. Aircrew Training Program Commander's Guide to Individual and Crew Training, (Washington, DC: Department of the Army, 1992), 3-19.

Chapter 2

¹U.S. Congress, Office of Technology Assessment, Who Goes There: Friend or Foe?, (Washington, DC: U.S. Government Printing Office, 1993), iii, 29, 31.

²John Lancaster and Barton Gellman, "Breakthrough to Avert 'Friendly Fire' in War is Years Away, Army Says," The Washington Post, 13 December 1991, p. A-10.

³U.S. Army, Fratricide Risk Assessment for Company Leadership: Handbook No. 92-3, (Fort Leavenworth, Kans.: Center for Army Lessons Learned, 1992), Foreword.

⁴Charles R. Shrader, "Friendly Fire: The Inevitable Price," Parameters, Autumn 1992, 41, 43.

⁵David H. Hackworth, "'Friendly Fire' Casualties," Marine Corps Gazette, March 1992, 46.

⁶U.S. General Accounting Office, Operation Desert Storm: Apache Helicopter Fratricide Incident, (Washington, DC: U.S. Government Printing Office, 1993).

⁷William G. Carter, Department of the Army, 1st Infantry Division, Memorandum For Commanding General, 1st Infantry Division, Subject: Investigation of the Death of Two Soldiers That Occurred at NT 965247 on 17 February 1991. (Southwest Asia: Assistant Division Commander, 19 February 1991).

⁸Department of the Army, Apache Tape, (Washington, DC: Office of the Chief of Staff for Public Affairs, Video Tape, 17 February 1991), segments aired on CBS: 60 Minutes, "Friendly Fire in the Gulf", November 1991.

Chapter 3

¹U.S. Congress, Office of Technology Assessment, Who Goes There: Friend or Foe?, (Washington, DC: U.S. Government Printing Office, 1993), 26.

²Ibid., 1, 2.

³For definition of terms "situational awareness" and "fixation," see Term Definitions on pages 27, 29.

⁴U.S. Congress, Who Goes There: Friend or Foe?, 32, 33.

⁵U.S. Grant Sharp, Strategy For Defeat: Vietnam in Retrospect, (San Rafael, Calif.: Presidio Press, 1979), 94-104.

⁶U.S. Congress, Who Goes There: Friend or Foe?, 35.

⁷James L. Hillman, Task Force 1-41 Infantry: Fratricide Experience in Southwest Asia, (Carlisle Barracks, Pa.: U.S. Army War College, 1993), Abstract.

⁸Steve Vogel, "Apaches saw radar as Iraqi air defense gun," Army Times, 19 August 1991, p. 11.

⁹U.S. Congress, Who Goes There: Friend or Foe?, 26.

¹⁰Ibid., 27.

¹¹U.S. General Accounting Office, Operation Desert Storm: Apache Helicopter Fratricide Incident, (Washington, DC: U.S. Government Printing Office, 1993), 1.

¹²Irving L. Janis, Groupthink, (Boston: Houghton Mifflin Company, 1982), 7-9.

¹⁵U.S. Congress, Who Goes There: Friend or Foe?, 9.

¹⁶Ralph Gaillard Jr. and Lucy Shackelford, "Gulf War's Friendly Fire Tally Triples," The Washington Post, 14 August 1991, p. A27.

¹⁷David H. Hackworth, "'Friendly Fire' Casualties," Marine Corps Gazette, March 1992, 47.

¹⁸U.S. GAO, Apache Fratricide Incident, 12-14.

¹⁹Ibid., 15-19.

²⁰U.S. Congress, Who Goes There: Friend or Foe?, 27.

²¹Ibid.

Chapter 4

¹Charles R. Shrader, Amicicide: The Problem of Friendly Fire in Modern War, Research Survey no. 1/Combat Studies Institute, U.S. Army Command and General Staff College (Washington DC: U.S. Government Printing Office, 1982), Tables 1, 3, 4, 5, pp. 27, 63, 74, 104.

²Ibid., p. x.

³Ibid.

⁴Ibid., Tables 1, 3, 4, 5, pp. 27, 63, 74, 104.

⁵Ibid., pp. vii-xii.

