# THE CHALLENGES IN TRAINING OF THE MECHANIZED INFANTRY UNITS OF THE REPUBLIC OF KOREA ARMY IN TRANSITIONING FROM THE ARMORED PERSONNEL CARRIER (K200) TO INFANTRY FIGHTING VEHICLE (K21)

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
General Studies

by

CHANGHO LEE, MAJOR, THE REPUBLIC OF KOREA ARMY
B.S., Korea Military Academy, Seoul, Korea, 1998
M.A., Korea National Defense University, Seoul, Korea, 2004

Fort Leavenworth, Kansas
2012-02

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| **1. REPORT DATE** *(DD-MM-YYYY)* | **2. REPORT TYPE** | **3. DATES COVERED** *(From - To)* |
|---|---|---|
| 14-12-2012 | Master's Thesis | FEB 2012 – DEC 2012 |

**4. TITLE AND SUBTITLE**
The Challenges in Training of the Mechanized Infantry Units of the Republic of Korea Army in Transitioning from the Armored Personnel Carrier (K200) to Infantry Fighting Vehicle (K21)

**5a. CONTRACT NUMBER**

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

**6. AUTHOR(S)**

Major Changho Lee

**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

**8. PERFORMING ORG REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

**10. SPONSOR/MONITOR'S ACRONYM(S)**

**11. SPONSOR/MONITOR'S REPORT NUMBER(S)**

**12. DISTRIBUTION / AVAILABILITY STATEMENT**
Approved for Public Release; Distribution is Unlimited

**13. SUPPLEMENTARY NOTES**

## 14. ABSTRACT

This is a case study of fielding and employment of the M2 Bradley Fighting Vehicle to anticipate potential training challenges of the K21 Infantry Fighting Vehicle fielded units, and to find possible solutions for them.

By analyzing the various literatures about the training challenges of the M2 Bradley Fighting Vehicle units, the study found 21 important training challenges which are potential training challenges of the K21 Infantry Fighting Vehicle units. Then, the 21 training challenges were logically grouped into five categories: training doctrine, mounted gunnery training, dismounted infantry training, training support, and leader training.

After that, the study prioritized these five categories of training challenges based on the analysis of the literature review and the interviews with subject matter experts. As a result, it identified three salient training challenges which are directly related to the K21 IFV units: training doctrine, mounted gunnery training, and dismounted infantry training.

Finally, the study analyzed these salient training challenges more in-depth, and suggested possible solutions for them.

**15. SUBJECT TERMS**
Armored Personnel Carrier (APC), K200, Infantry Fighting Vehicle (IFV), K21, Mechnized Infantry, M2 Bradley Fighting Vehicle (BFV), Training, Doctrine

| **16. SECURITY CLASSIFICATION OF:** | | | **17. LIMITATION OF ABSTRACT** | **18. NUMBER OF PAGES** | **19a. NAME OF RESPONSIBLE PERSON** |
|---|---|---|---|---|---|
| **a. REPORT** | **b. ABSTRACT** | **c. THIS PAGE** | | | **19b. PHONE NUMBER** *(include area code)* |
| (U) | (U) | (U) | (U) | 96 | |

**Standard Form 298 (Rev. 8-98)**
**Prescribed by ANSI Std. Z39.18**

MASTER OF MILITARY ART AND SCIENCE
THESIS APPROVAL PAGE

Name of Candidate: Changho Lee, Major, the Republic of Korea Army

Thesis Title: The Challenges in Training of the Mechanized Infantry Units of the Republic of Korea Army in Transitioning from the Armored Personnel Carrier (K200) to Infantry Fighting Vehicle (K21)

Approved by:

_____, Thesis Committee Chair
Nathaniel Stevenson, Jr., MPA

_____, Member
Wayne C. Sodowsky, M.M.A.S.

_____, Member
Timothy R. Hentschel, Ph.D.

Accepted this 14th day of December 2012 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

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

THE CHALLENGES IN TRAINING OF THE MECHANIZED INFANTRY UNITS OF THE REPUBLIC OF KOREA ARMY IN TRANSITIONING FROM THE ARMORED PERSONNEL CARRIER (K200) TO INFANTRY FIGHTING VEHICLE (K21), by Major Changho Lee, the Republic of Korea Army, 96 pages.

This is a case study of fielding and employment of the M2 Bradley Fighting Vehicle to anticipate potential training challenges of the K21 Infantry Fighting Vehicle fielded units, and to find possible solutions for them.

By analyzing the various literatures about the training challenges of the M2 Bradley Fighting Vehicle units, the study found 21 important training challenges which are potential training challenges of the K21 Infantry Fighting Vehicle units. Then, the 21 training challenge were logically grouped into five categories: training doctrine, mounted gunnery training, dismounted infantry training, training support, and leader training.

After that, the study prioritized these five categories of training challenges based on the analysis of the literature review and the interviews with subject matter experts. As a result, it identified three salient training challenges which are directly related to the K21 IFV units: training doctrine, mounted gunnery training, and dismounted infantry training.

Finally, the study analyzed these salient training challenges more in-depth, and suggested possible solutions for them.

# ACKNOWLEDGMENTS

As in any project of this nature I am indebted to many individuals and there is always the danger of omitting someone. First, my thanks to the staffs of the Combined Arms Research Library at Fort Leavenworth. No one is more professional. Their expertise and supportiveness is phenomenal. Second, I will remain ever grateful to the members of my thesis committee. Each one offered excellent counsel and insight for my study. The conversations I had with all three members of my committee, to include topics other than the thesis topics, proved an unexpected gift for my professional development and the happiness of my family at CGSC.

I also give my sincere thanks to several individuals who accepted my interview request. These include, Lieutenant Colonel (Ret.) Richard Averna, Major David W. Mayfield, Major David W. Briten, and Major Sunguk Shin (ROKA). Their comments contributed significantly to the quality of my paper.

I owe of course the greatest debt to my wife Byungsun and my son Joonsung. Their patience, support, and love throughout this year while “Daddy was busy with the time consuming writing” constitutes a sacrifice I do not deserve. Words are insufficient to adequately express what I owe them and what they mean to me.

Especially, I thank the Republic of Korea Army for giving me the opportunity to study at CGSC. To pay back its obligation, I will continue to develop and prepare myself to play an important role in the combined and joint operations sector, especially with the U.S. Army. Finally, I thank you all the Gaintainers of the staff group 5B. I learned from you as much as from the text books, and made this year “the best year of my life.”

TABLE OF CONTENTS

Page

# ACRONYMS

| | |
|---|---|
| APC | Armored Personnel Carrier |
| ARI | Army Research Institute for the Behavioral and Social Science |
| BC | Bradley Commander |
| BETS | Bradley Embedded Training System |
| BFV | Bradley Fighting Vehicle |
| CALL | Center for Army Lessons Learned |
| CAMB | Combined Arms Maneuver Battalion |
| COFT | Conduct of Fire Trainer |
| DOTMLPF | Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, and Facilities and environmental concerns |
| DT | Dismounted infantry Training |
| FIST-B | Full-crew Interactive Simulation Trainer-Bradley |
| FM | Field Manual |
| GT | Mounted Gunnery Training |
| IFV | Infantry Fighting Vehicle |
| LTC | Lieutenant Colonel |
| MG | Machine Gun |
| NCOIC | Non-Commissioned Officer In Charge |
| NET | New Equipment Training |
| ROKA | Republic of Korea Army |
| SME | Subject Matter Expert |
| TD | Training Doctrine |
| TOW | Tube-launched Optically tracked Wire-guided |

TABLES

Page

# CHAPTER 1

# INTRODUCTION

## Research questions and background

On November 30, 2009, the first Infantry Fighting Vehicles of the Republic of Korea Army (ROKA) were fielded to the Lion Battalion under the 20th Mechanized Infantry Division (The Korea Defense Daily 2010a). It was an historic day for the ROKA as it began the transition of a key piece of its infantry equipment, the Armored Personnel Carrier (APC), K200 to the Infantry Fighting Vehicle (IFV), K21. But it was also the beginning of many challenges for the mechanized infantry units in learning to fight with this new equipment and to maximize its capabilities.

On July 29, 2010, one K21 IFV sank while swimming at a river crossing training site because of mechanical problems and lack of proper training. There was one casualty, SSG. Kim (Whang 2010). Because of this accident, the ROKA suspended the fielding of the K21 IFV until May 31, 2011, when all of the mechanical problems discovered during the investigation were completely solved (Donga Daily 2011).

Although most of the K21 IFV mechanical problems have been resolved, there remain several challenges in training and related doctrine of the K21 IFV fielded units. Those challenges mainly stem from substantial functional differences between the old APC, K200 and the new IFV, K21. The K200 APCs were fielded in December, 1984, transitioning from the U.S. M113 APC. Its main function was, like the battle taxi, M113 APC, transporting infantry troops around the battle field (The Korea Defense Daily 2010a). Because the K200 APC has light armaments, 12.7mm Machine Gun (MG) and 7.62mm MG, no turret system, and light armor protection (Doosan DST 2009), there was

not much difference in the basic infantry role of the mechanized infantry units compared to the majority of light infantry units. Also, the ROKA had many experiences operating the M113 APC, which was provided by the U.S. Army in the late 1960s and early 1970s, before the K200 APCs were fielded. Moreover, the K200 APC has very similar function and appearance to the M113. It was a fairly smooth and unchallenging transition from the M113 to the K200 in the 1980s, because the ROKA could directly apply the knowledge and wisdom gained from operating the M113 in training and in combat during the Vietnam War.

On the other hand, the K21 IFV is much more advanced than a simple armored transport vehicle, such as the K200 or M113. It has a two-man turret with 40mm Cannon, 7.62mm coaxial MG and the 3rd generation anti-tank missile system which provides high accuracy and lethality against moving targets. It can suppress and destroy enemy tanks, other armored vehicles, low-velocity and low-altitude aircraft, as well as provide accurate and powerful covering fire to dismounted infantry (Doosan DST 2010). This is a revolutionary advancement of capabilities to the ROKA mechanized infantry units, but it also means a great challenge for them. They must master all of the gunnery training and mounted combat skills, as with other tank units, while still maintaining high level of dismounted infantry training.

These challenges of the K21 IFV units can be found in the U.S. Army's history when it fielded the M2 Bradley Fighting Vehicle (BFV) in 1983; first, the very complicated turret system of the M2 BFV was a crucial challenge for U.S. mechanized infantry units to overcome. This was highlighted in more than 40 research reports of the U.S. Army Research Institute for the Behavioral and Social Science (ARI) in the 1980s.

It is clear that there were so many trials and errors in the gunnery and crew training of the M2 BFV units, even though the M2 BFVs were fielded after thorough mechanical testing and doctrine development; second, there was a significant amount of research highlighting the problem of weakened dismounted infantry training of the M2 BFV units from the late 1980s to the early 1990s. Lieutenant Colonel (LTC) Theodore Severn explained the reality of the weakened dismounted infantry training of M2 BFV units and argued the importance of dismounted infantry training for Air-Land Battle preparation (Severn 1988). Also, Major Edward Gibbons analyzed the reasons for the decline of dismounted infantry in M2 BFV units (Gibbons 1995). In addition, Captain David H. Ling (1993) and Major Brian D. Jones (1995) articulated organizational problems and recommendations for the M2 BFV platoon and battalion. All of these research efforts unequivocally document the challenges of the M2 BFV fielded units of the U.S. Army.

Because the M2 BFV is mechanically very similar to the K21 IFV we can reasonably anticipate that K21 IFV units of the ROKA might go through the same or similar challenges to those the U.S. Army experienced with its transition. Therefore, the primary research question of this thesis is "What are the potential training challenges for the mechanized infantry units of the ROKA as they transition from the Armored Personnel Carrier (K200) to the Infantry Fighting Vehicle (K21)?" Ancillary, to this primary question are two secondary questions. They form logical subsidiary concerns which must be dealt with either as background or as legitimate supplementary analysis. These secondary questions are:

1. What are the salient challenges in training of the K21 IFV fielded units?

2. What are the possible solutions for the salient challenges in training of the K21 IFV fielded units?

## Assumptions

This thesis assumes that the training challenges faced by the U.S. Army in fielding the M2 BFVs will be very similar, if not identical, to those the ROKA will face in transitioning to the K21 IFVs. Given the similarities between the K200 APC and M113 APC, and between the K21 IFV and M2 BFV, and the shared doctrinal background of the U.S. Army and ROKA, this is a very logical and realistic assumption.

## Scope

The overall goal of this paper is to anticipate the potential challenges in training, with the K21 IFV, the ROKA will face in the future. This thesis will mainly analyze the case of the U.S. Army's fielding of the M2 BFV and its upgraded variants: M2A1, M2A2 and M2A3 BFV.

This is the first exploratory research to find the potential future challenges in training of the K21 IFV fielded units of the ROKA through the case study of the U.S. Army's M2 BFV fielding. That is why it is difficult to designate a specific echelon of BFV units, such as platoon, company, or battalion above, to find the answer for the research questions. Therefore, this thesis browses and analyzes the overall M2 BFV fielding history of 30 years through various literatures.

## Limitations and delimitation

Due to the sensitivity of the information about the ROKA's armored vehicles, all K200 and K21 related references in this thesis are used only from open sources. The

information sources are limited to published documents, not the author's own hands-on observations. Also, due to the limited time and resources, this thesis focuses only on training and related doctrine. Therefore, the challenges which are related to mechanical problem, such as the K21 sinking accident, are not included.

## Significance

Proper training methodologies and doctrinal improvements are crucial to maximize the effect of new equipment. According to the U.S. Army Infantry School's Director of Combined Arms and Tactics, "It is the increase in vehicle capability and complexity that has led to fundamental changes in the way infantry does business (Ernest and White 1986, 21)." That means that the effect of the U.S. Army's transition from the M113 APC to the M2 BFV was so powerful as to prescribe fundamental changes in training and doctrine without any significant change in battlefield conditions.

The result of this study will be the proper anticipation by the ROKA of potential challenges in training of K21 IFV fielded units and the minimization of possible failures in training and related doctrine. By analyzing and applying the U.S. Army's experience in fielding the M2 BFV, this thesis can contribute to attaining and maintaining a superior level of training and combat readiness within the K21 IFV units in the ROKA.

# CHAPTER 2

# LITERATURE REVIEW

## K21 Infantry Fighting Vehicle

There is almost no literature which directly deals with the possible challenges in training of K21 IFV units. This is primarily because of the short time span since the ROKA resumed fielding the K21 following the sinking accident in July 2010. Based on the fact that the active academic research about the M2 BFV unit's training and doctrine in the U.S. Army began about five years after the beginning of the fielding M2 BFV in 1983, the author believes that active academic research about the K21 IFV unit's training will begin in 2 or 3 years. This thesis will serve as a pilot study for future study about the training and doctrine of the K21 IFV units.

The unclassified documents and sources about the ROKA's infantry armored vehicles were very useful in obtaining knowledge about the K200 and K21. The *Korea Defense Daily*, the media equivalent to the *Stars and Stripes* in the U.S., published a series of special articles about the K200 APC and K21 IFV from January 11 to July 26, 2010. These articles extensively and professionally explained the history of the ROKA's infantry armored vehicles. Also, the various on-line sources, such as K200 and K21 pamphlet by Doosan DST, the website of the Joint Chiefs of Staff of the Republic of Korea, and an abundance of newspaper and media articles were very useful and credible in getting accurate information about the K200 APC and K21 IFV.

In addition, *Tank Warfare in Korea* by Steven J. Zaloga and George Balin in 1994, *Armor Warfare of the Korean War* by the ROKA headquarters in 2009, *Defense White Paper* published by the Ministry of National Defense in 2010, and the *Joint Concept*

*2012-2016* by the Joint Chiefs of Staff of the Republic of Korea in 2010 were also important sources to infer the effective ways to employ the mechanized infantry units on the Korean peninsula.

## M2 Bradley Fighting Vehicle

This is a summary of the U.S. Army M2 BFV fielding history. FMC Corp. (now BAE System) began delivering the first production of the M2 BFVs in May 1981, and finished the initial fielding of 500 M2 BFVs in 1983 (Military Periscope 2010). Later in the decade, as a result of a series of live-fire vulnerability tests, the U.S. Army began adding a number of surivivability enhancements - steel applique armor, exterior attachment points for adding reactive or passive armor, interior spall liners for the crew compartment, and relocating ammunition to less vulnerable areas. This high survivablity vehicle was classified M2A2, and included an increase in engine power to accommodate the weight increase (Urbina 1999, 427). After proving itself in the Gulf War, the U.S. Army Bradley system continues to be upgraded based on the M2A3 Bradley upgrade program. The first low-rate initial production of M2A3 BFVs were delivered in November 1998 and entered service in April 2000. The system was approved for full-rate production in May 2001 (Army Technology 2011).