⁶David M. Sa'adah, Friendly Fire: Will We Get It Right This Time?, White Paper, U.S. Army Concepts Analysis Agency (Washington, DC: Department of the Army, 1992), 7.

⁷Ibid.

⁸Ibid., 8, 9.

⁹Ibid., 10.

¹⁰Ibid., 9.

¹¹George C. Herring, America's Longest War: The United States and Vietnam, 1950-1975, 2d ed., (New York: Newbery Award Records, Inc., 1986), 243.

¹²U.S. Congress, Office of Technology Assessment, Who Goes There: Friend or Foe?, (Washington, DC: U.S. Government Printing Office, 1993), 2.

¹³Mark Adkin, Urgent Fury: The Battle for Grenada, Lexington Books Issues in Low-Intensity Conflict series (Lexington, Mass.: Lexington Books, 1989), 309.

¹⁴Ibid., 286.

¹⁵Michael P. C. Carns, Joint Staff Memorandum For The Secretary of Defense (International Security Affairs) Subject: Operation Just Cause Casualties, (Washington, DC: Director Joint Staff, 27 June 1990), 1-2.

¹⁶Statistics used for Panama fratricide incidents were compiled by thesis author from multiple open source documents. Although fratricide casualty data from Operation Just Cause has been widely reported, no official single source document has been published detailing the incidents which led to those casualties.

¹⁷U.S. Congress, Who Goes There: Friend or Foe?, 27.

¹⁸Adjusted statistics reflect additional incidents of fratricide and friendly fire discovered during research which are not included in Assistant Secretary of Defense (Public Affairs) source documents. Adjusted statistics also reflect this study's reclassification of one ground to ground incident as an artillery incident, and the subsequent disqualification of one ground to ground incident due to its failure to meet this study's defined criteria for either a fratricide or friendly fire incident.

¹⁹James Blackwell, Thunder in the Desert: The Strategy and Tactics of the Persian Gulf War, (New York: Bantam Books, 1991), 103.

²⁰Ibid., 106, 107.

²¹U.S. Congress, Who Goes There: Friend or Foe?, 26.

²²Ibid., 2.

²³Ibid.

²⁴Ibid.

²⁵Ibid.

²⁶Combat Training Center Exportable View-graph Take Home Packet provided to thesis author by CPT Thomas Jucks, action officer, Center for Army Lessons Learned, Fort Leavenworth, Kansas.

²⁷U.S. Congress, Who Goes There: Friend or Foe?, 9.

²⁸Ibid., 12.

²⁹Ibid., 17.

³⁰David H. Hackworth, "'Friendly Fire' Casualties," Marine Corps Gazette, March 1992, 47.

³¹George W. Gawrych, "Attack Helicopter Operations: Attack Helicopters in Lebanon, 1982," in Combined Arms in Battle Since 1939, ed. Roger J. Spiller (Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1992), 40.

³²U.S. Congress, Who Goes There: Friend or Foe?, 13, 14.

³³Charles R. Shrader, "Friendly Fire: The Inevitable Price," Parameters, Autumn 1992, 35.

³⁴Thomas Donnelly, Margaret Roth, and Caleb Baker, Operation Just Cause: The Storming of Panama, (New York: Lexington Books, 1991), 151, 152.

³⁵Daniel W. Christman, Department of the Army Memorandum For Vice Director, Joint Staff, Subject: Operation Just Cause Casualties, (Washington, DC: Army Deputy Operations, 25 June 1990), 1-2.

³⁶David H. Hackworth, "Killed by Their Comrades," Newsweek, 18 November 1991, 45, 46.

³⁷U.S. Army, Fratricide: Reducing Self-Inflicted Losses: Newsletter No. 92-4, (Fort Leavenworth, Kans.: Center for Army Lessons Learned, 1992), 12.

³⁸U.S. Congress, Who Goes There: Friend or Foe?, 1-2.

³⁹U.S. Army, Fratricide Newsletter No. 92-4, 9.

Chapter 5

¹U.S. Army, "The U.S. Army in Vietnam," in American Military History, Army Historical Series (Washington, DC: Center of Military History, United States Army, 1989), 630.

²Arthur T. Frame, "Airmobile Operations: The 1st Cavalry Division's Exploitation of Helicopters in the Ia Drang Valley," in Combined Arms in Battle Since 1939, ed. Roger J. Spiller (Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1992), 11.

³Ibid.

⁴Hans Halberstadt, Army Aviation, The Presidio Power Series, Landpower no. 3006 (Navato, Calif.: Presidio Press, 1990), 43, 44, 45.

⁵U.S. Army, "The U.S. Army in Vietnam," 631.

⁶Frame, "Airmobile Operations," 12.

⁷U.S. Military Assistance Command, Vietnam, Counterinsurgency Lessons Learned No. 62: Salient Lessons Learned, (MACJ343, 11 March 1967), 20, 21.

⁸Steven J. Zaloga and George J. Balin, Anti-Tank Helicopters, (London: Osprey Publishing, 1986), 4.

⁹Ibid.

¹⁰Ibid., 5.

¹¹Ibid., 10.

¹²Ibid., 3.

¹³Ibid., 10.

¹⁴Ibid., 11.

¹⁵Charles R. Shrader, Amicicide: The Problem of Friendly Fire in Modern War, Research Survey no. 1/Combat Studies Institute, U.S. Army Command and General Staff College (Washington, DC: U.S. Government Printing Office, 1982), 58.

¹⁶Ibid., 59.

¹⁷Ibid.

¹⁸Ibid., 58, 59.

¹⁹Ibid., 55.

²⁰Ibid., 60.

²¹Ibid., 59, 60.

²²Ibid., 62.

²³Zaloga, Anti-Tank Helicopters, 12, 13.

²⁴Ibid., 13-17.

²⁵Ibid., 17.

²⁶Ibid., 18.

²⁷Ibid.

²⁸Mark Adkin, Urgent Fury: The Battle for Grenada, Lexington Books Issues in Low-Intensity Conflict series (Lexington, Mass.: Lexington Books, 1989), 201, 202.

²⁹Ibid., 202.

³⁰Benjamin F. Schemmer, "JCS Reply to Congressional Reform Caucus' Critique of the Grenada Rescue Operation," Armed Forces Journal International, July 1984, 12-14, 18, 99.

³¹Zaloga, Anti-Tank Helicopters, 5.

³²Ibid., 20.

³³Ibid., 21.

³⁴Halberstad, Army Aviation, 67, 68.

³⁵Ibid., 68.

³⁶Robert R. Ropelewski, "Planning, Precision, and Surprise Led to Panama Successes," Armed Forces Journal International, February 1990, 30.

³⁷Ibid., 28-30.

³⁸Ibid., 27.

³⁹Thomas Donnelly, Margaret Roth, and Caleb Baker, Operation Just Cause: The Storming of Panama, (New York: Lexington Books, 1991), 156, 157.

⁴⁰Ibid., 157.

⁴¹Sanitized account of fratricide incident provided by U.S. Special Operations Command, Historian Office, Macdill AFB, FL, through CSI, Fort Leavenworth, KS to thesis author.

⁴²Donnelly, Operation Just Cause, 343.

⁴³Ibid., 349.

⁴⁴Hal Mayforth, "Panama: How Many Civilians Died?," Newsweek, 15 January 1990, 8.

⁴⁵Donnelly, Operation Just Cause, 292.

⁴⁶Lorenzo Crowell, "The Anatomy of Just Cause: The Forces Involved, the Adequacy of Intelligence, and Its Success as a Joint Operation," in Operation Just Cause: The U.S. Intervention in Panama, ed. Bruce W. Watson and Peter G. Tsouras (Boulder: Westview Press, 1991), 82.

⁴⁷Donnelly, Operation Just Cause, 381-383.

⁴⁸Robert H. Scales, Certain Victory: The U.S. Army in the Gulf War, (Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1994), 391.

⁴⁹U.S. General Accounting Office, Operation Desert Storm: Apache Helicopter Fratricide Incident, (Washington, DC: U.S. Government Printing Office, 1993), 56.

⁵⁰Ibid.

⁵¹F. Michael O'Brien, "Aviation: An Interview With LtGen Duane A. Wills," Marine Corps Gazette, December 1992, 34-37.

⁵²Association of the United States Army, The U.S. Army in Operation Desert Storm, (Arlington: The AUSA Institute of Land Warfare, n.d.), 12.

⁵³Ibid.