Because this paper mainly depends on the case study of the U.S. M2 BFV fielding, the author reviewed a wide variety of literature addressing all the challenges the U.S. Army faced in the process of fielding and operating the M2 BFVs for more than 20 years. That literature can be roughly categorized into four groups: books and periodicals, theses and monographs, government documents, and research papers mainly from the ARI.

## Books and Periodicals

Various historical literature about the armored history of the U.S. Army, such as *The Bradley and How It Got that Way* by W. Blair Haworth, Jr. (1999), *Camp Colt to Desert Storm: The History of the U.S. Armored Forces* edited by George F. Hofmann and Donn A. Starry (1999), and *Modern American Armor: Combat Vehicles of the United States Army Today* by Steven J. Zaloga and James W. Loop (1982), provided the basic understanding of the U.S. Armored Forces, especially the M2 BFV units, and helped to orient the overall direction of the thesis.

Several training challenges within M2 BFV fielded units in the 1980s were uncovered through review of the available literature. First of all, it seems clear that the officers in newly-fielded M2 BFV units were quite confused about how to employ BFVs on the battlefield and concomitantly challenged with training the soldiers in the units. This was due in part to the fact that the M2 BFVs were not developed to realize the 1982 doctrine of Air-Land Battle, but rather to cope with the threat of the Soviet BMP infantry combat vehicle, which appeared in public in November 1967, and to keep up with the new main battle tank, the M1 (Zaloga and Loop 1982, 56).

In short, the equipment (M2 BFV) was developed earlier than the related detailed training doctrine. LTC Robert G. Bernier, who was commander of the M2 Bradley fielded combined arms maneuver battalion underneath the 8th Cavalry in the 1980s, expressed the difficulties of employing the M2 Bradley in combination with the M1Abrams tank.

> For the first time, we have an infantry fighting vehicle (M2 Bradley) intentionally designed for its employment in combination with the new main battle tank. We expect the effect of the Bradley IFV and the Abrams tank, when

> properly employed together, to be greater than that of either system employed separately.
>
> This effect, however, is not automatic. Events at the National Training Center have shown that units find it difficult to obtain their full potential. The speed of the M1 and M2 makes their employment harder to control. . . The demands to get infantrymen forward to breach and clear obstacles compete with the pressing need to keep Bradley TOW launchers firing from long stand-off ranges. . . The command and control arrangements for dismounting infantrymen are an entirely new dimension in the employment of infantry. (Bernier 1988, 14)

According to the LTC Bernier's article, the training challenges in M2 BFV units can be summarized into mounted combat skill in combination with the M1 tank, the competing need between dismounting infantrymen close to an object and maintaining sufficient stand-off range for employing 25mm chain gun and TOW (Tube-launched Optically tracked Wire-guided) missiles, and commanding and controlling dismounted infantrymen. These challenges also mainly stem from the fact that the M2 BFV is a complicated hybrid vehicle whose mission has evolved as doctrine and requirements changed. Due to the M2 BFV's hybrid character of APC and Tank, and the lack of detailed proven doctrine, there had been much confusion and misunderstanding in employing it on the training sites and the battlefield until the 1990s.

> There has been long-standing confusion or misunderstanding what the Bradley is and is not designed to do. It is not an M113 APC, designed as a battle taxi to transport troops or serve as an arms room, although it does transport infantrymen and their weapons. Nor is it a tank. It lacks the tank's heavy armor, although it has a tank-killing capability and is a partner to the tank in combat. Finally, it is not a boat, although for many years it was required to swim. . . . It is designed to provide speed of movement and reaction on the battlefield, as well as suppressive fire and antitank capabilities. (Urbina 1999, 428)

The overtasking of the infantry squad leader was also a big challenge in maintaining a high level of combat readiness, because initially the M2 BFV squad leader was required to perform both as a Bradley Commander (BC) and a leader of the

dismounted infantry squad, based on the old M113 doctrinal field manual (Zaloga 1986, 36). LTC Ralph Hallenbeck, who was an M2 BFV mechanized infantry battalion commander in 1983, and Captain Nicolas F. Altomare, a New Equipment Trainer in 1983 highlighted the serious problem of overtasking the M2 BFV squad leaders.

> (An M2 BFV) squad leader would have to be capable of replacing both an M60 tank commander and a straight infantry squad leader. He would also be required to perform as a combined arms platoon leader on a small scale. In sum, his daily tasks would be virtually impossible. (Hallenbeck 1983, 12)

> Doctrine required that both the squad leader and assistant leader be capable of commanding either the vehicle of the dismount team, effectively requiring both men to combine the expertise of a tank commander (who had to be a fairly competent gunner and driver in his right) and a rifle squad leader. (Altomare 1985, 33)

In addition, LTC Robert L. Friedrich, who was also an M2 BFV mechanized infantry battalion commander in 1985, stressed the challenges in training management both of vehicle mounted gunnery training and traditional dismounted light infantry training. The training of the vehicle and dismounted teams themselves was relatively straightforward except that a Bradley battalion would add between 24 and 36 days of vehicle and gunnery training to its already full annual program (Friedrich 1985, 33). Coordination between the mounted and dismounted training syllabi, however, was problematic; doctrine demanded the treatment of the Bradley-equipped squad as a single entity, yet the complexity and time demands of training the whole organization exerted considerable pressure to split the squad's training into infantry and gunnery tracks (Friedrich 1985, 34).

Moreover, LTC Bernier stressed that infantry soldiers in the M2 BFV units did not receive enough training for dismounted combat skills due to the overtasking to the

BFV platoons and squads, and focusing too much on vehicle mounted gunnery training. He noted that this problem can be solved at the company level and below.

> One of the first issues invariably raised is the suspected degradation of individual training that may result from branch biases of the various CAMB (Combined Arms Maneuver Battalion) leaders. A case in this point is the concern over training and use of the Bradley-mounted infantryman . . . the feeling is that, particularly under an armor-based CAMB, the 11M (mechanized infantry Military Occupational Specialty) soldier will not receive adequate training in basic infantry fighting skill. . . . But, in reality, individual training takes place almost entirely within the purview of company command. Under CAMB, recall, nothing changes at line company level. (Bernier 1988, 17)

## Theses and Monographs

The U.S. Army War College and U.S. Army Command and General Staff College provided many theses and monographs dealing with the training problems in the M2 BFV fielded units between 1988 and 1995. Interestingly, the majority of them were written by infantry officers, and they argued alike that dismounted infantry combat skills had been obviously neglected and were degrading in the M2 BFV fielded units. LTC Severn argued the focus on crew gunnery and vehicle maintenance, combined with limited time resources, caused erosion of traditional dismounted skills, and stressed importance of dismounted infantry training for Air-Land Battle preparation (Severn 1988, 1-4).

Also, Major Gibbons analyzed the reasons for the decline of dismounted infantry training in the M2 BFV units. He argued that M2 BFV companies had been concentrating on vehicular gunnery tasks, a supplementary effect that reinforces an inherent capability of the tank, rather than preparing to execute their complementary dismounted mission, therefore, it had been jeopardizing the ability of mechanized infantry units to fulfill their battlefield role of dismounted combat (Gibbons 1995, 2-3).

In addition, Major John M. Carmichael studied about determining the correct organization of the dismounted infantry squad as the right starting point for improving dismounted combat capability of the BFV units (Carmichael 1988, 1-2). Moreover, LTC Severn articulated additional key challenges in training, besides weakened dismounted combat skills, of the BFV units;

> There are well over 100 additional tasks for Bradley infantrymen to learn, beyond what is required of airborne, light, or airmobile infantrymen because of sophisticated turret system; Bradley infantrymen must constantly be prepared to integrate the vehicle and dismount team in any number of tactical situations; the Bradley platoon is now expected to be equally proficient at executing the dismounted skills of a light infantry platoon, the mounted gunnery skills of an armor platoon, and the anti-tank skills required of an improved tow vehicle platoon; The single most pressing challenge for Bradley leaders is to design training programs and allocate resources which support sustaining proficiency in all area. (Severn 1988, 14)

## Government Documents

In 1980, just before fielding the M2 BFVs, the U.S. Army Infantry School at Fort Benning , Georgia attempted to describe the battlefield role of BFV-equipped mechanized infantry by Special Text 7-7-1 FY80, *The Mechanized Infantry Platoon and Squad (IFV).*

> The (M2) IFV is not an improved Armored Personnel Carrier (APC); it is truly a fighting vehicle. This is a new dimension infantrymen must master. The fundamentals of current tactical doctrine remain essentially unchanged. They must, however, be modified to capitalize on the IFV's capabilities. The more conservative thinkers will tend to regard the IFV as an improved APC or "battle taxi." The other extreme will think of the IFV as a light tank. The correct role of the IFV is in between these Two Extremes, but probably slightly more toward the light tank. (U.S. Army Infantry School 1980, 1)

> In the past, mechanized infantry used the APC as a means of battlefield transportation. Once at the scene of a fight, the infantry became the center of interest and the APC merely added to the squad's fire power with its caliber .50 machine-gun. With the IFV this changes. The dismounted infantry is still critically important but the IFV is of equal importance and in some situations even more important. The infantry must grasp the fact that the squad is a part of

> IFV and the IFV is a part of squad. The two are one system. (U.S. Army Infantry School 1980, 1-1)

Although the U.S. Army Infantry School tried to articulate the differences between the M113 APC and the M2 BFV, and how to employ the M2 BFV on the battlefield, it was not enough to solve the confusion and challenges of M2 BFV fielded units, because the body of ST 7-7-1 drew heavily on its predecessor, the Field Manual (FM) 7-7, *The Mechanized Infantry Platoon and Squad* dated September 30, 1977, even to recycling graphics and appendices (Haworth 1999, 99). As with the earlier M113 APC equipped platoon, the M2 BFV platoon was organized into a headquaters and three squads, each in their own IFV. The headquarters consist of a platoon leader, platoon sergeant (traded to another IFV for a rifleman so as not to risk the entire headquarters in one vehicle), radio-telephone operator, and attached medic and forward observer team, plus driver and gunner. Each squad was organized into an IFV team and dismount team (U.S. Army Infantry School 1980). This initial Bradley platoon organization didn't account for the vehicle as a weapon system, which made it very difficult for the platoon leader and squad leader to fulfill both roles of vehicle commander and leading dismounted infantrymen.

Despite the exceptionalism claimed in ST 7-7-1's introduction, the new capabilities of the Bradley were in the main treated as quantitative enhancements rather than revolutionary ones. Little emphasis, for instance, was placed on the exploitation of the stabilized main armament to enhance mounted movement to suppress anti-armor threats in support of tanks (Haworth 1999, 99). That is why the U.S. Army published a White Paper, *Bradley fighting vehicle,* in 1986 to articulate the battlefield role of the M2 BFV equipped mechanized infantry and the overarching concept to employ the M2 BFVs.

> The Bradley is a fighting vehicle, not a tank or an armored personnel carrier. The Bradley's predecessor, the M113 APC, is not as effective as the Bradley at fixing and enemy force because it lacks firepower, range, protection, and mobility. Without the Bradley we would, therefore, be forced to use tanks to fix the enemy. The Bradley, on the other hand, gives us the capability to use a fighting vehicle to fix the enemy and to free up our tanks to maneuver and attack the enemy in his flanks and rear. (Department of the Army 1986 1-3)

This literature stresses the Bradley unit's battlefield role as a fixing force. That means that the Bradley unit should be trained and prepared for engaging both the enemy's tanks and mechanized infantry to fulfill the responsibility as a fixing force. It also means that mounted crew training and mounted combat skills became crucial to accomplishing the mission as a fixing force, because mounted crews operate the sophisticated turret weapon system which can effectively destroy an enemy's tanks and other armored vehicles.

## Research Papers

The concept of employing the M2 BFV units as a fixing force for the Air-Land Battle was not intuitively realized. There were many challenges in training to gain and maintain a high level of combat readiness. More than 40 M2 BFV related research papers of the ARI between 1984 and 2002 (the majority of them were written in 1980s) prove how much effort the U.S. Army spent on improving the BFV uints' mechanical capability, doctrine, and training.

There are several advantages in reviewing the ARI papers compared to other sources of literature, because the ARI has contributed to a program to define emerging problems, address critical issues affecting the M2 BFV, and suggest possible solutions to them since the M2 BFV was fielded. The ARI papers about the M2 BFV, which were written by professional subject matter experts (SMEs), dealt with urgent and very

important issues in employing the M2 BFVs at that time. Also, since each paper has one or two specific topics, such as 25mm gunnery and ammunition reloading procedure, it is convenient to get detailed professional knowledge about crucial parts of the M2 BFV unit's training. Needless to say, all the research results have been applied to the FMs and doctrine of the U.S. Army. Therefore, reviewing the history of the ARI's papers about the M2 BFV unit's training make it possible to understand the key challenges in training of the M2 BFV units since 1983, when the first batch of 500 M2 BFVs were fielded.

The author identified 22 ARI research papers which are directly related to the M2 BFV unit's training from more than 40 M2 BFV related papers between 1984 and 2002. According to table 1, most of the research about the M2 BFV unit's training (17 out of 22 research projects) was executed between 1984 and 1989, which means that major M2 BFV related training doctrine development, as well as mechanical capability upgrades, had been achieved in the first six years of the M2 BFVs initial fielding.

Also, the author could find there were changes in the main research topic over time. First, they were focused on trying to find the optimum standard operating procedure for the M2 BFV crews to operate the vehicle from 1983 to 1986; then, the research focus shifted to the mounted element's gunnery training from 1987 to the 1990s; there were just a few research efforts about the M2 BFV leader training and integrated training between mounted and dismounted elements in 1988 and 1998. In addition, table 1 shows that the M2 BFV units and the ARI identified training challenges different from the M113 APC units. Those were the M2 BFV leader training, operations under all visibility conditions (including preventing fratricide), and most importantly, vehicle mounted gunnery training and simulator training.

| Table 1. ARI research papers related to the BFV unit's training | | | |
|---|---|---|---|
| No. | Date | Title | Category |
| 1 | Feb. 84 | BIFV (Bradley Infantry Fighting Vehicle) Procedure Guide: Driver | MT |
| 2 | Feb. 84 | BIFV Procedure Guide: Commander and Gunner | MT/GT |
| 3 | Feb. 84 | BIFV Procedure Guide: Evaluation | MT |
| 4 | Mar. 86 | Analysis of Gunnery Training for the BIFV | MT/GT |
| 5 | Oct. 86 | Analysis of Content and Organization of the BFV Commanders Course | LT/MT/ GT |
| 6 | Oct. 86 | Task Analysis of Tactical Leadership Skills for BFV Leaders | LT |
| 7 | Jul. 87 | BFV Gunnery Training Devices: Trainer Attitudes | MT/GT |
| 8 | Jul. 87 | Effects of Revised Ammunition Reloading Procedures on Reload Time for the BIFV | MT |
| 9 | Dec. 87 | Analysis of BFV Gunnery with Emphasis on Factors Affecting First-Round Accuracy of the 25mm Gun | MT/GT |
| 10 | Apr. 88 | A Survey Comparing the M2/3 BFV & the M113 APC by Members of NTC Operation Group and OPFOR | TD |
| 11 | Apr. 88 | Development of Aiming Rules for the 25mm Gun of BFV | MT/GT |
| 12 | Jul. 88 | A Technique for Classifying Vehicular Targets as Either Frontal of Flank Views for Use in Range Estimation and Application of Lead Rules for the BFV | MT/GT |
| 13 | Aug. 88 | Review and Analysis of BIFV Operations under All Visibility Conditions | IT/MT/ GT |
| 14 | Aug. 88 | BFV System Combat Effectiveness: Evaluations of Developments in Tactics, Training, and Equipment | TD/MT/ GT |
| 15 | Aug. 88 | BIFV Squad and Platoon Leader Span of Control | LT |
| 16 | Oct. 88 | Techniques and Procedures to Improve 25mm Gunnery of the BFV | MT/GT |
| 17 | Jun. 89 | An Introduction to the Bradley Conduct of Fire Trainer | MT/GT |

| | | | |
|---|---|---|---|
| 18 | Sep. 96 | Relationship Between Platoon Gunnery Training and Live-Fire Performance | MT/GT |
| 19 | Feb. 98 | Assessment of the SIMITAR Gunnery Training Strategy Through Development of a Database of Gunnery Outcome Measures | MT/GT |
| 20 | May. 98 | Full Crew Interactive Simulation Trainer-Bradley (FIST-B): Limited User Assessment | IT |
| 21 | Jan. 01 | BFV M2/M3 A3: Training and Soldier System Observations | MT |
| 22 | Nov. 02 | Preliminary User Feedback of a Prototype BFV M2A3/M3A3 Embedded Training System (BETS) | MT/GT |
| (Remark) MT: Mounted element training, DT: Dismounted element training, GT: Mounted gunnery training, LT: Leader training, IT: Integrated training (mounted + dismounted), TD: Training doctrine | | | |

*Source:* Created by the author based on the data of the ARI's research products.