*USMC Cobra engagement of Saudi APC took place on 30 January; near miss of BFV by AH-64 took place on 15 February; and 1-1 AVN Commander engagement of two TF 1-41 vehicles took place on 17 February.

"David H. Hackworth, "Killed by Their Comrades," Newsweek, 18 November 1991, 45, and "'Friendly Fire' Casualties," Marine Corps Gazette, March 1992, 47.

*Interview conducted by thesis author with Saudi Officer at U.S. Army Command and General Staff College on 21 March, 1994.

*U.S. GAO, Apache Fratricide Incident, 17.

*Ibid., 19.

*Ibid., 30.

*Task Force Iron consisted of the 3d Brigade (Headquarters), the 1-4 CAV, a task force element from the 1st Battalion, 41st Infantry Regiment (TF 1-41), supporting artillery, and other elements formed under the command of the 3d Brigade Commander.

*U.S. GAO, Apache Fratricide Incident, 20.

*Ibid., 26.

*Ibid., 27-28.

*Ibid., 28-29.

*Ibid., 34.

*Ibid.

*Ibid.

*Ibid., 35.

*Ibid.

*Ibid., 35-36.

*Ibid., 36.

*Ibid., 37.

⁷⁶The first number (0) indicates the location of the grid coordinate in the Fire Control Computer. The second set of numbers (38R NT) identifies the geographical area. The next set of numbers (95592445) is the grid coordinate, which identifies the area where the north-south (9559) and east-west grid lines (2445) intersect. The "A+" followed by a set of numbers, indicates the altitude above mean sea level of the grid coordinate.

⁷⁶U.S. GAO, Apache Fratricide Incident, 37.

⁷⁶Ibid., 37-38.

⁷⁶Ibid., 38.

⁷⁷Ibid., 38, 72.

⁷⁷Ibid., 39.

⁷⁷Ibid., 39, 40, 73.

⁸⁰Ibid., 42.

⁸¹Ibid., 2.

⁸²Ibid., 20.

⁸³Ibid., 3.

⁸⁴Ibid., 65-75.

⁸⁵Ibid., 50, 51.

⁸⁶Ibid., 67, 70, 73.

⁸⁷William G. Carter, Department of the Army, 1st Infantry Division, Memorandum For Commanding General, 1st Infantry Division, Subject: Investigation of the Death of Two Soldiers That Occurred at NT 965247 on 17 February 1991, (Southwest Asia: Assistant Division Commander, 19 February 1991) 2.

⁸⁸Ibid., 3.

⁸⁹U.S. Congress, Who Goes There: Friend or Foe?, 76.

⁹⁰Ibid., 35.

Chapter 6

¹Charles R. Shrader, Amicicide: The Problem of Friendly Fire in Modern War, Research Survey no.1/Combat Studies Institute, U.S. Army Command and General Staff College (Washington, DC: U.S. Government Printing Office, 1982), 109.

²Ibid.

³David H. Hackworth, "'Friendly Fire' Casualties," Marine Corps Gazette, March 1992, 47.

⁴U.S. Army, Fratricide: Reducing Self-Inflicted Losses: Newsletter 92-4, (Fort Leavenworth, Kans.: Center for Army Lessons Learned, 1992), 10.

⁵Ibid., 1, 2.

⁶U.S. General Accounting Office, Operation Desert Storm: Apache Helicopter Fratricide Incident, (Washington, DC: U.S. Government Printing Office, 1993), 70, 72.

⁷Rick Atkinson, Crusade: The Untold Story of the Persian Gulf War, (Boston: Houghton Mifflin Company, 1993), 316-317.

⁸U.S. Congress, Office of Technology Assessment, Who Goes There: Friend or Foe?, (Washington, DC: U.S. Government Printing Office, 1993), 24-25.

⁹Ibid., 78.

¹⁰David H. Hackworth, "Killed by Their Comrades," Newsweek, 18 November 1991, 46.

¹¹Hackworth, "'Friendly Fire' Casualties", 48.

¹²The New York Times, "U.S. jets kill 15 Americans: 26 die over no-fly zone after erroneous attack," The Kansas City Star, 15 April 1994, p A-1.

¹³Ibid.

¹⁴Knight-Ridder Newspapers, "High-tech weapons focus debate on 'friendly fire'," The Kansas City Star, 15 April 1994, p A-17.