Moreover, table 2 shows that the most important concern in the BFV units' training was mounted element training, especially vehicle mounted gunnery training. Relatively fewer research efforts were spent on the other fields, such as leader training and integrated training. There was no research effort focused on enhancing dismounted infantry training. These training issues, which had less ARI effort, might have been successfully handled by the M2 BFV fielded units, or they presented no problems. The author could see that the importance of training in these areas was relatively neglected, by reviewing several theses and monographs published at the U.S. Army War College and the U.S. Army Command and General Staff College in the late 1990s. These studies articulated degrading dismounted infantry skills, the difficulties in integrating mounted

element and dismounted element in NTC training, and the overtasking to the squad and platoon leaders.

Table 2. Number of categorized ARI research papers by the trainings

| Category | MT (GT) | DT | IT | LD | TD |
|---|---|---|---|---|---|
| Number | 18 (14) | 0 | 2 | 3 | 2 |

(Remark) MT: Mounted element training, DT: Dismounted element training,
GT: Mounted gunnery training, LT: Leader training,
IT: Integrated training (mounted + dismounted), TD: Training doctrine

*Source:* Created by the author based on the data of the ARI's research products.

## Comparison among the Infantry Armored Vehicles of the U.S Army and the ROKA

If there are many similarities between the K200 APC and the M113 APC, and between the K21 IFV and the M2 BFV, it is logical and realistic to decide that the K21 IFV units will face some of the challenges as the M2 BFV units. To compare the transition to the K21 IFV from K200 APC with that of the U.S. Army, first of all, the author compared the M113 APC of the U.S. Army and the K200 APC of the ROKA; then, he continued to compare the M2 BFV of the U.S. Army and the K21 IFV of the ROKA; after that, the comparing doctrinal and historical background in fielding IFVs between the both of the countries was followed.

### Comparison between the M113 APC and the K200 APC

The M113, which was manufactured by United Defense, is the most successful U.S. Army APC. It was developed in the late 1950s and first vehicles were used in 1960.

Key recognition features are box-shaped hull with front sloping at 60 degree to rear, horizontal roof, rear hull which can hold 11 soldiers, vertical hull rear with large power-operated ramp, driver's circular hatch front left with air louvers to right, and commander's cupolar with externally mounted 12.7mm M2 MG in center of roof with rectangular hatch to rear (Foss 1996, 210).

The M113 APC, powered by petrol engine, acts like a battle taxi, which brings soldiers into battlefield usually behind tanks. It can travel through almost any area, and runs smoothly over sand or mud. It can even swim in the water propelled by its track. The M113 was replaced in production by diesel-powered M113A1 in 1964 which in turn was replaced by the M113A2 with a number of automotive improvements. Latest model is the M113A3 which entered service in 1987 having many improvements including more powerful engine, spall liners and optional applique armor (Foss 1992, 304).

Meanwhile, the K200 APC was developed by the ROKA and Special Products Division of Daewoo Heavy Industries to replace the old M113APC in the mechanized divisions in early 1980s. When the ROKA initiated the research to develop new infantry armored vehicle in 1980, it tried to develop infantry fighting vehicle rather than armored personnel carrier to keep abreast of the other countries' advanced IFV research and production (especially the U.S. Army's M2 BFV). The ROKA, however, finally decided to develop an APC rather than an IFV based on the experience of employing the M113 APC for 13 years because of the limited budget; the price of the turret system of IFV was almost same as hull (The Korea Defense Daily 2010d).

In 1984, the ROKA initially fielded the K200 APCs to the 20th mechanized infantry division. Thanks to the M113 APC employing experience for a long time, the

newly developed K200 APC had not only very similar features to the M113 APC, but it also reflected the improved functions and parts of the M113 APC upgraded variations (M113A1and M113A2). The K200 APC's similar recognition features to M113 APC are box-shaped hull with front sloping, horizontal roof, rear hull which can hold nine soldiers, vertical hull rear with large power-operated ramp, driver's circular hatch front left , swimming capability, and so on. Meanwhile, the improved functions and parts of the K200 APC were commander's cupola with an external 7.62mm MG to rear of driver, gunner's cupola with armor shield, 12.7mm M2 MG right, two firing ports with vision block in each side of troop compartment.

Table 3 shows general comparison between the M113A2 and the K200. The reason of the comparing the K200 with the M113A2 is the M113A2 APC was fielded in 1979 when the ROKA initiated new infantry armored vehicle research. The K200 APC was very similar to the M113A2 APC in appearance and functions, but had slightly improved mounted assault capabilities, such as two mounted machine guns, armor shield to gunner's cupola, and six firing ports in the rear troop compartment. These improvements were substantially affected by adopting the U.S. Army's experience to upgrade the M113 APC to the Armored Cavalry Assault Vehicle (ACAV) during the Vietnam War, to which 12.7mm M2 MG cupola armor shield and two M60 MG shields rear were added (Zaloga 1982, 52). The K200 APC also had improved mobility and survivability compared to the M113A2 APC; it was fast enough to operate with the K1 main battle tank of the ROKA; it had upgraded mobility in the water and obstacles; it also had smoke dischargers and NBC equipment to enhance survivability.

| Table 3. Comparison between M113A2 APC and K200 APC | | |
|---|---|---|
| | M113A2 | K200 |
| Country of origin | U.S. | Korea |
| Date of introduction | 1979 | 1984 |
| Crew | 2 (commander, driver) + 11 passengers | 3 (commander, gunner, driver) + 9 passengers |
| Armament | 1x12.7mm MG | 1x12.7mm MG, 1x7.62mm MG, 1x6 smoke dischargers |
| Weight (Combat/Empty) | 11,253kg/9,957kg | 12,900kg/12,500kg |
| Engine | V-6 diesel developing 212hp at 2,800rpm | V-8 diesel developing 280hp at 2,300rpm |
| Maximum road speed | 60.7km/h | 74km/h |
| Maximum water speed | 5.8km/h | 6km/h |
| Maximum cruising range | 480km | 480km |
| Fording | Amphibious | Amphibious |
| Trench | 1.68m | 1.7m |
| Vertical obstacle | 0.61m | 0.63m |
| NBC system | Optional | Yes |
| Night Vision equipment | Yes (passive or infra-red for driver) | Yes (passive for commander and driver) |

*Source:* Christopher F. Foss, *Jane's AFV Recognition Handbook* (United Kingdom: Butler and Tanner, 1992), 300-306.

## Comparison between the M2 BFV and the K21 IFV

The M2 BFV was developed in the 1970s as a replacement for the U.S. Army's aging M113 APC. The first two prototypes of XM2 were completed by FMC Corporation (now United Defense LP) in 1978. After trials it was standardized as M2 in 1980 with first vehicles in 1981, when it was named Bradley IFV (Foss 1996, 206). The BFV was faster and better armed than the M113 APC, and it supported troops with tremendous fire power, and can even destroy enemy tanks.

Key recognition features of the M2 BFV are high hull line with well sloped glacis plate, driver's hatch left side, horizontal hull top, large ramp at hull rear, and hatch above rear troop compartment. In addition, the turret has twin TOW launcher on left side, extensive external stowage with 25mm chain gun front and 7.62mm coaxial MG right, and two spherical firing ports with periscope above in each side of hull (Foss 1996, 206).

The initial version of the M2 BFV was fully amphibious with floating screen erected (carried collapsed round top of hull). After a few minutes of preparation, a M2 BFV could enter the water and move at a maximum speed of 7.2kilometers per hour, propelled by the motion of its track. Later production vehicles (M2A and M2A2) had many improvements with the A3 models having increased armor protection and upgraded engine. Some M2 BFVs have been fitted with explosive reactive armor to their turret and hulls for increased battlefield survivability.

Meanwhile, the K21 IFV of the ROKA was developed by the Doosan DST in 2000s to replace the aging the K200 APC and to keep up with international IFV development trend. The key development concepts of the K21 were high performance with cost effectiveness; operational capabilities to meet the future battlefield environment

(various threats and three-dimensional attacks of enemies in the digital warfare); flexible design to adopt users' requirements and performance improvement (Doosan DST 2010).

The K21 IFV has many similarities in appearance and functions compared to the M2 BFV: high hull line with well sloped glacis plate, driver's hatch left side, horizontal hull top, large ramp at hull rear, stabilized turret with twin anti-tank missile launcher on left side, swimming capability, and so on.

Table 4 shows general comparison between M2 BFV and K21 IFV. The K21 IFV has more improved fire power, mobility, surveillance, and embedded digital training system. Two-man stabilized turret with 40mm chain gun and the 3rd generation anti-tank missile system provides high accuracy and lethality against moving targets, and 40mm Armor-Piercing Fin-Stabilized Discarding Sabot (APFSDS) ammunition to defeat all kinds of APC and IFV at ranges up to 2,000m; the water operating system makes safe water operations possible by using an inflating airbag and trim-vane; moreover, the K21 IFV can fire its stabilized main gun even when it swims; chassis control computer enables all the crew to access the information of the vehicle and the battlefield easily during day and night; the battlefield management system creates synergy amongst all the combat forces by sharing near real-time battlefield information with all friendly units (Doosan DST 2010).

Although, the K21 has superiorities in several functional areas compared to the initial version of the M2 BFV manufactured about 30 years ago, there is almost no essential difference between the two because the upgraded version of the M2 BFV, M2A3 has almost same capabilities as the K21 IFV in those functional areas.

| Table 4. Comparison between M2 BFV and K21 IFV | | |
|---|---|---|
| | M2 BFV | K21 IFV |
| Country of origin | U.S. | Korea |
| Date of introduction | 1981 | 2009 |
| Crew | 3 (commander, gunner, driver) + 6 passengers | 3 (commander, gunner, driver) + 9 passengers |
| Armament | 1x25mm chain gun, 1x7.62mm MG (coaxial), 2x TOW ATGW launcher, 2x4 smoke dischargers | 1x40mm chain gun, 1x7.62mm MG (coaxial), 2x ATGW launcher, 2x4 smoke dischargers |
| Main gun stabilization | Yes | Yes |
| Fire control system | Yes | Yes |
| Range finder | Yes | Yes |
| GPS | N/A | Yes |
| Battlefield Mgnt System | N/A | Yes |
| Weight (Combat/Empty) | 22,940kg/19,005kg | 25,000kg/ |
| Engine | V-8 turbo charged diesel developing 500hp at 2,600rpm | V-10 turbo-intercooled diesel developing 750hp |
| Maximum road speed | 66km/h | 70km/h |
| Maximum water speed | 7.2km/h | 7km/h |
| Maximum cruising range | 483km | 450km |
| Fording | Amphibious with preparation (floating screen) | Amphibious with preparation (inflatable airbag and trim-vane) |
| Trench | 2.54m | 2.5m |
| Vertical obstacle | 0.914m | 0.8m |
| NBC system | Yes | Yes |
| Night Vision Equipment | Yes (passive for commander, gunner and driver) | Yes (passive and active for commander, gunner, and driver) |
| Embedded training system | N/A | Yes (3D virtual image and sound generation) |

*Source:* Created by the author based on the data of Christopher F. Foss, *Jane's AFV Recognition Handbook* (United Kingdom: Butler and Tanner, 1992), 295-266; Doosan DST, *K21 Infantry Fighting Vehicle* (Seoul: Doosan DST, 2010).

## Comparison of the Doctrinal and Historical Background

The author could find important doctrinal and historical similarities between the fielding of the U.S. Army's M2 BFV and that of the ROKA's K21 IFV. First, both Armies fielded their IFVs gradually after the long time experience of employing the APCs for more than 20 years. Their main IFV development concepts were combined arms operations capability especially with main battle tanks (M1 and K1 respectively), and suppressing or destroying enemy armored vehicles.

In addition, the U.S. Army has shared APC and IFV related doctrine with the ROKA for a long time. For about 30 years, the U.S. Army has improved the M2 BFV's mechanical capabilities and doctrine based on the employing experience both on the training sites and battlefields. Because the ROKA has closely allied with the U.S. Army for about 60 years, and shared APC and IFV related doctrine as well, it could minimize trial and errors when it developed the K21 IFV by reflecting the U.S. Army's M2 BFV development. It was a prudent measure for the ROKA to use the knowledge attained by the U.S. Army in its pioneering effort to find the right path to develop the best IFV (M2 BFV) about 35 years ago, and proved the excellence of the M2 BFV in the Persian Gulf War in 1990.

## Summary

In chapter 2, this paper reviewed the various literatures about the K21 IFV of the ROKA and the M2 BFV of the U.S. Army, especially focusing on the M2 BFV fielding history. Today's reliable and efficient training system for the M2 BFVs was not achieved in a short period of time. There were many challenges to overcome since the M2 BFV

was fielded in 1983, such as the high level of the vehicle mounted gunnery training, relatively degraded dismounted infantry skills, confusion and misunderstanding about the battlefield role of the M2 BFV, overtasking of the squad and platoon leaders, difficulties in managing both mounted and dismounted elements' training at the same time, increasing importance of simulator training and leader training, and so on.

These challenges mainly occurred at company level and below, and directly or indirectly affected the whole infantry and armor community of the U.S. Army. In the process of overcoming those challenges for more than 20 years, the U.S. Army persistently upgraded the training system and related doctrine as well as mechanical capabilities of the M2 BFV (A2 and A3 version).

In addition, the comparison among the infantry armored vehicles of the U.S. Army and the ROKA showed many similarities in the mechanical and functional point of view. The author also found important similarities in historical and doctrinal back ground of the both Army's IFV fielding. Therefore, anticipating training challenges in the K21 IFV units through the study of the M2 BFV fielding case is very logical and realistic.

# CHAPTER 3

# RESEARCH METHODOLOGY

## Qualification

The author served in K200 APC units as a platoon leader and a company commander, and he also served in a BMP3 IFV unit as a battalion operations officer in 2010. He could recognize significant differences in training between the K200 APC units and BMP3 IFV unit. In the BMP3 IFV unit, where vehicle mounted gunnery training, maintenance, and mounted combat skills were the training focus, it was very difficult to train on both mounted and dismounted elements according to the current K200 APC centered training guidance and doctrine of the ROKA mechanized units. He felt the way to fight and related training should be changed when the ROKA transition K200 APCs to K21 IFVs in the mechanized infantry units. This firsthand experience both in APC and IFV units gave him inspiration to research this topic, and was be used as a basis for this research.

## Outline of the Research Methods

To anticipate the possible challenges in training of the K21 IFV units, this thesis is mainly dependent on the case study of the U.S Army's fielding of the M2 BFV. Based on the fact that this is the first research to find possible training challenges of the K21 IFV, it is difficult to designate a specific echelon for research, such as platoon, company, or battalion. Therefore, this paper will use the exploratory measure to ascertain out the key challenges in training which the ROKA may face in fielding the K21 IFV from the more than 20 years of lessons learned during the U.S. Army's M2 BFV fielding and

employment history. That exploratory measure begins with a review of the literature related to M2 BFV units' training challenges, regardless of the levels of echelon or scope they are dealing with, and it narrows all the training challenges of the M2 BFV units into a few identified key challenges which can be directly related to the K21 fielded units of the ROKA. It then analyzes all the key training challenges more in-depth in an effort to find the possible solutions to the challenges.

Simply stated, this paper's research process takes following steps. First, this thesis reviews the historical background of the ROKA's transitioning from K200 APCs to K21 IFVs to find the similarities with the U.S. Army's transitioning from M113 APC to M2 BFV, especially in the perspective of mechanical similarity and training challenges. Identified similarities between the two justify the assumption and methodology of this thesis and provide the basis for further studies.

Second, a detailed review of historical training challenges of the M2 BFV fielded units. This thesis reviews several books, periodicals, theses, monographs, research papers (focusing on ARI research products), and other various sources. A review of published government documents and the U.S. Army's doctrinal publications to trace the primary challenges in training doctrine of the mechanized infantry units, which were originated from transitioning M113 APCs to M2 BFVs, is conducted.

Third, the major portion of the work, this thesis evaluates and prioritizes all the challenges which were found in step two, and identify the salient challenges among them which can possibly be directly related to the ROKA's K21 IFV fielding. To identify the salient challenges of the ROKA's K21 IFV fielded units, this thesis uses the interviews with a few SMEs who have experiences to serve in the M2 BFV or K21 IFV units as a

leader, commander, or staff officer as well as the literature review, which were conducted by the author. These supplementary interviews with the SMEs contribute to get updated information about the M2 BFV and K21 IFV unit's training, and to complement or reinforce the findings from step three.

For this particular research methodology a Command and General Staff College standard interview written consent form was used for all the interviewees. The content of the interview consent form is presented in Appendix A. Blank consent forms were sent by email, filled in by the interviewees, signed, and sent back to the author. Finally, this thesis analyzes each salient challenge in-depth and suggests the possible solutions for it.

## Strengths and Weaknesses of the Methodology

### Strengths

Again, the methodology of this paper is the case study of the U.S. Army's M2 BFV fielding and employment history. There is a plethora of reliable literature which deals with nearly 30 years of the M2 BFV fielding and employment (training and combat) history. The case study of the M2 BFV is valuable enough to anticipate the possible training challenges of K21 IFV fielded units of the ROKA in near future.

It is also a strength to use the exploratory research measure, rather than focusing on a specific M2 BFV echelon's training doctrine or training challenges—it is almost impossible to anticipate which echelon of unit or area of training will be most challenged before the K21 field units are fully employed in training and on a battlefield. Reviewing overall challenges of M2 BFV units' training history for three decades will make it possible to identify possible key training challenges of the K21 fielded units of the ROKA.

Moreover, using the interviews with a few M2 BFV and K21 IFV subject matter SMEs by the author as supplementary measure to this case study will help this paper provide most updated information and professional insight to the possible solutions for each key training challenge likely to be encountered by K21 IFV fielded units.

## Weaknesses

Although the methodology of this paper has many strengths, there are several weaknesses to overcome. First of all, this methodology solely deals with the U.S. Army's M2 BFV fielding and employment. Because it is narrowly focused, its generalization to other types of IFV fielded units might have limitation unless there is quite a high level of mechanical and doctrinal similarity.

In addition, this paper's character of explorative research might not come up with in-depth information about narrowed and specific training issues. Although the fourth step of the research process is going to analyze the identified key training challenges in-depth, this method might produce less in-depth analysis compared to other research on one or two narrow, more specific training topics.

Moreover, this methodology does not include direct experience with employment of the K21 IFV, because the fielding of the K21 IFVs and New Equipment Training (NET) are still ongoing. Therefore, the findings of this paper are not the proven training challenges of the K21 fielded units in real world, but the deducted possible challenges in training based on critical and creative reasoning. All these weaknesses should be mitigated by the follow-on research and actual K21 IFV employment experiences both in training and operation.

# CHAPTER 4

# ANALYSIS

## Outline of the Analysis

The previous chapters stressed the significance of the thesis, reviewed the past studies and various literature, and established the overall framework for this paper. Through the literature review to anticipate the possible training challenges of the K21 IFV fielded units of the ROKA, the author identified the many historical training challenges of the M2 BFV units of the U.S. Army during the process of fielding and employment for over 30 years. The majority of the challenges occurred at company level and below, as evidenced by the focus of previously published studies and research.

In this chapter, the author begins the analysis with arrangement of historical training challenges of the M2 BFV units, which were found through the previous literature reviews. Then, he identifies the salient challenges which can be directly related to the ROKA's K21 IFV fielding and employment. Finally, he analyzes these salient challenges more in-depth and suggests the possible solutions for them.

## Historical Training Challenges of the M2 BFV Units

Again, the M2 BFV was not developed to realize the 1982 doctrine of Air-Land Battle, but rather to cope with the threat of the Soviet BMP infantry combat vehicle, and to keep with the new main battle tank, the M1 (Zaloga and Loop 1982, 56). Because the equipment (M2 BFVs) was developed earlier than the related doctrine, the M2 BFV units have experienced many training challenges since the U.S. Army initiated M2 BFV fielding in 1981.

To analyze historical training challenges of the M2 BFV units, the author divided the M2 BFV fielding and employment history into four phases based on the several important M2 BFV fielding events: from 1980, when M2 BFV development was finished to 1985; from 1986, when M2A1 BFV fielded to 1989; from 1990, when M2A2 BFV fielded to 2000; from 2001, when M2A3 BFV fielded to 2010.

## Phase 1: Defining the Critical Training Tasks of the M2 BFV Crew, 1980-1985

The first M2 BFV, field in 1981, represented a huge change from the M113 APC. The M2 BFV, like the M113 APC, was designed to carry personnel, but differed markedly from the M113 APC in its ability to defeat armored vehicles with its 25mm chain gun, and personnel targets and unarmored targets using the 7.62mm coaxially mounted machine gun. It also became a tank killer with TOW missile (Salter 2001,1). Its unique capabilities raised questions about the tactical employment of these capabilities and the tactical doctrine which is needed to provide training developments for the M2 BFV individuals and units (McDade 1986, 2).

Although the M2 BFV had a major improvement in potential infantry effectiveness on the battlefield, this potential could not be realized without defining the M2 BFV's roles and how to train and prepare commanders and soldiers to carry out these roles accurately, efficiently and effectively. Therefore, training challenges during phase one (1981-1984) occurred in defining the role of the M2 BFV on the battlefield and the critical tasks of the crew (BC, gunner, and driver).

The M2 BFVwas designed to make maximun use of the terrain in providing overwatch and establishing defensive positions. The vehicle's height allows clearing

many obstacles, and the 25mm chain gun or the TOW can be fired from the hull defilade position. The dismounted element is also available for the military operations in urban terrain and forest enviroments, and providing local security (McDade 1986, 3). When the U.S. Army Infantry School defined the M2 BFV's role on the battlefield in 1980, it highlighted the M2 BFV's mounted combat capability.

> The (M-2) IFV is not an improved Armored Personnel Carrier (APC); it is truly a fighting vehicle. This is a new dimension infantrymen must master. The fundamentals of current tactical doctrine remain essentially unchanged. They must, however, be modified to capitalize on the IFV's capabilities. The more conservative thinkers will tend to regard the IFV as an improved APC or "battle taxi." The other extreme will think of the IFV as a light tank. The correct role of the IFV is in between these Two Extremes, but probably slightly more toward the light tank. (U.S. Army Infantry School 1980, 1)

The U.S. Army Infantry School's initial perception about the M2 BFV's role the battlefield, which stressed the mounted combat capability of the M2 BFV, made the ARI provide serial research on the critical tasks and procedures of the M2 BFV mounted element's crew in 1984 (Salter 1984a). A set of the M2 BFV procedures guides for the mounted element's crew (BC, gunner, and driver) followed the same format as the M1 tank procedures guides developed by the ARI. The M2 BFV procedures guides included critical guidance on emergency procecures, porper use of the vehicle systems, and preventive maintenance check (Salter 1984b). The intent of the M2 BFV guides was to provide each mounted crew member a position specific guide which, in addtion to being technically correct, makes it possible to use the M2 BFV's mounted combat capbility on the battlefield more effectively.

## Phase 2: Focusing on Mounted Gunnery Training and Degrading Dismounted Infantry Skills, 1986-1989

For five years, since the U.S. Army initiated the fielding of the M2A1 BFV, the slightly upgraded version of the M2 BFV in 1986, the training focus of the M2 BFV units had been on improving mounted gunnery capability. Spending almost all efforts on improving mounted gunnery skills of the M2 BFV was an unavoidable choice for the infantry community, which lacked the experience of employing complex turret weapon systems compared to the armor community. As a result, the traditional dismounted infantry skill was relatively neglected and degrading. Moreover, the squad and platoon organizations, which did not reflect increased roles and tasks of the squad and platoon leaders, caused the unexpected overtasking problem to squad and platoon leaders.

### Challenges in mounted gunnery training

The ARI played a most important role in enhancing the M2 BFV mounted gunnery training. Ten out of 14 ARI research papers regarding M2 BFV units' training which were published between 1985 and 1989, directly dealt with the mounted gunnery training of the M2 BFV.[1] After the M2 BFV units acquired a pretty good level of proficiency in operating the vehicles in the early 1980s through the NET program, and supported by key literature such as the procedures guides (for BC, gunner, and driver) by the ARI and FM 23-1, *Bradley Fighting Vehicle Gunnery*, published in 1982, the research focus of the ARI shifted to finding potential improvement areas of the M2 BFV gunnery training. As a result, the ARI published the "Analysis of Gunnery Training for the Bradley Infantry Fighting Vehicle" in March 1986.

[1]See table 1 of this paper.

The paper consisted of a synopsis of available literature about the M2 BFV gunnery requirements and tasks; an overview of the training practices, programs of instruction, and training resources; and consideration of available and projected training devices (Strasel et al. 1984). In other words, this paper summarized the knowledge of the M2 BFV gunnery training at that time, and provided a basis for follow-on research in gunnery training.

The paper argued that while procedural skills and tasks appeared to be adequately trained, the training in the overall tactical aspects of gunnery and in several of the most significant and highly critical tasks appeared to be slighted. It also articulated the nine tasks which were inadequately trained: site selection, determination of fields of fire, 360 degree observation, reaction to enemy fire, acquiring potential targets, target identification, estimating target range, determination target priority, and observe and adjust fire (Strasel et al. 1984, 75-76). In addition, it identified five main training problems of the institution (the U.S. Army Infantry School) and units' M2 BFV gunnery training. These problems were inadquate training in: range determination, target acquisition, target identification, target engagement (live fire or adequate substitute with live targets), and night gunnery (Strasel et al. 1984, 78). Those findings helped inform ARI's follow-on research and analysis of the main training challenges of BFV gunnery and to put forth practical solutions.

First of all, to improve range determination and target acquisition, the ARI published "A Technique for Classifying Vehicular Targets as Either Frontal or Flank Views for Use in Range Estimation and Application of Lead Rules for the BFV" in 1988. This paper suggested new target-view classification technique and the modified quick

reference table, which allowed more effective use of the quick reference table for range estimation, more accurate use of the ranging stadia on the auxiliary sight unit, and the application of lead rules for engaging flank views of moving targets (Perkins 1988b).

Second, there were several research effort to improve the overall effectiveness of operating the M2 BFV turret mounted weapon system. Robert L. Rollier suggested the prototype on-board ammunition stowage container to eliminate the cumbersome features of the previous ammunition shipping containers, to reduce the number of linkages, and to permit stowage of a larger number of rounds with more efficient use of space (Rollier et al. 1987). Mike S. Perkins found various factors which are related to first-round accuracy with the 25mm chain gun, and suggested the innovative improvements in the various areas: boresighting equipment and procedures, zeroing, range estimation, range cards, aiming rules, preliminary gunnery training and full caliber gunnery (Perkins 1987). He also suggested the improved aiming rules for the 25mm chain gun in his follow-on research. His improved aiming rules optimized the first-round accuracy of the 25mm gun when it is used to engage moving targets from a stationary M2 BFV (lead rule), and to engage stationary targets from a moving M2 BFV (reverse-lead rule) (Perkins 1988a).

Third, the substantial effort to improve night gunnery was also followed. Gaining and maintaining high proficiency in night gunnery was crucial for the M2 BFV units to prevent possible fratricide and efficiently destroy the enemy by fully utilizing the superiority of the night combat system of the M2 BFV. Robert L. Rollier and el al. wrote “Review and Analysis of BIFV Operations Under All Visibility Conditions” in 1988. This research broadly analyzed the M2 BFV doctrine, tactics, techniques, and training , with particular emphasis on the night and limited visibility operations, and identified

several key areas where the M2 BFV's combat effectiveness under all visibility conditions could be enhanced: target detection and recognition of friend or foe, night and limited visibility and continuous operations, and the use of the thermal mode of the integrated sight unit (Rollier et al. 1988b).

Finally, the ARI's "Bradley Fighting Vehicle System Combat Effectiveness: Evaluations of Developments in Tactics, Training, and Equipment," published in 1988, played a monumental role to summarize overall training challenges across tactics, training, and equipment from the five years of experience employing the M2 BFVs on the field. It mainly delt with mounted gunnery training, such as gunnery procedures and night and limited visibility training, and the gunnery related leader training: platoon and squad leader span of control and the Bradley Commanders Course (Rollier et al. 1988a).

Degrading dismounted infantry skills

The more effort spent on improving vehicle mounted gunnery training for the first ten years of the BFV fielding, less effort was spent on maintaining or improving traditonal dismounted infantry skills. From the previous literature review, the author could find the several infantry officers of the U.S. Army who expressed serious concerns about the degrading dismounted infantry skills of the M2 BFV fielded units from 1988 to 1995.

LTC Bernier argued that soldiers in the M2 BFV field units did not receive adequate training in basic infantry fighting skills due to the overtasking of the BFV platoons and squads, and focusing too much on vehicle mounted gunnery training (Bernier 1988, 17). LTC Severn also argued the focus on crew gunnery and vehicle maintenance caused the erosion of traditional dismounted skills, and suggested a way of

training management of the M2 BFV units to balance between turret mounted gunnery training and dismounted infantry training (Severn 1988). This problem of degrading dismounted infantry skills seems to have remained unfixed until the 1990s. Major Gibbons analyzed the reasons for the declining infantry skills in the M2 BFV fielded units in his master's thesis in 1995.

## Phase 3: Development of the Gunnery Simulators, 1990-2000

In the 1990s, the resources available for military training became scarce. The cost of fuel and ammunition, which were essential for mechanized infantry training, was increasing, and the competition for live-fire ranges put training time at a premium. To solve this problem of limited training time and resources, the U.S. Army developed a series of M2 BFV gunnery simulators in 1990s.

The first simulator was the Conduct of Fire Trainer (COFT). The COFT was a computer driven, high fidelity precision gunnery trainer. The Unit Conduct of Fire Trainer (U-COFT), which was a type of the COFT, was designed to provide basic training for beginning gunners, transition training for personnel with some related prior experience, and cross training for personnel who are familiar with the system, but are not yet experience with the turret system. It was also used to complement live-fire training to ensure that no crew loses his skills through lack of practice (Salter 1989, 1).

In the early 1990s, the U.S. Army fielded the Platoon Gunnery Trainers (PGTs) for M2 BFVs which consisted of four linked U-COFTs. Commanders and gunners could see their platoon's vehicles as well as other vehicles on the battlefield. Platoon leaders could give commands to control when and how fast the platoon moves. Platoons received

printed feedback on gunnery performance as well as verbal feedback on command and control issues from the senior instructor or company commander (Sterling 1996, 1-2).

In the late 1990s, the U.S. Army developed the prototype Full Crew Interactive Simulation Trainer-Bradley (FIST-B). FIST-B was conceptualized as an inexpensive strap-on gunnery trainer to be appended to the turret of a stationary Bradley, and provided realistic scenarios to the BFV crew—BC, gunner, and driver. It can also be linked to an Engagement Skills Trainer device, which is a gunnery simulator for dismounted infantry squads. Therefore, the BFV crew and the dismounted infantry squad could train together sharing the same database (Salter 1998). This prototype FIST-B was upgraded to the Bradley Advanced Training System and fielded in 2002.

About ten years of experience in the development and employment the M2 BFV gunnery simulators culminated when the U.S. Army fielded the Bradley Embedded Training System (BETS) for the M2A3 BFV in the early 2000s. The BETS used BFV vehicle controls and optics and the same training device software as the Bradley Advanced Training System. The remarkable advantage of the BETS was its mobility, and providing the opportunity to train more soldiers in a short time. The ability to cross train, and to maintain skills while deployed, was also seen as an important advantage (Salter 2002).