¹⁵Charles R. Shrader, interview by author, Telephonic and Fax, Fort Leavenworth, Kansas, 22-25 April 1994.

BIBLIOGRAPHY

Books

- Adkin, Mark. Urgent Fury: The Battle for Grenada, Lexington, Mass.: Lexington Books, 1989.
- Atkinson, Rick. Crusade: The Untold Story of the Persian Gulf War, Boston: Houghton Mifflin Company, 1993.
- Blackwell, James. Thunder in the Desert: The Strategy and Tactics of the Persian Gulf war, New York: Bantam Books, 1991.
- Donnelly, Thomas, Margaret Roth, and Caleb Baker. Operation Just Cause: The Storming of Panama, New York: Lexington Books, 1991.
- Flanagan, Edward M. Jr. Battle for Panama: Inside Operation Just Cause, Washington, DC: Brassey's (US), Inc., 1993.
- Gabriel, Richard A. Military Incompetence: Why the American Military Doesn't Win, New York: Hill and Wang, 1985.
- Halberstadt, Hans. Army Aviation, Navato, Calif.: Presidio Press, 1990.
- Herring, George C. America's Longest War: The United States and Vietnam, 1950-1975, New York: Alfred A Knopf, 1979.
- Janis, Irving L. Victims of Groupthink: A Psychological Study of Foreign-Policy Decisions and Fiascos, Boston: Houghton Mifflin Company, 1976.
- Karnow, Stanley. Vietnam: A History, New York: Viking Press, 1983.
- Keaney, Thomas A., and Eliot A. Cohen. Gulf War Air Power Survey Summary Report, Washington DC: U.S. Government Printing Office, 1993.
- Krepinevich, Andrew F. Jr. The Army and Vietnam, Baltimore: The Johns Hopkins University Press, 1986.

McConnell, Malcolm. Just Cause: The Real Story of America's High-Tech Invasion of Panama, New York: St. Martin's Press, 1991.

Scales, Robert H. Certain Victory: The U.S. Army in the Gulf War, Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1994.

Sharp, U.S. Grant. Strategy For Defeat: Vietnam in Retrospect, San Rafael, Calif.: Presidio Press, 1978.

Shrader, Charles R. Amicicide: The Problem of Friendly Fire in Modern War, Research Survey no. 1/Combat Studies Institute, U.S. Army Command and General Staff College, Washington, DC: U.S. Government Printing Office, 1982.

Spiller, Roger J., ed. Combined Arms in Battle Since 1939, Fort Leavenworth, Kans.: U.S. Army Command and General Staff College Press, 1992.

Summers, Harry G. On Strategy: The Vietnam War In Context, Washington, DC: U.S. Government Printing Office, 1986.

Watson, Bruce W., and Peter G. Tsouras, ed. Operation Just Cause: The U.S. Intervention in Panama, Boulder: Westview Press, 1991.

Zaloga, Steven J., and George J. Balin. Anti-Tank Helicopters, London: Osprey Publishing, 1986.

Periodicals and Articles

Bird, Julie, and Tom Donnelly. "Friendly Fire: Report to Reveal More U.S. Casualties." Army Times, 19 August 1991, 3.

Bird, Julie. "Friendly Fire: Deadly Mistakes in U.S. Air Attacks Studied for Solutions." Air Force Times, 26 August 1991, 12.

Bird, Julie. "AF, Army Developing Combat ID Systems." Air Force Times, 23 December 1991, 4.

Branigin, William. "U.S. Agent Rescued From Panama Cell Minutes Before Anti-Noriega Offensive." The Washington Post, 1 January 1990, A12.

Collins, Joseph J. "Desert Storm and the Lessons of Learning." Parameters, Autumn 1992, 83-95.