In all, the more M2 BFV units' gunnery training was limited by reducing training resources, the more training aids (especially the gunnery simulators) assumed an increasingly important role in assisting the M2 BFV units in achieving and maintaining gunnery readiness.

## Phase 4: Digitization Training, 2001-2010

The final upgraded version of Bradley, the M2A3 BFV, was fielded in 2001. It was radically different from those that preceded it, and presented a different type of training challenge, digitization training. The M2A3 was not just an upgraded version of the old system.

> The M2A3 BFV has tactical and video displays, and built-in test capabilities. It includes the Bradley Commander (BC) and squad leader displays; hull and turret processing units for fire control, command and control (C2), digital maps and navigation. The digitized A3 can receive, store, retrieve, and display combat information through an integrated messaging and display capability. The A3 is interoperable with other Force XXI digitized platforms, and it uses the Single Channel Ground Airborne Radio System (SINCGARS) with enhanced position location reporting system (EPLRS). (Salter 2001, 4)

Although the M2A3 BFV had many similarities to the predecessor vehicles, there was significantly more and new hard-ware and accompanying procedural changes incorporated in the system. There was also a considerable number of computer skills (for example, messaging, menus, and screen navigation) that must be demonstrated by the crew who wish to take full advantage of the digitization capability. The M2A3 BFV created a considerable impact on Bradley training.

The task list for the M2A3 BFV was comprised of 85 tasks. Of these tasks, only 30 (35 percent) were unchanged from earlier vehicles. 18 (21 percent) were predecessor tasks that must be in some way modified for the A3. Additionally, there were 37 new or proposed tasks (44 percent) (Salter 2001, 6).

> Besides the existing tasks, and those to be modified, there are additional tasks. Some have no comparable predecessor tasks; others are totally new to the Bradley. Some require both keyboard and computer skills, expertise previously not required. These tasks include, for example, global tasks such as operate the IBAS (Improved Bradley Acquisition Subsystem), operate CTD (Commander's Tactical Display), and operate the CIV (Commander's Independent Viewer). There are other tasks such as operate auto-tracking; manipulate status bar and soft

> keys; adjust the sustainment and diagnostics screen; modify environmental parameters screen; operate the Squad Leader's Tactical Display. (Salter 2001, 6-7)

The M2A3 BFV was a radical departure from the previous vehicles, probably more radical a departure even than the original was from its predecessor, the M113 APC. It was complex, and somewhat fragile, although not beyond the capability of a well-trained operator, especially one with a certain amount of computer familiarity (Salter 2001, 8).

## Summary

It is very interesting to know how the U.S. Infantry School took responsibility to develop mechanized infantry doctrine and training system in 1970s.

> In the early 1970s, Major General Thomas M. Tarpley was commandant of the U.S. Infantry School. With the infantry having been immersed in the Vietnam War for the previous ten years, Tarpley was not quick to dismiss the Vietnam experience as a deviation from traditional warfare, as did his Armor School counterpart, General Starry. Starry, in lockstep with General DePuy's doctrine, was given responsibility for revising the Army's doctrine into a combined arms concept. The Infantry School seemed unable to articulate how the Mechanized Infantry Combat Vehicle (MICV) would be used in a mechanized war due to its unfamiliarity with the tactics and doctrine of armored vehicles. . . . At one point, Tarpley feared the Infantry School would lose the mechanized infantry mission entirely to the Armor School. . . . The Infantry school ultimately retained the mechanized infantry mission, and the field manuals governing its employment were numbered differently to clearly indicate they were neither armor nor infantry in origin. (Urbina 1999, 411)

It is somewhat dramatic that the infantry community came to play a central role in developing the training methodologies and related doctrines for the M2 BFV fielded units. However, this proved quite challenging as the infantry community sought to fully exploit the capabilities of the BFV, having no experience employing sophisticated turret mounted weapons systems; it took roughly 20 years from the time the first M2 BFV was fielded.

For the first several years after the initial version of M2 BFV was developed, the major training challenges were defining the role of the M2 BFV on the battlefield and searching optimal procedures guides for the mounted crew—BC, gunner, and driver. Next, the training focus had generally been shifted on the mounted gunnery training for the following several years. This shift in the training focus is evidenced by the fact that 10 out of 14 (71 percent) BFV training related ARI research papers, which were published for those years, dealt with the mounted gunnery training. In addition, the traditional dismounted infantry skills were clearly degrading as relatively less training efforts were spent on this area.

Then, the U.S. Army ardently developed a series of gunnery simulators during 1990s. The development of gunnery simulators and related training methodologies was an inevitable challenge for the M2 BFV units because training resources and time was becoming scarce. Through the 1990s, the gunnery simulators proved to be of great utility, and were continuously upgraded until the early 2000s.

A very different kind of training challenge emerged after 2001 when the latest version of the Bradley, the M2A3 BFV, was fielded. That was digitization training. Because the M2A3 BFV is equipped with a highly upgraded surveillance system and the force XXI digitized platform, which were radically different from the previous versions, new digitization training tasks, such as keyboard and computer skills, operating many digital devices, adjusting various digital situation screens, and so on became fundamental.

## The Salient Training Challenges of the K21 IFV Units

To identify the salient training challenges of the K21 IFV units from the historical training challenges of the M2 BFV units, the author uses a three steps process. First, the author categorized all the training challenges of the M2 BFV which were uncovered in the literature review, and prioritize each category of training challenge applying three evaluation criteria: the volume of literature on the issue (as an indication of the seriousness of the issue), the number of researchers (or authors), and the length of time required to overcome each challenge.

Then, he analyzed the interviews with SMEs who have experience serving in the M2 BFV or K21 IFV units as a leader, commander, or staff officers to complement or adjust the list of the prioritized challenges which. Finally, the author chose several salient challenges from the prioritized training challenges to analyze in more depth.

### Categorizing and Prioritizing the Training Challenges of the M2 BFV Units

Based on the literature review, the author grouped all of the challenges into five categories: training doctrine (TD), mounted gunnery training (GT), dismounted infantry training (DT), training support (TS), and leader training (LT). He also identified 21 important sub-challenges as the U.S. Army transitioned to the M2 BFV, four under training doctrine, ten under mounted gunnery training, two under dismounted infantry training, two under training support, and three under leader training.

Table 5 shows the five training categories and detailed list of the sub-challenges for each category. Among the five categories, the mounted gunnery training was seen as the most predominant challenge. This assessment is based on the fact that most of the

research data on record address this particular issue. Applying the same metric, the area of training doctrine and dismounted infantry training were nearly equal in importance, with an obvious distinction based on the time period when each was predominantly studied; the training doctrine for the newly fielded M2 BFV was rigorously studied for the first couple of years in the early 1980s immediately following the initial fielding of the vehicles; the problem of degrading dismounted infantry skills was manifest after the late 1980s, and lasted for more than ten years.

| Table 5. Categorized training challenges of the M2 BFV units | |
|---|---|
| Category | Sub-challenges |
| Training doctrine (TD) | TD-1. Defining the BFV's role on the battlefield<br>TD-2. Developing procedures guides for the crew (BC, gunner, and driver)<br>TD-3. Tactical employment<br>TD-4. Finding optimum organization of the squad and platoon |
| Mounted gunnery training (GT) | GT-1. Range determination<br>GT-2. Target acquisition<br>GT-3. Target identification<br>GT-4. Target engagement<br>GT-5. Night gunnery<br>GT-6. Employing gunnery simulators<br>GT-7. Cross training in case of combat loss<br>GT-8. Ammunition reloading training<br>GT-9. Digitization training<br>GT-10. Developing institutional training program for gunners |
| Dismounted infantry training (DT) | DT-1. Preventing overtasking of squad leaders, platoon leaders, and platoon sergeants<br>DT-2. Innovation in the training management both of the mounted and dismounted element |
| Training support (TS) | TS-1. Managing training resources<br>TS-2. Range control |
| Leader training (LT) | LT-1. Validating platoon and squad leader span of control<br>LT-2. Developing tactical trainers (simulators)<br>LT-3. Developing institutional training program for leaders |
| (Total) 21 sub-challenges: TD (4), GT (10), DT (2), TS (2), LT (3) | |

*Source:* Created by the author based on the literature review of this paper.

Because the prioritizing process itself is quite subjective, the author tried to maintain as much objectivity as possible by applying three reasonable evaluation criteria: the amount of research data available concerning the issue, the number of researcher (or authors) addressing the issue, and time duration from identification of the challenge to its resolution.

Table 6 shows the result of the prioritization. The author assigned a numerical value of from one to five to each training challenge based on the relative ranking for each evaluation criteria; for example, the first place received five points, and the fifth place received one point. Through this process, the priority of each training challenge emerged. The priority, from first to fifth is: mounted gunnery training, training doctrine, dismounted infantry training, training support, and leader training.

Table 6. Prioritized training challenges of the M2 BFV units

| Training challenges | Ranking and points for criteria (Rank/Points) | | | Total | Priority |
|---|---|---|---|---|---|
| | Number of literature | Number of researcher | Period of lasting | | |
| TD | 2/4 | 2/4 | 4/2 | 10 | 2 |
| GT | 1/5 | 1/5 | 2/4 | 14 | 1 |
| DT | 3/3 | 4/2 | 1/5 | 10 | 3 |
| TS | 5/1 | 5/1 | 5/1 | 3 | 5 |
| LT | 4/2 | 3/3 | 3/3 | 8 | 4 |

(Remark) TD: Training doctrine, GT: Mounted gunnery training, DT: Dismounted infantry training, TS: Training support, LT: Leader training

*Source:* Created by the author based on the literature review of this paper.

## Analysis of Interviews with SMEs

The author interviewed four SMEs in the M2 BFV or K21 IFV to complement or adjust the priority of the training challenges which was made in the previous step. Because most of the historical training challenges of the M2 BFV fielded units occurred at company level and below (Bernier 1988, 17), the author selected three Army officers (two U.S. officers and one Korean officer) who served in M2 BFV or K21 IFV unit as a platoon leader, company executive officer, company commander, or battalion staff officer to interview. He also selected a retired infantry lieutenant colonel who is employed as a maneuver analyst at the Center for Army Lessons Learned (CALL). Table 7 shows the general information gleaned from the selected SMEs.

Table 7. General information about the selected SMEs

| Name | David W. Mayfield | David W. Briten | Richard Averna | Sunguk Shin |
|---|---|---|---|---|
| Nationality | U.S. | U.S. | U.S. | Republic of Korea |
| Rank or position | Major (Intelligence) | Major (Infantry) | Maneuver Analyst in CALL (Ret. LTC/infantry) | Major (Infantry) |
| Related experience | M2 BFV PL/ Company XO | M2 BFV CO/ BN S-3 | Mech. Infantry Brigade Staff | K21 IFV BN S-3 |
| Date of interview | August 31, 2012 | August 31, 2012 | June 5, 2012 | September 2, 2012 |
| Interviewer | The author | The author | The author | The author |

(Remark) PL: platoon leader, CO: company commander, XO: executive officer, BN: battalion, S-3: operations officer, Mech.: Mechanized

*Source:* Created by the author based on the interviews of this paper.

The author's primary question for the SMEs was "What were the salient training challenges of the M2 BFV units (or the K21 IFV units for the Korean officer) compared to the APC or light infantry units?"; the secondary question was "What were (or are) the solutions for those salient training challenges?" All SMEs provided the professional insight to the author, while differing from one another in their perspectives regarding the priority of the challenges.

First of all, Major David W. Mayfield[2], who served in a BFV unit as a platoon leader and a company executive officer from 2000 to 2003, mentioned various training challenges across the five categories identified from the previous literature analysis. Among them, he highlighted the problem of degrading light infantry skills.

> Because of the unique atmosphere of the armor division in which the first priority was always vehicles and maintenance, dismounted infantry training was always second or third priority. Infantry squads were lack of basic dismounted infantry skills, such as LP/OP and patrolling; even the essential dismounted infantry skill in the mechanized units, employing anti-tank system was not properly trained. In addition, the maintenance support for dismounted infantry was not enough because the priority of maintenance was always the vehicle, not the dismounted infantry equipment. (Mayfield 2012)

He also mentioned the difficulty in mastering vehicle identification and fratricide prevention. He argued that in spite of the technological developments of the BFV, such as the blue force tracking system, it is still very important and requires much time-consuming training for the crew to identify and classify targets as quickly as possible.

In addition, he emphasized that the traditional tactical relationship between mounted and dismounted elements in the M113 APC units, in which the dismounted element is always supported, was changed; due to the revolutionarily enhanced weapon

[2]Major David W. Mayfield served in the 1st Armor Division as a platoon leader in 2000, and as a company executive officer in 2001.

and surveillance system of the M2 BFV, both the dismounted operations that support the mounted (usually in the open terrain) and the mounted operations that support the dismounted (usually in the forest or urban terrain) came to have almost the same value.

Second, Major David W. Briten[3], who served in a BFV unit as a company commander and a battalion staff officer from 2008 to 2011, said that the time-consuming BFV mounted gunnery training was the most difficult and predominant challenge.

> The training focus of my division, in my perspective, was always gunnery. That was number one priority. Other infantry stuffs like rifle and machine gun qualification were done during spare time. It was difficult to achieve valance between the gunnery and infantry training. . . . I would argue that the Bradley gunnery qualification requirements were not high at all. The difficulty was to train the crew proficient enough to shoot the live bullets to that level. It took at least 40 hours to train a crew from table one to four in the simulator. Then, the crew could be ready to shoot a live bullet. But, the real problem was you can only be in the simulator maximum two hours before you start to lose all your coolness. You can become physically sick. It will become hard to focus on the training. It is very time-consuming. Once simulator training started, crew cannot be changed out. . . . Absolutely the gunnery was most difficult challenge. (Briten 2012)

Third, to acquire more professional advice from the CALL, the author interviewed a prestigious SME, Richard Averna (a maneuver analyst in the CALL). Somewhat differently from the previous two officers, he highlighted the importance of optimized training management both for the mounted and dismounted elements, which culminates at the platoon live fire exercise.

> To achieve the balance between mounted and dismounted training, the training in the BFV unit should be started from each element's independent training at squad level and below; then, each element should be marry for the platoon live fire exercise, which is the most important integrated training in the BFV units; after that, the training should be proceeded to the company team (BFVs and Tanks) level combined arms live fire exercise. (Averna 2012)

[3]Major David W. Briten served in the 2-7 Cavalry Battalion, 4th BCT, 1st Cavalry Division as a company commander in 2008, and a battalion operations officer in 2010.

In addition, he emphasized developing gunnery related school education—Bradley Commander Course, Gunner Course, and Master Gunner Course—to gain and maintain a high level of gunnery proficiency.

Finally, the author interviewed Major Sunguk Shin, who served in the first K21 IFV fielded battalion as an operations officer (S-3), from 2009 to 2010. Because this paper is mainly focused on the case study of the M2 BFV fielding to anticipate potential training challenges of the K21 IFV units, the direct interview with the Korean officer was a very good opportunity to understand the current situation of the K21 IFV fielded units. The most salient training challenge he mentioned was developing and applying the new training doctrine for the K21 units.

> If someone use only voice communication and texting function from a state of the art smartphone, that smartphone is just another ordinary cellular phone. Likewise, if the commanders and leaders of the K21 IFV units only apply the old APC doctrine to new K21 IFV units' training, the K21 is just another kind of APC to which additional attacking functions are added. Because there is almost no doctrine and previous experience about tactical employment of IFVs, the commanders and leaders of the K21 IFV units are depending on the previous experience and old doctrine of the K200 APC. I couldn't find any difference between the tactical employment of the K200 APC and that of the K21 IFV in the training site. (Shin 2012)

He also emphasized the difficulty in NCO (IFV commander) training and the expanded requirement for training support (training site, firing range, ammunition, etc.).