- Collins, Steven N. "Just Cause Up Close: A Light Infantryman's View of LIC." Parameters, Summer 1992, 55-65.
- Fialka, John J. "In Battle for Grenada, Commando Missions Didn't Go as Planned." The Wall Street Journal, 15 November 1983, A1.
- Gaillard, Ralph Jr., and Lucy Shackelford. "Gulf War's Friendly Fire Tally Triples." The Washington Post, 14 August 1991, A27.
- Garver, John W. "The Chinese Threat in the Vietnam War." Parameters, Spring 1992, 73-85.
- Gellman, Barton. "Gulf War's Friendly Fire Tally Triples." The Washington Post, 14 August 1991, A1.
- Gellman, Barton. "3 Rebuked In 'Friendly Fire' Death." The Washington Post, 4 June 1992, A1.
- Hackworth, David H. "'Friendly Fire' Casualties." Marine Corps Gazette, March 1992, 46-48.
- Hackworth, David H. "Lessons of a Lucky War." Newsweek, 11 March 1991, 49.
- Hackworth, David H. "Killed by Their Comrades." Newsweek, 18 November 1991, 45-48.
- Hammer, Joshua, and Douglas Waller. "Risking 'Friendly Fire'." Newsweek, 4 March 1991, 33.
- Harmeyer, George H., and John F. Antal. "Fire Discipline and Fratricide." Army, 1992, 26-28.
- Jehl, Douglas, and Tracy Wilkinson. "Looking for Lessons: U.S. Evaluates Tactics, Weapons of Gulf War." Los Angeles Times, 24 March 1991, A1.
- Johnson, Robert, and Caleb Solomon. "Gulf War Casualty: 'Friendly Fire' Downs The Soaring Career Of a Gung-Ho Colonel." The Wall Street Journal, 10 September 1991, A1.
- Johnson, Robert, and Caleb Solomon. "Chilling Tapes Show How Soldiers Died In 'Friendly Fire'." The Wall Street Journal, 7 November 1991, A1.
- Jones, Robert A. "Friendly Fire: Where Is The Weak Link?" Marine Corps Gazette, June 1992, 63.

Lancaster, John, and Barton Gellman. "Breakthrough to Avert 'Friendly Fire' in War is Years Away, Army Says." The Washington Post, 13 December 1991, A10.

Mayforth, Hal. "Panama: How Many Civilians Died?" Newsweek, 15 January 1990, 8.

O'Brien, F. Michael. "An Interview With LtGen Duane A. Wills." Marine Corps Gazette, December 1992, 34-37.

Pollard, Roger L. "The Battle for OP-4: Start of the Ground War." Marine Corps Gazette, March 1992, 48-51.

Powell, Stewart M. "Friendly Fire." Air Force Magazine, December 1991, 58-63.

Ropelewski, Robert R. "Planning, Precision, and Surprise Led to Panama Successes." Armed Forces Journal International, February 1990, 26-32.

Schemmer, Benjamin F. "JCS Reply to Congressional Reform Caucus' Critique of the Grenada Rescue Operation." Armed Forces Journal International, July 1984, 12.

Schmitt, Eric. "Army Says U.S. Fire Killed 2 G.I.'s in Panama Invasion." The New York Times International, 19 June 1990, A3.

Shrader, Charles R. "Friendly Fire: The Inevitable Price." Parameters, Autumn 1992, 29-44.

Special Report: Grenada and Lebanon. "American's At War." Newsweek, 7 November 1983.

Special Report: Rescue In Grenada, Sacrifice In Beirut. "Worth The Price? Tough Moves, Hard Questions." Time, 7 November 1983.

Steele, Dennis. "Keeping Friendly Fire Friendly." Army, March 1992, 30-34.

Steele, Dennis. "New Technology Targets Friendly Fire Deaths." Army, April 1993, 37-40.

Ursey, Floyd J. Jr. "Stop Killing Each Other!" Marine Corps Gazette, September 1992, 39-41.

Van Voorst, Bruce. "They Didn't Have to Die." Time, 26 August 1991, 20.

Vogel, Steve. "Apaches saw radar as Iraqi air defense gun." Army Times, 19 August 1991, 11.

Washabaugh, Bradford G. "Friendly Fire: Time For Action."
Marine Corps Gazette, September 1992, 37-39.

Government Documents

Carns, Michael P. C. Joint Staff Memorandum For The
Secretary of Defense (International Security Affairs)
Subject: Operation Just Cause Casualties, Washington,
DC: Director Joint Staff, 27 June 1990.

Carter, William G. Department of the Army, 1st Infantry
Division, Memorandum For Commanding General, 1st
Infantry Division, Subject: Investigation of the
Death of Two Soldiers That Occurred at NT 965247 on
17 February 1991, Southwest Asia: Assistant Division
Commander, 19 February 1991.

Christman, Daniel W. Department of the Army Memorandum For
Vice Director, Joint Staff, Subject: Operation Just
Cause Casualties, Washington, DC: Army Deputy
Operations, 25 June 1990.

Department of Defense, Final Report to Congress. Conduct of
the Persian Gulf War, Washington, DC: U.S. Government
Printing Office, April 1992.

Department of Defense, Office of Assistant Secretary of
Defense (Public Affairs). No. 504-91: Military Probes
Friendly Fire Incidents, Washington, DC: Department of
Defense, 13 August 1991.

U.S. Army. Fratricide Risk Assessment for Company
Leadership: Handbook No. 92-3, Fort Leavenworth, Kans.:
Center for Army Lessons Learned, 1992.

U.S. Army. Fratricide: Reducing Self-Inflicted Losses:
Newsletter No. 92-4, Fort Leavenworth, Kans.: Center
for Army Lessons Learned, 1992.

U.S. Congress, Office of Technology Assessment. Who Goes
There: Friend or Foe?, Washington, DC: U.S. Government
Printing Office, 1993.

U.S. General Accounting Office. Operation Desert Storm:
War Offers Important Insights Into Army and Marine
Corps Training Needs, Washington, DC: U.S. Government
Printing Office, 1992.

U.S. General Accounting Office. Operation Desert Storm:
Apache Helicopter Fratricide Incident, Washington, DC:
U.S. Government Printing Office, 1993.

U.S. Military Assistance Command, Vietnam. Counterinsurgency Lessons Learned No. 61: Salient Lessons Learned, MACJ343, 27 January 1967.

U.S. Military Assistance Command, Vietnam. Counterinsurgency Lessons Learned No. 62: Salient Lessons Learned, MACJ343, 11 March 1967.

U.S. Military Assistance Command, Vietnam. Lessons Learned No. 70: Friendly Casualties From Friendly Fires, MACJ343, 17 October 1968.

Unpublished Materials

Association of The United States Army. The U.S. Army in Operation Desert Storm, Arlington: The AUSA Institute of Land Warfare, n.d.

Galloway, Archie, Army Initiatives Group. Fratricide File, Washington, DC: Office of the Deputy Chief of Staff for Operations and Plans, February 1991.

Garrett, William B., III. Fratricide: Doctrine's Role in Reducing Friendly Fire, Fort Leavenworth, Kans.: School of Advanced Military Studies, U.S. Army Command and General Staff College, 1992.

Hillman, James L. Task Force 1-41 Infantry: Fratricide Experience in Southwest Asia, Carlisle Barracks, Pa.: U.S. Army War College, 1993.

I D Systems Inc. An Introduction To The Through Sight Identification System, San Antonio: White Paper, I D Systems Inc., 1992.

O'Connor, Michael P. Fratricide: A Preventable Technological Disease, Carlisle Barracks, Pa.: U.S. Army War College, 1992.

Sa'adah, David M. Friendly Fire: Will We Get It Right This Time?, Washington, DC: White Paper, U.S. Army Concepts Analysis Agency, 1992.

Schmidt, Michael C. Friendly Fire and Combat Identification in Groundwars, Aberdeen Proving Ground, Md.: U.S. Army Materiel Systems Analysis Activity, 1992.

INITIAL DISTRIBUTION LIST

1. Combined Arms Research Library
U.S. Army Command and General Staff College
Fort Leavenworth, KS 66027-6900
2. Commander
ATTN: CSSC Research Analysis and Statistics Division
U.S. Army Safety Center
Fort Rucker, AL 36360-5033
3. Commander
ATTN: ATTG-C Training Development and Analysis Director
H.Q. Training and Doctrine Command
Fort Monroe, VA 23651-6000
4. Defense Technical Information Center
Cameron Station
Alexandria, VA 22314
5. LTC Dennis L. Barba
DSRO
USACGSC
Fort Leavenworth, KS 66027-6900
6. MAJ Calvin Crow
CSI
USACGSC
Fort Leavenworth, KS 66027
7. LTC (Ret) Ralph E. Hayles Jr.
100 N.E. Loop 410, Suite 1380
San Antonio, TX 78216
8. COL James L. Hillman
U.S. Army Concepts Analysis Agency
8120 Woodmont Ave
Bethesda, MD 20814-2797
9. MAJ George E. Hodge
CTAC
USACGSC
Fort Leavenworth, KS 66027-6900