> When the K21 IFVs were fielded, the battalion received increased authorizations for NCOs, who were going to be IFV commanders. Because the majority of these NCOs did not have prior mechanized infantry (K200 APC) unit experience, and the K21 IFV training for NCOs was dependent only on the new equipment training (NET) from a civilian company's training team, the NCOs' understanding about the training was not satisfactory and very slow. . . . In addition, the K21 IFV units had to use the old APC training sites and firing ranges, which were designed for firing rifles and machine guns. It was extremely difficult to increase the number of training sites and firing range for the K21 IFVs in a short period of time. Moreover, due to the lack of training ammunition, the trainees could not get enough live fire experience. (Shin 2012)

Table 8 shows the summary of the salient challenges of the M2 BFV units (or K21 IFV units) which the interviewees mentioned. In short, the SMEs mentioned that degrading dismounted infantry training, mounted gunnery training, and developing and applying new training doctrine (either for M2 BFV units or K21 IFV units) were the salient training challenges. In addition, it is unique and noteworthy that Major Shin, the Korean officer, mentioned that the lack of training support (training sites, firing ranges, ammunition, etc.) is another important challenge because that challenge is deeply related to the problem of limited defense budget and the strategic decisions of the Ministry of National Defense, the Republic of Korea, and cannot be overcome in a short period of time.

Table 8. Salient training challenges by priority that the interviewees mentioned

| Name / Priority | David W. Mayfield | David W. Briten | Richard Averna | Sunguk Shin |
|---|---|---|---|---|
| 1st | DT | GT | DT | TD |
| 2nd | GT | • | GT | GT |
| 3rd | TD | • | LT | TS |

(Remark) TD: Training doctrine, GT: Mounted gunnery training, DT: Dismounted infantry training, TS: Training support

*Source:* Created by the author based on the interviews of this paper.

## The Salient Training Challenges of the K21 IFV Units

To identify the salient training challenges of the K21 IFV units, the author analyzed two source of information: the list of historical training challenges of the M2 BFV units from the literature review and the interviews with the SMEs. The results of the both analyses were very similar to each other. Table 9 shows the comparison of both analyses. Both analyses indicate that training doctrine, mounted gunnery training, and dismounted infantry training were the more important challenges in the M2 BFV or K21 IFV units.

Although, the leader training and training support are also important training challenges, and should not be ignored, the author reasonably selected three—training doctrine, mounted gunnery training, and dismounted infantry training—as salient training challenges of the K21 IFV units to analyze more in-depth to find possible solutions for each challenge.

Table 9. Comparison between the analysis of the literature and the interviews

| | Prioritized training challenges | | | | |
|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th |
| Analysis of the literature | GT | TD | DT | LT | TS |
| Analysis of the interviews | DT | TD | GT | TS | LT |

(Remark) TD: Training doctrine, GT: Mounted gunnery training, DT: Dismounted infantry training, TS: Training support

*Source:* Created by the author based on the analysis of the literature and interviews.

## Analysis of the Salient Training Challenges of the K21 IFV Units

The author identified three salient training challenges of the K21 IFV units through the analysis of the literature and the interviews with SMEs. In this step, he analyzes each salient challenge more in-depth.

### Training Doctrine

Developing new training doctrine for the K21 IFV units will be the nearest training challenge for the ROKA, based on the fact that the first training challenge which the M2 BFV units faced in the early 1980s was defining the BFV's role on the battlefield and its tactical employment. This is also partially proved by the interview with Major Shin, who articulated developing new training doctrine for the K21 IFV was the most difficult challenge in his battalion[4].

Table 10 shows the relevance of each sub-challenge of the training doctrine to the K21 IFV units. The author identified two less relevant sub-challenges considering the different current situation of the K21 IFV units: developing procedures guides for the crew (TD-2) and finding optimum organization of the squad and platoon (TD-4). The challenge of TD-2 can be solved by the on-going NET program from a civilian company's training team, although it still needs additional efforts from the ROKA to maintain and upgrade the procedures guides for the crew continuously. The challenge of TD-4 has weak relevance because the K21 IFV's rear hull can hold nine dismounted infantry soldiers differently from the initial version of the M2 BFV, which could hold

[4]See pages 48-49 in this paper.

only six dismounted infantry soldiers, and therefore faced many difficulties in defining the optimum squad and platoon organization.

Meanwhile, the author identified two more relevant sub-challenges; defining the IFV's role (TD-1) and tactical employment (TD-3) are still very relevant to the K21 units. The author analyzes both issues in more detail.

| Table 10. Relevant sub-challenges to the K21 units' training doctrine | |
|---|---|
| Sub-challenges | Relevance |
| TD-1. Defining the BFV (IFV)'s role on the battlefield | O |
| TD-2. Developing procedures guides for the crew (BC, gunner, driver) | Δ |
| TD-3. Tactical employment | O |
| TD-4. Finding optimum organization of the squad and platoon | • |
| (Remark) O: Strong relevance, Δ: Medium relevance, •: Weak relevance | |

*Source:* Created by the author based on the analysis of the literature and the interviews.

First, deciding what needs to be trained in an IFV unit is in part dependent on the role of the IFV is to fulfill on the battlefield. The K200 APC, like the M113 APC, was designed to carry personnel with limited armor protection and compatible speed with the K1 main battle tank of the ROKA. Its 12.7mm MG can provide direct fire support for dismounted infantry, but it cannot either support friendly tanks or kill enemy tanks. Therefore, in most cases, the infantrymen of the K200 APC must be always dismounted to fully utilize their combat power engaging with enemy mechanized forces.

Meanwhile, the BMP, the first Soviet IFV was designed with a cannon and anti-tank missile combination so that the vehicle could itself be a tank killer at both near and far ranges. Due to the vehicle's heavy fire power and the firing ports in the rear hull, the BMPs could support friendly tanks and kill enemy tanks. The dismounted infantry, differently from APC units', would be able to defend and attack from under armor protection when desired (Foss 1996, 174-175).

In addition, the German Army's Marder refined the IFV concept to include a chain gun rather than a canon and missile combination. The chain gun refined the infantry's role to that of supporting tanks in the attack and not that of tank killers. Although the Germans added the anti-tank missile system (the Milan) to their vehicle, that was mainly used by the dismounted infantry squad in the defense (Strasel et al. 1984, 3).

The challenge in defining the K21 IFV's role on the battlefield, like the M2 BFV's, stems mainly from its hybrid character. The K21 IFV has adopted the German concept of a chain gun but included the anti-tank missile system as a permanent part of the vehicle, while maintaining APC's basic capability to transport personnel on the battlefield. This allows the K21 IFV to have multiple roles: transporting personnel and supporting dismounted infantry (similar to the K200 APC), supporting tanks (similar to the German Marder), and killing enemy tanks (similar to the Soviet BMP), which make it difficult to define its main role on the battlefield.

Second, finding optimum tactical employment of the K21 IFV will also be an important challenge. This challenge originates from the clear difference in capability between the dismounted infantry and the vehicle. The dismounted infantryman can walk

at cross-country speed of 3-5 kilometers per hour and his weapons are effective out to 1,000 meters. Comparatively, the K21 IFV has maximum cross-country speed of about 45 kilometers per hour and its weapons are effective at range out to about 3,500 meters. Therefore, there is the competing need between dismounting infantrymen close to an object and maintaining sufficient stand-off range for employing 40mm gun and anti-tank missiles.

The terrain desired for optimum employment of each element is also different. The dismounted infantrymen are best employed in restrictive terrain with fields of fire under 1000 meters, while the K21 IFV is best employed where it can make use of long range fields of fire and multiple positions. Recognizing this disparity, leaders and commanders must learn to think flexibly to maximize the capabilities of both the vehicle and the infantry (Carmichael 1988, 3).

Due to radically upgraded capability of the K21 IFV, the value of the mounted element came to compete with that of the dismounted element. When the ROKA employed the K200 APCs, it is very clear that the value of the dismounted element was much bigger than the mounted element because the majority of combat power comes from dismounted infantrymen who are equipped with rifles, machine guns, anti-tank systems, an so on. The mounted element, however, provided the dismounted element only with transportation and limited direct fire support by 12.7mm MG. Therefore, the platoon and squad leaders were almost always with the dismounted element.

Comparatively, in the K21 IFV fielded units, it is unclear which one is more valueable between the mounted and dismounted elements, because the vehicle itself has pretty high combat power even after the infantrymen dismounted from it; the turret

mounted weapon systems can destory every kinds of armored vehicle; the vehicle surveilance system enables the mounted element to execute all visibility operations; the global positioning system and battlefield management system help the IFV commanders's situational awareness and understandings which are essential for the command and control. Therefore, it is very important for commanders and leaders to decide when and where to dismount their infantrymen, and especially where the platoon leaders should be—with their dismounted element or mounted element.

In brief, developing new training doctrine will be the first salient challenge for the K21 IFV units. This challenge mainly originated from the multi-roles on the battlefield (transporting infantrymen, supporting fire, and killing tanks) and radically upgraded vehicle capability of the K21 IFV. Accordingly, the K21 IFV requires concepts for its tactical employment which are necessarily different from that of the K200 APC.

## Mounted Gunnery Training

The author's first experience with the training of an IFV unit was when he served in a BMP3 unit as a battalion operations officer in 2010. Although he had many previous training experiences in the K200 APC units, the training management of the BMP3 unit was very challenging to him because of the BMP3's sophisticated turret mounted weapon system. The turret mounted weapon system was a very difficult challenge to the commanders and leaders of his battalion too. Their number one training priority was mounted gunnery training. The majority of their training time and effort was on this task.

Similarly to the M2 BFV fielding history, the mounted gunnery training will be the most difficult challenge of the K21 IFV units. It will not be overcome in a short period of time because the K21 IFV is the first turret mounted weapon system employed

by the majority of the infantry community of the ROKA. It will require the infantry to attain and sustain nearly the same proficiency in mounted gunnery training as armor units.

As table 11 shows, the author identified three more relevant sub-challenges of the mounted gunnery training to the K21 IFV units: target acquisition (GT-2), target identification (GT-3), and target engagement (GT-4). This identification is based on the literature analysis, the current training status of the mechanized infantry of the ROKA, and upgraded capabilities of the K21 IFV, such as laser range finder, all-visibility surveillance system, embedded training simulator, and user-friendly digital devices and screens.

Table 11. Relevant sub-challenges to the K21 units' mounted gunnery training

| Sub-challenges | Relevance |
|---|---|
| GT-1. Range determination | • |
| GT-2. Target acquisition | O |
| GT-3. Target identification | O |
| GT-4. Target engagement | O |
| GT-5. Night gunnery | Δ |
| GT-6. Employing gunnery simulators | Δ |
| GT-7. Cross training in case of combat loss | Δ |
| GT-8. Ammunition reloading training | • |
| GT-9. Digitization training | • |
| GT-10. Developing institutional training program for gunners | Δ |
| (Remark) O: Strong relevance, Δ: Medium relevance, •: Weak relevance | |

*Source:* Created by the author based on the analysis of the literature and the interviews.

All of the three more relevant sub-challenges are closely related to the tactical situation on the battlefield. Getting proficiency in K21 IFV gunnery procedures is not sufficient for the gunners to survive and to destroy the enemy on the battlefield. The fundamentals of K21 IFV gunnery should be integrated with tactical training, and that will be very difficult to achieve. The U.S. Army also spent an enormous amount of time and effort on achieving that goal.

> First and foremost, Bradley gunnery training should be intimately inter-winded with the training of overall Bradley doctrine, tactics and techniques—as part of a total systems' package. That is not currently happening either in the School or in units. . . . In our review of the School courses above and in the companion document, it has been shown that there is little true integration of tactics and doctrines with the fundamentals of Bradley gunnery. This does happen to some extent in the Commanders Course, but only to a small degree. Otherwise, gunnery training is basically isolated from tactical training and is taught as an end in itself. (Strasel, et al. 1984)

First of all, target acquisition with the K21 IFV will be the important skill to master on the battlefield. To acquire targets more efficiently, the commanders and gunners should know how to select the proper site for the vehicle to protect itself and find the enemy, and how to maintain 360 degree observation for an extended period of time considering the mission variables (Mission, Enemy, Terrain and Weather, Troops, Time available, and Civil consideration).

Understanding the operational significance and use of range card will also be critical for target acquisition. Very basically, the range card is a drawing that represents the location and range to man-made and natural terrain features in an IFV sector of fire. In the process of preparing the range card, the commanders and gunners become familiar with the terrain, and it helps the IFV crew acquire targets and potential targets more effectively (Perkins 1986, 23).

Second, the target identification will be essential to select the proper means of engagement. Because the K21 IFV has various weapon systems (40mm chain gun, 7.62mm coaxial MG, and anti-tank missile), the gunners must be capable of identifying the targets and deciding the means of engaging it as fast as they can. They have to identify the types, key features, strengths, and weaknesses of the targets in the various situations (limited visibility, near or far distance, moving or stationary, etc.). Just memorizing the combat vehicles identification cards, which are prevalently being used in the ROKA, is not enough to deal with very volatile situation on the battlefield. The gunners should identify the targets regardless of the distance up to three or four kilometers by their various surveillance systems. Especially, the target identification by thermal surveillance optics will be very challenging, and will need much time and effort to acquire the proper level of skill since the thermal images are not replicas of what is seen with unaided optics. Use of the thermal mode will be the norm in combat because of a visually obscured battlefield and since darkness occurs about half of each 24 hour day. Target identification will be complicated by differences in the appearance of unaided daytime and thermal-type images (Perkins 1986, 22).

In addition, the target identification will be also important to prevent fratricide. Given the assumption of a highly fluid battlefield and increased requirements for fighting under limited visibility conditions, the ability to rapidly determine whether a detected vehicle or dismounted element represents a threat will be critical to survivability and mission success. The ARI highlighted the importance of the friendly vehicle identification training of the M2 BFV units in 1988.

> During the on-site visits to observe BFV unit ARTEPs (Army Training and Evaluation Programs), the research team noted instances where BFV crews "successfully" engaged and killed friendly vehicles thinking they were enemy. This finding is attenuated by the fact that the OPFOR (Opponent Force) typically uses U.S. Army vehicles during ARTEPs. However, reports from the National Training Center also cite kills of friendly vehicles when the OPFOR was using vehicles visually modified to represent Threat equipment. The alarming frequency with which own forces are engaged by friendly fire during training simulations should alert commanders and trainers to the probable disastrous consequences in actual combat. (Rollier et al. 1988c, E-1)

In short, target identification will be one of the critical tasks for the K21 IFV commanders and gunners not only for engaging the enemy effectively, but also for preventing fratricide. The current training of the K200 APC units of the ROKA is insufficient to make the troops of the K21 IFV proficient in target identification. Additional training and equipment developments are required to improve proficiency in battlefield recognition and identification, and to prevent possible incidence of fratricidal engagement.

Third, target engagement will be a crucial skill in deciding the final success of the mounted gunnery training because the K21 IFV will face various enemies and situations on the battlefield due to its hybrid character and various weapon systems. The acquisition and identification of targets provides the commander and gunner with only the basic information for further decisive target engagement.

For example, after the commander and gunner acquire and identify targets, they should determine target priority to maximize the enemy's damage and to minimize friendly damage. Then, they should decide the correct weapon system for killing either infantry vehicles or tanks. After that, they should select the proper mode of the multi-purpose ammunition (proximity, air burst, armor-piercing, and fragmentation). They also

must be capable of observing and adjusting fire after the first round of ammunition is fired.

In addition, armor-type fire commands will be a relatively new language for the infantry. It will take a long time for the crew to fully master the commands. Moreover, the K21 IFV crew must be well prepared for the reactions to all types of enemy fire as well because the K21 IFVs will become much more lucrative targets to the enemy compared to the K200 APCs.

In summary, the author identified the mounted gunnery training as the most difficult challenge for the K21 IFV fielded units because the K21 IFV is the first sophisticated turret mounted weapon system to the majority of the infantry community of the ROKA, which needs almost the same amount of knowledge and skills as tank crews. The first step of the gunnery training will be getting proficiency in all the procedures to operate the turret system and fire the various weapons properly, and the ROKA will achieve this goal with little difficulty supported by the NET of the civilian companies. But, the tactical gunnery skills, such as target acquisition, target identification, and target engagement, cannot be taught by the NET program, and will remain as the essential challenges of the K21 IFV gunnery training.

## Dismounted Infantry Training

The focus on mounted combat of the M2 BFV units in 1980s resulted from the infantry force's reaction to the complexity of the M2 BFV's turreted weapons. As a result, the M2 BFV unit performance trends at the training centers indicated that dismounted skills were in a decline, and that commanders and staffs tended to relegate them to a background role (Gibbons 1995, 34).