10. DR. John Partin
Special Operations Historian Office
United States Special Operations Command
Macdill Air Force Base, Florida 33621
11. DR. Charles R. Shrader
910 Forbes Road
Carlisle, PA 17013
12. DR. Roger J. Spiller
George C. Marshall Professor of Military History
U.S. Army Command and General Staff College
Fort Leavenworth, KS 66027-6900

CERTIFICATION FOR MMAS DISTRIBUTION STATEMENT

1. Certification Date: 15 / 04 / 94
2. Thesis Author: MAJ James A. TOWE
3. Thesis Title: Eliminating Fratricide From Attack Helicopter Fires: An Army Aviator's Perspective

4. Thesis Committee Members
Signatures:

Dennis L. Barba DENNIS L. BARBA
George E. Hedge GEORGE E. HEDGE
Ken [unclear] Ken [unclear]

5. Distribution Statement: See distribution statements A-X on reverse, then circle appropriate distribution statement letter code below:

(A) B C D E F X SEE EXPLANATION OF CODES ON REVERSE

If your thesis does not fit into any of the above categories or is classified, you must coordinate with the classified section at CARL.

6. Justification: Justification is required for any distribution other than described in Distribution Statement A. All or part of a thesis may justify distribution limitation. See limitation justification statements 1-10 on reverse, then list, below, the statement(s) that applies (apply) to your thesis and corresponding chapters/sections and pages. Follow sample format shown below:

S	-----SAMPLE-----			SAMPLE	-----SAMPLE-----	S
A	<u>Limitation Justification Statement</u>	/	<u>Chapter/Section</u>	/	<u>Page(s)</u>	A
M						M
P	<u>Direct Military Support (10)</u>	/	<u>Chapter 3</u>	/	<u>12</u>	P
L	<u>Critical Technology (3)</u>	/	<u>Sect 4</u>	/	<u>31</u>	L
E	<u>Administrative Operational Use (7)</u>	/	<u>Chapter 2</u>	/	<u>13-32</u>	E
	-----SAMPLE-----			SAMPLE	-----SAMPLE-----	

Fill in limitation justification for your thesis below:

<u>Limitation Justification Statement</u>	<u>Chapter/Section</u>	<u>Page(s)</u>
/	/	/
/	/	/
/	/	/
/	/	/

7. MMAS Thesis Author's Signature: [Signature]

STATEMENT A: Approved for public release; distribution is unlimited. (Documents with this statement may be made available or sold to the general public and foreign nationals).

STATEMENT B: Distribution authorized to U.S. Government agencies only (insert reason and date ON REVERSE OF THIS FORM). Currently used reasons for imposing this statement include the following:

1. Foreign Government Information. Protection of foreign information.
2. Proprietary Information. Protection of proprietary information not owned by the U.S. Government.
3. Critical Technology. Protection and control of critical technology including technical data with potential military application.
4. Test and Evaluation. Protection of test and evaluation of commercial production or military hardware.
5. Contractor Performance Evaluation. Protection of information involving contractor performance evaluation.
6. Premature Dissemination. Protection of information involving systems or hardware from premature dissemination.
7. Administrative/Operational Use. Protection of information restricted to official use or for administrative or operational purposes.
8. Software Documentation. Protection of software documentation - release only in accordance with the provisions of DoD Instruction 7930.2.
9. Specific Authority. Protection of information required by a specific authority.
10. Direct Military Support. To protect export-controlled technical data of such military significance that release for purposes other than direct support of DoD-approved activities may jeopardize a U.S. military advantage.

STATEMENT C: Distribution authorized to U.S. Government agencies and their contractors: (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT D: Distribution authorized to DoD and U.S. DoD contractors only; (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT E: Distribution authorized to DoD only; (REASON AND DATE). Currently most used reasons are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

STATEMENT F: Further dissemination only as directed by (controlling DoD office and date), or higher DoD authority. Used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R.

STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals of enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25; (date). Controlling DoD office is (insert).