Based on the M2 BFV units' training challenge in dismounted infantry training, without innovative changes in the training management and methodology of the K21 IFV units, the infantry's traditional dismounted combat skills will be degraded as they spend more and more time and effort on mounted gunnery training. It will become a serious problem to the mechanized infantry units in the end because the infantry's complementary effect[5] of the combined arms[6] can be achieved only when the infantry dismount from the vehicle (Gibbons 1995, 24).

As depicted in table 12, both sub-challenges of the M2 BFV units' dismounted infantry training, which were identified through the previous analysis, will be very relevant to the K21 IFV units as well.

Table 12. Relevant sub-challenges to the K21 unit's dismounted infantry training

| Sub-challenges | Relevance |
|---|---|
| DT-1. Preventing overtasking of the SL, PL, and PSG | O |
| DT-2. Innovation in the training management both of the mounted and dismounted elements | O |

(Remark) O: Strong relevance, Δ: Medium relevance, •: Weak relevance
SL: squad leader, PL: platoon leader, PSG: platoon sergeant

*Source:* Created by the author based on the analysis of the literature and the interviews.

[5]The 1982 version of FM 100-5, *Operations* states that complementary combined arms seek to integrate wholly different systems or capabilities to complicate and multiply the types of threat facing an opponent.

[6]The 1982 version of FM 100-5, *Operations* states that the combined arms is two or more arms in mutual support to produce complementary and reinforcing effects that neither can obtain separately.

First, preventing the overtasking of the squad leader, platoon leader, and platoon sergeant will be the first step to solve the problem of degrading dismounted infantry combat skills of the K21 IFV units. After five years of the BFV fielding, the U.S. Army slowly realized the appreciable degradation of dismounted infantry skills, and shifted the emphasis from gunnery to training of the dismounted infantryman.

The initial solution for the degrading dismounted infantry skills was a reorganization of the BFV platoon by Major General Michael Spigelmire, Chief of Infantry, in 1990. The fundamental aspect of the reorganization was to separate the functions of dismounted and vehicular leadership to prevent overtasking to squad leader. By this change, the squad leader no longer served as both a BC and a dismounted team leader (Spigelmire 1990, 2). In addition, LTC Severn pointed out the same split focus on the part of platoon leader. He analyzed the overtasking problem of the BFV platoons and platoon leaders, and suggested new platoon organization and training methodologies (Severn 1988). Preventing overtasking of the squad leaders, platoon leaders, and platoon sergeants of the K21 IFV units itself might not be directly related to improving dismounted infantry training, but it will make favorable conditions so those leaders can spend more time and efforts on dismounted combat skills.

Second, the innovative and efficient training management both of the mounted and dismounted elements will be very important for long-term success in dismounted infantry training of the K21 IFV units. Like the M2 BFV fielding history, The K21 IFV platoon will be expected to be equally proficient at executing the dismounted skills of a light infantry platoon, the mounted gunnery skills of an armor platoon, and anti-tank skills required of an improved anti-tank platoon. This will become especially frustrating

when considering the remarkably increased number of tasks to train. The single most pressing challenge for the K21 IFV leaders will be to develop training programs and allocate resources which support sustaining proficiency in all areas.

Because the majority of the K21 IFV leaders will give priority to the mounted gunnery training facing so many additional training tasks, without the innovation in the training management, the erosion of dismounted combat skills will not be avoided. LTC Severn also articulated several problems of the M2 BFV units' training management, which was impacting on the erosion of dismounted skills.

> The crew training in preparation for gunnery tables requires so much time and effort that leaders are distracted from training the dismounted element. . . . Dismounted infantrymen frequently pulling guard and detail duty for vehicle crew members to allow the completion of preliminary gunnery training, and work detail on live fire gunnery ranges in support of vehicle crew training. . . . Junior leaders don't maximize use of available training windows to train the dismounted element, and consequently never become experienced on the ground themselves. . . . Soldiers train harder knowing that they are going to be evaluated formally in the end. . . . Since dismounted maneuver is not evaluated most of the time, bad habits picked up during limited training are reinforced during exercise evaluation. . . .There are many hours of wasted time in the motor pool for the dismounted team when, if planned properly, the dismounted team could have been released for training on dismounted skills elsewhere. (Severn 1988, 15-18)

To sum up, the author identified the dismounted infantry training as another salient training challenge of the K21 IFV units. This challenge, however, will not be seemed as a critical issue by the K21 IFV units in the near future because the majority of training resources will be spent mainly on the vehicle operating procedures and the mounted gunnery training for a couple of years without realizing the problem of slowly degrading basic infantry skills. A prudent allocation of time and resources to dismounted infantry training would prevent the erosion of those skills to the point of ineffectiveness.

In fact, only effective dismounted infantry can achieve the complementary effect of the combined arms fight, and it is absolutely essential to success on the battlefield. The importance of good infantry is learned over and over again. If the infantry fails, the combined arms team fails (Carmichael 1988, 35). From the M2 BFV fielding and employment history, the author identified two very relevant sub-challenges of the dismounted infantry training for the K21 IFV units to retain and improve the proficiency in dismounted infantry training: preventing overtasking of squad leaders, platoon leaders, and platoon sergeants, and the innovation in the training management both of the mounted and dismounted elements.

## Solutions for the Salient Training Challenges of the K21 IFV Units

Through the previous steps in chapter four, the author identified three salient challenges which are directly related to the K21 IFV units: training doctrine, mounted gunnery training, and dismounted infantry training, and analyzed each salient challenge more in-depth. In this final step, he suggests possible solutions for those salient training challenges. Because the primary purpose of this paper is not to find the detailed solutions, but to find the potential training challenges of the K21 IFV units, he suggests the overall concepts of solutions to the each salient training challenge although there are some specific solutions.

### Solutions for the Challenge of Training Doctrine

The crux of the training doctrine problem centers on the resolution of two issues. First, the ROKA, especially the infantry community, must clearly define the K21 IFV's

role in the battlefield to induce the essential training tasks of the K21 IFV units. Second, the ROKA must develop new ways of tactical employment of the K21 IFVs reflecting the radically enhanced capabilities of the vehicle. To accomplish these, the following solutions are offered.

First, the ROKA should clearly state that the K21 IFV is only a new tool with which to perform the infantry mission which has traditionally been to support armor in the offense and to take and hold ground. The K21 IFV is not a light tank because of relatively thin armor and less fire power, and not an effective tank killer either because of the slow fire rate of the anti-tank missiles. While providing the capability to do some things that could not be done the same way with the K200 APC, the K21 IFV is still only an improved and more powerful tool to support infantry squad, platoon, company and higher unit activities.

Second, the ROKA Infantry School should play a central role in providing an integrated doctrinal basis for all the K21 IFV training, for its implementation, and for effective employment of its weapon capabilities. The infantry community of the ROKA has poorly contributed to developing and improving mechanized infantry doctrine and training because, for a long time, the majority of the infantry community thought that light infantry doctrine and training is the infantry's primary task, but the mechanized infantry's belonged to the armor community.

Since the K200 APC was fielded in 1984, the K200 mechanized infantry tactics was taught not in the Infantry School but in the Armor School, and the mechanized infantry officer and NCO's basic and advanced training courses were also managed by the Armor School. This prolonged policy has facilitated the infantry community's lack of

interest in participating in the mechanized infantry area. The current technology centered operational environment, however, requires the ROKA infantry community to take full advantages of technologies, especially various armored vehicles. Therefore, the ROKA infantry school should be more actively involved in developing and improving mechanized infantry doctrine and training, and play a central role in providing an integrated doctrinal basis for all the K21 IFV training.

Third, the ROKA should refine the relationship between the mounted and dismounted elements of the K21 IFV units. Differently from the K200 APC of which the dismounted element is almost always supported, the mounted and dismounted elements of the K21 IFV are almost equally supporting and supported (depending on the mission variables) because of radically improved capabilities of the vehicle. The ROKA has to find new ways of training management in order to maximize the use of the vehicle's capabilities while maintaining and improving traditional dismounted infantry skills.

Fourth and last, the ROKA should develop the tactics of dismounting infantrymen from the K21 IFVs. The tactics of dismounting infantrymen from the K21 IFVs are different from the K200 APCs because of the improved long range fire power and protection of the vehicle, and the competing need between dismounting infantrymen close to an object and maintaining sufficient stand-off range for employing 40mm chain gun and anti-tank missile.

To develop the dismounting tactics of the K21 IFV, the ROKA should articulate the conditions which require the infantrymen to dismount from the vehicles. The K21 IFVs become more capable of operation with tanks and mounted assault due to the K21 IFV's upgraded protection and fire power. Therefore, the leaders and commanders of the

K21 IFV units should clearly know which conditions require the infantrymen to dismount from the vehicles because needless dismounting infantrymen slow the speed of maneuver and expose the dismounted infantries to the fatal threat from an enemy's direct and indirect fire.

The ROKA should also refine the responsibility to lead the dismounted element of the K21 IFV platoon. Although the leader of the K200 APC platoon's dismounted element has been almost always a platoon leader, the leader of the K21 IFV platoon's dismounted element might not be a platoon leader because, many times, a mounted platoon leader supported by improved surveillance and battlefield management systems can lead both mounted and dismounted element more effectively than dismounted platoon leader. FM 3-21.71, *Mechanized Infantry Platoon and Squad (Bradley)* published in November 2010 gave the M2 BFV platoons more flexibility to designate the leader of the dismounted element. Like the M2 BFV platoons, the K21 IFV platoons should be given the flexibility to designate the leader of the dismounted element considering the mission variables.

> The platoon leader usually dismounts when the situation causes the platoon dismounted. . . . The platoon leader monitors his commander's tactical display to maintain awareness of BFV positions relative to the platoon formation or the dismounted rifle squads (if he remains mounted). . . . The platoon sergeant controls the mounted element when the platoon leader dismounts, or dismounts and commands and controls the platoon when necessary (METT-TC dependent). (Department of the Army 2010, 1-7-1-9)

In addition, the K21 IFV platoon should adopt the maneuver by section while it approaches a dismounting point to provide the dismounted infantry with continuous long range overwatch from the vehicles and to minimize the friendly damage by the enemies' direct fire. The M2 BFV platoon organization, which is organized into two sections of

two M2 BFVs each, suggests alignment of the platoon with the armor force, and proved its usefulness to fully utilize the vehicle's enhanced fire, maneuver, and surveillance capabilities (Haworth 1999, 39-40). Therefore, adopting the two-by-two organization of the M2 BFV platoon will significantly contribute to developing dismounting tactics of the K21 IFV.

## Solutions for the Challenge of Mounted Gunnery Training

The M2 BFV gunnery, a large fraction of the platoon's training program, had evolved steadily over the years from the early Infantry School syllabus to one more and more similar to armor practice (Haworth 1999, 140). Similarly to the M2 BFV fielding history, the mounted gunnery training will be the most difficult challenge of the K21 IFV units, which will be rapid adoption of the abundant mounted gunnery experience of the armor community. The author identified three more relevent sub-challenges of the mounted gunnery training to the K21 IFV units in the last step of analysis: target acquisition, target identification, and target engagement. Based on the findings from the mounted gunnery training analysis, the following solutions are provided.

First, effective mounted gunnery training aids and materials should be developed to solve the potential problems of target acquisition and identification. Since training in target acquision and foe recognition, especially with thermal imagery, will be desperately needed in the K21 IFV units, the ROKA should develop effective program of instruction and a gunnery manual. This program of instruction and gunnery manual should include identification of the causes and effects of thermal energy in relation to vehicular and other target images. The scale target and range training will be effective too. Various self-

propelled vehicular scale models can be remotely controled in the scale range depicting tactical situations within current state-of-the-art technologies for indicating target hit and miss are also available. Utilization of the scale target and range would require very limited terrain in the vicinity of the K21 IFV units. Properly developed and implemented, the scale target and range will substantially contribute to improving the K21 IFV mounted gunnery training.

Second, the ROKA should continuously improve the K21 IFV gunnery simulators and related training methodologies. There have been many trials and errors in developing optimum gunnery simulators for the M2 BFV over the last 20 years; and the simulator training has proved to be the most effective means of gunnery training to overcome scarce training resources, such as live-fire range, fuel, ammunition, and time. Although the K21 IFV has a well developed embeded training system (3D virtual image and sound generation), without proper ways of training and continuous improvement, this technology device's contribution to the K21 IFV gunnery training will be very limited.

Third, the ROKA should gain and maintain the proper number of the K21 IFV gunnery instructor NCOs. Because the vehicle mounted gunnery training is very unfamiliar to the ROKA infantry community, and very difficult to be led and developed by officers who frequently move to various types of infantry units (mechanized, light, airborne, etc.) and have only basic knowledges about the gunnery, the ROKA should assign the K21 IFV gunnery specialists to each echelon to lead and advise gunnery training and to prevent overtasking to the leaders and commanders of the K21 IFV units. The U.S. Army's employing master gunners assigned to the M2 BFV platoons and above are a good example.

> The primary mission of the master gunner is to train gunnery. The master gunner helps commanders at all echelons plan, develop, execute, and evaluate all Bradley-related training (individual, crew, and collective). . . . The master gunner assists the validation or certification of newly assigned soldiers; assists all elements in the unit concerning gunnery training; forecasts all ammunition for training; manages gunnery records; supervises live-fire ranges to ensure all standards are followed. . . . The master gunner has received formal training to function at battalion level. This includes extensive training in BFV maintenance, range plan preparation and execution, and all phases of gunnery training. (Department of the Army 2003, 3-7)

Fourth, the ROKA infantry school or other organizations should be designated as the center for developing the K21 IFV gunnery and tactics. As with the U.S. Army Infantry School and ARI, which played important role in developing M2 BFV gunnery and tactics for about 30 years, the ROKA needs central organizations to continuously develop the K21 IFV gunnery and tactics. According to the interview with Major Shin, the K21 IFV units' mounted gunnery training is heavily dependent on the NET program from a civilian company now. Without central organizations for developing the K21 IFV gunnery and tactics, it will be difficult for K21 IFV units to maintain high levels of combat readiness after the NET program ends. The designated organizations for developing K21 IFV gunnery and tactics should collect and analyze experiential data from the field and other relevant sources, and develop training and doctrinal guidance for K21 IFV units.

## Solutions for the Challenge of Dismounted Infantry Training

While the K21 IFV can reinforce tanks in the direct fire fight with its 40mm chain gun and anti-tank missiles, only the dismounted infantrymen allows the mechanized infantry force to produce complementary effects that the tank cannot achieve alone. However, overtasking of squad leaders, platoon leaders, and platoon sergeants will make

it difficult for them to train their soldiers on dismounted infantry skills. The failure in balanced training management for both the mounted and dismounted elements will precipitate the K21 IFV leaders' and commanders' lack of interest in dismounted infantry training. Research clearly indicates that traditional dismounted infantry skills will decline in the end. To solve this problem, the following solutions are recommended.

First and foremost, the functions of dismounted and vehicular leadership should be separated to prevent overtasking to squad leaders in the K21 IFV units. The squad leaders in the K21 IFV units cannot be served as both a vehicle commander and a dismounted squad leader any longer due to many additional tasks compared to the K200 APC units' squad leaders. Removing the platoon leaders and company commanders from the primary crews of their respective K21 IFVs, however, is not recommended although Major Gibbons (1995) suggested that idea to create favorable conditions for dismounted infantry training because the platoon leaders and company commanders cannot use the well-developed turret mounted surveillance system and battlefield management system which play key roles for commanding their units. Rather than excluding the platoon leader and company commander from the vehicular leadership positions, the ROKA should develop optimum institutional training programs for the K21 IFV leaders (platoon leader, platoon sergeant, and company commander) to mitigate the overtasking problem before they are assigned to the K21 IFV units.

Second, the ROKA should consider the adoption of a dismounted non-commissioned officer in charge (NCOIC), who is the most experienced NCO after the platoon sergeant, to mitigate the overtasking to the platoon sergeants of the K21 IFV units. He would, like the dismounted squad leaders, have a dismounted function only. He

would be the second-in-command on the ground under the platoon leader or platoon sergeant and he would normally ride in the platoon leader's vehicle. He would also substantially contribute to managing and improving dismounted infantry training in the K21 IFV platoon.

Third, the ROKA should adopt the concept of independent and combined element training in the K21 IFV platoons, which was proposed by LTC Severn in 1988, to balance mounted and dismounted training and to improve the efficiency in using training resources, especially time and training sites. Independent element training calls for the mounted element and dismounted element to train separately. Each element's training can be led by either a platoon leader or a platoon sergeant, and a platoon master gunner and a dismounted NCOIC also can lead and support the mounted and dismounted elements trainings. This training concept is based on the premise that mounted and dismounted forces fight better on different types of terrain; the K21 IFVs require relatively open terrain where they can best take advantage of their long range weapons; the dismounted element fights best from dense covered and concealed locations for the close-in fight, supported by long range fire from the mounted element; the two elements operate best on terrain where they can complement each other. By applying the independent element training, the K21 IFV platoons' training quality and efficiency can be enhanced.

Meanwhile, the combined element training, which generally means platoon training, calls for both elements in a platoon to train together under the leadership of the platoon leader or company commander. After achieving the qualification of each element of a platoon, the platoon integrates both elements' training as combined element training, culminating at the platoon live fire exercise. By adopting the concept of independent and

combined element training, the K21 IFV units will successfully achieve balanced training management both of mounted and dismounted element trainings. Therefore, the traditional dismounted infantry skills can be maintained and improved.

Fourth, to use training resources efficiently, the ROKA should refine the essential training tasks for the dismounted infantrymen of the K21 IFV units, and issue training aids and material needed to them. Instead of practicing common light infantry skills such as rappelling and long range road march, the training focus of the dismounted infantrymen of the K21 IFV units should be on the tasks more specific to working with tanks, such as breaching major tank obstacles, securing objectives, and employment of anti-tank systems. The refined essential training tasks will help the dismounted infantrymen better focus training efforts and maintain combat readiness while overcoming limited training resources.

Finally, the K21 IFV units must prevent soldiers from having the perception that dismounted soldiers are somehow inferior to the vehicle crewmen. Even in the K200 APC units, the commanders and leaders have tried to eradicate that perception for a long time. Without additional measures, that perception will be more intensified in the K21 IFV units due to the increased number of vehicle crewmen and radically improved capabilities of the vehicle, and it will lead to the failure in gaining mutual appreciation of each mounted and dismounted elements' capabilities and limitations required for the genesis of mutual support. To remedy this, regular rotating of these elements following each semi-annual or annual gunnery density, or frequent cross training for the dismounted infantrymen to experience mounted crew roles will be needed. A marginal decrease in the mounted gunnery proficiency would possibly result, the ability of the

infantry to provide complementary support to armor, its central battlefield focus, would increase accordingly (Gibbons 1995, 40-41).

## Summary

In chapter 4, the author analyzed the training challenges from the M2 BFV fielding and employment history, and found 21 important training challenges. These challenges were logically grouped into five categories: training doctrine, mounted gunnery training, dismounted infantry training, training support, and leader training. Then, he prioritized these five categories of training and identified three salient challenges which are directly related to the K21 IFV units: training doctrine, mounted gunnery training, and dismounted infantry training. After that, the author analyzed each salient challenge more in-depth, and suggested several possible solutions for each one. In the following chapter, this thesis concludes by summarizing the findings of the research, and offer some recommendations for future studies.

# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

## Conclusions

This thesis began with the basic premise that the training challenges faced by the ROKA in transitioning to the K21 IFV will be very similar, if not identical, to those the U.S. Army faced in fielding the M2 BFV. The K200 APC was very similar to the M113 APC in appearance and functions, and there was almost no essential difference between the K21 IFV and M2 BFV. In addition, there were important doctrinal and historical similarities between the fielding of the M2 BFV and that of the ROKA's K21 IFV. These circumstances demand that this paper will be useful for the ROKA to anticipate the training challenges of the K21 fielded units and find solutions for them.

The primary research question of this thesis was "What are the potential training challenges for the K21 IFV units?" To find the answer, the author analyzed various literature pertaining to the training challenges of the M2 BFV units for about 30 years, and found 21 important training challenges. These are the potential training challenges of the K21 IFV units.

He also found the major training challenges of the M2 BFV units shifted over time. For the first several years after the initial fielding of the M2 BFVs in the early 1980s, the major training challenge was defining the role of the M2 BFV on the battlefield and developing procedures guides for the mounted crew. Next, the training focus had generally been shifted on the mounted gunnery training for the following several years. Then, the U.S. Army aggressively developed a series of gunnery simulators from 1990s to early 2000s because training resources were becoming scarce. From about

2001, a very different kind of training challenge emerged, digitization training when the latest version of Bradley, the M2A3 BFV, was fielded. This finding will be useful for the K21 units to anticipate the change of major training challenges as time goes on.

The secondary questions were “What are the salient training challenges of the K21 IFV units?” and “What are the possible solutions for them?” To find the answers for these questions, the author logically grouped the 21 training challenges into five categories: training doctrine, mounted gunnery training, dismounted infantry training, training support, and leader training. Then, he prioritized these five categories of training challenges based on the analysis of the literature review and interviews with SMEs. As a result, he identified three salient challenges which are directly related to the K21 IFV units: training doctrine (TD), mounted gunnery training (MT), and dismounted infantry training (DT).

After that, a more in-depth analysis for each salient challenge conducted to find possible solutions. The author believes that these solutions, listed below, could minimize possible failures in training and related doctrine of the K21 IFV units.

1. (TD) Clearly state that the K21 IFV is only a new tool with which to perform the infantry mission which has traditionally been to support armor in the offense and to take and hold ground.
2. (TD) The ROKA Infantry School should play a central role in providing an integrated doctrinal basis for the K21 IFV training and employment.
3. (TD) Refine the relationship between the mounted and dismounted elements of the K21 IFV units; the mounted and dismounted elements are almost equally supporting and supported (depending mission variables).

4. (TD) Develop the tactics of dismounting infantry from the K21 IFVs
    a. Articulate the conditions which require the infantrymen to dismount from the vehicles.
    b. Refine the responsibility to lead the dismounted element of the K21 IFV platoon.
    c. Adopt the maneuver by section of the K21 IFV platoon.
5. (MT) Develop effective mounted gunnery training aids and materials to solve the potential problems of target acquisition and identification.
6. (MT) Continuously improve the K21 IFV gunnery simulators and related training methodologies.
7. (MT) Gain and maintain the proper number of the K21 IFV gunnery instructor NCOs.
8. (MT) Develop an optimum institutional training program for the K21 IFV leaders (platoon leaders, platoon sergeants, and company commanders).
9. (MT) ROKA Infantry School or other organizations should be designated for the K21 IFV gunnery and tactics development center.
10. (DT) Exclude the squad leader from the vehicular leadership position to prevent overtasking problem.
11. (DT) Consider the adoption of a dismounted NCOIC in the K21 IFV platoons.
12. (DT) Adopt the concept of independent element training and combined element training of the K21 IFV platoons.
13. (DT) Refine the essential training tasks for the dismounted infantry, and issue the training aids and materials needed to them.

In summary, the result of this study will help the ROKA anticipate the potential training challenges of the K21 IFV units and find the solutions for them. It will also contribute to attaining and maintaining a superior level of training and combat readiness within the K21 IFV units in the ROKA.

## Recommendations

The DOTMLPF (Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, Facilities and environmental concerns) is a joint tool providing integrated analysis and solutions to capability gaps (Command and General Staff College 2010, 3-5). Among the domains of the DOTMLPF, materiel is the hardest to change because it has been associated with the complex and time consuming defense acquisition process, and it is strongly related to other DOTMLPF components' development. Therefore, it is very logical that the ROKA's fielding the K21 IFVs (materiel) strongly affects other domains of the DOTMLPF, including training on which this thesis focused.

Because this thesis is the first exploratory research to find potential future training challenges of the K21 IFV fielded units, it did not designate a specific echelon to analyze, such as platoon, company, or battalion above. Browsing and analyzing overall M2 BFV fielding history of 30 years was very useful to anticipate salient training challenges of the K21 IFV units, and to navigate overall direction of the further studies.

Future studies should focus more on specific echelons, especially the company level and below because the author found that the majority of the training challenges in the M2 BFV units occurred at company level and below. To suggest more practical solutions, future studies also should be more focused on specific training topics mainly from the salient challenges the author found, such as the K21 IFV's role in the combined

arms warfare, developing mounted gunnery training aids and materials, and the K21 IFV squad and platoon leader span of control.

In addition, future studies can deal with other domains of the DOTMLPF rather than training. The radically upgraded capabilities of the K21 IFV will require the doctrinal changes in mechanized warfare, organizational and personnel changes, developing leaders, and improving facilities. Especially improved fire power and mobility will require more firing ranges, more ammunition, bigger training sites, and more fuel, which will become more difficult to acquire within the limited defense budget. These potential challenges from other domains of the DOTMLPF will be good topics for further study.

# APPENDIX A

## CONSENT AND USE AGREEMENT FOR ORAL HISTORY

You have the right to choose whether or not you will participate in this oral history interview, and once you begin you may cease participating at any time without penalty. The anticipated risk to you in participating is negligible and no direct personal benefit has been offered for your participation. If you have questions about this research study, please contact the student at:_____ or Dr. Robert F. Baumann, Director of Graduate Degree Programs, at (913) 684-2742.

To: Director, Graduate Degree Programs
Room 4508, Lewis & Clark Center
U.S. Army Command and General Staff College

1. I, _____, participated in an oral history interview conducted by

_____, a graduate student in the Master of Military Art and Science

Degree Program, on the following date [s]: _____ concerning the

following topic: _____.

2. I understand that the recording [s] and any transcript resulting from this oral history will belong to the U.S. Government to be used in any manner deemed in the best interests of the Command and General Staff College or the U.S. Army, in accordance with guidelines posted by the Director, Graduate Degree Programs and the Center for Military History. I also understand that subject to security classification restrictions I will be provided with a copy of the recording for my professional records. In addition, prior to the publication of any complete edited transcript of this oral history, I will be afforded an opportunity to verify its accuracy.

3. I hereby expressly and voluntarily relinquish all rights and interests in the recording [s] with the following caveat:

_____ None _____ Other: _____
_____

I understand that my participation in this oral history interview is voluntary and I may stop participating at any time without explanation or penalty. I understand that the tapes and transcripts resulting from this oral history may be subject to the Freedom of Information Act, and therefore, may be releasable to the public contrary to my wishes. I further understand that, within the limits of the law, the U.S. Army will attempt to honor the restrictions I have requested to be placed on these materials.

_____
Name of Interviewee Signature Date

_____
Accepted on Behalf of the Army by Date

REFERENCE LIST

Altomare, Nicholas F. 1985. Bradley NET. *Infantry* 75 (September-October): 33.

ArmyTechnology.com. 2011. Project. April 1. http://www.army-technology.com/project/bradley/ (accessed March 2, 2012).

Averna, Rechard. 2012. Interview by Changho Lee. June 5.

Bernier, Robert G.1988. The combined arms maneuver battalion. *Armor* 97 (January-Februay): 14f.

Briten, David W. 2012. Interview by Changho Lee. August 31.

Carmichael, John M. 1998. Devising doctrine for the Bradley fighting vehicle platoon dismounted element--finding the right starting point. Monograph, U.S. Army Command and General Staff College, Fort Levenworth.

Command and General Staff College. 2010. *What is DOTMLPF?* Fort Leavenworth, KS: Government Printing Office, May.

Department of the Army.1982. FM 100-5, *Operations.* Washington, DC: Government Printing Office.

———. 2010. FM 3-21.71, *Mechnized infantry platoon and squad (Bradley).* Washington, DC: Government Printing Office.

———. 2003. FM 3-22.1, *Bradley gunnery.* Washington, DC: Government Printing Office.

———. 1986. *White Paper, Bradley fighting vehicle.* Washington, DC: Government Printing Office.

Donga Daily. 2011. *Dongailbo.* http://news.donga.com/Politics/3/00/20110526/37544944/1 (accessed April 23, 2012).

Doosan DST. 2011. *K21 infantry fighting vehicle*. Seoul: Doosan DST.

———. 2009. *Korean infantry fighting vehicle (KIFV).* Doosan DST.

Ernest, Carl F., and David M. White. 1986. Bradley infantry on the airland battlefield. *Infantry* (May-June): 21.

Foss, Christopher F. 1992. *Jane's AFV recognition handbook.* United Kingdom: Butler and Tanner.

———. 1996. *Jane's tank and combat vehicle recognition guide.* Italy: Harper Collins Publishers.

Friedrich, Robert L. 1985. NET. *Infantry* 75 (September-October).

Gibbons, Edward G.1995. Why Johnny can't dismount--the decline of America's mechnized infantry force. Monograph, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

Hallenbeck, Ralph A. 1983. Reorganize platoon. *Infantry* 73 (November-December): 12.

Haworth, W. Blair. 1999. *The Bradlley and how it got that way: Technology, institutions, and the problem of mechanized infantry in the Uinted States Army*. Westport: Greenwood Press.

Hofmann, George F., and Donn A. Starry, ed. 1999. *Camp Colt to Desert Storm: The history of U.S. armored forces.* Kentucky: The University Press of Kentucky.

Joint Chiefs of Staff, the Republic of Korea. 2010. *Joint concept 2012-2016* (unclassified). Seoul: Joint Chiefs of Staff, the Republic of Korea.

Jones, Brian D. 1995. Cutting the foot to fit the shoe--the organization of the Bradley battalion and the 1993 Version of FM 100-5. Monograph, U.S. Army Command and General Staff College, Fort Leavenworth.

Ling, David H. 1993. Combined arms in the Bradley infantry platoon. Master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

Mayfield, David W. 2012. Interview by Changho Lee. August 31.

McDade, Michael B. 1986. Bradley fighting vehicle (BFV) driver trainer training development study (TDS). Research Product, U.S. Army Infantry School, Fort Benning.

Military Periscope. com. M2 Bradley mechanized infantry fighting vehicle. http://www.militaryperiscope.com/weapons/gcv/apc/w0003657.html (accessed March 2, 2012).

Ministry of National Defense, Republic of Korea.2010. *Defense white paper.* Seoul: Ministry of National Defense.

Perkins, Mike S. 1987. Analysis of Bradley fighting vehicle gunnery with emphasis on factors affecting first-round accuracy of the 25-MM Gun. Research Product, U.S. Army Research Institute, Alexandria.

———. 1988a. Development of aiming rules for the 25-MM Gun of the Bradley fighting vehicle. Research Note, U.S. Army Research Institute, Alexandria.

———.1988b. A technique for classifying vehicular targets as either frontal or flank views for use in range estimation and application of lead rules for the Bradley fighting vehicle. Research Note, U.S. Army Research Institute, Alexandria.

Perkins, Mike S., and Robert L. Rollier. 1986. Analysis of content and organization of the Bradley fighting vehicle commanders course. Research Product, U.S. Army Research Institute, Alexandria.

Rollier, Robert L., Margaret S. Salter, Paul R. Roberson, and John C. Morey. 1987. Effects of revised ammunition reloading procedures on reload time for the Bradley infantry fighting vehicle. Research Report, U.S. Army Research Institute, Alexandria.

Rollier, Robert L., James A. Salter, Jon G. Grabe, Paul R. Roberson, Kenneth W. Harbin, and Craig S. Wilkinson. 1988a. Bradley fighting vehicle system combat effectiveness: Evaluations of developments in tactics, training, and equipment. Research Note, U.S. Army Research Institute, Alexandria.

Rollier, Robert L., Margaret S. Salter, Mike S. Perkins, and Gary C. Bayer. 1988b. Review and analysis of BIFV operations under all visibility conditions. Research Note, U.S. Army Research Institute, Alexandria.

Rollier, Robert L., Paul R. Roberson, James A. Salter, Jon G. Grabe, and Kenneth W. Harbin. 1988c. *BIFV squad and platoon leader span of control.* Research Note, U.S. Army Research Institute, Alexandria.

Salter, Margaret S. 1984a. Bradley fighting vehicle procedures guide: Commander and gunner. Research Product, U.S. Army Research Institute, Alexandria.

———. 1984b. Bradley fighting vehicle procedures guide: Driver. Research Product, U.S. Army Research Institute, Alexandria.

———. 1998. Full crew interactive simulation trainer-Bradley (FIST-B): Limited user assessment . Research Report, U.S. Army Research Institute, Alexandria.

———. 1989. An introduction to the Bradley conduct of fire trainer: A videotape. Research Note, U.S. Army Research Institute, Alexandria.

———. 2001. Bradley fighting vehicle M2/M3 A3: Training and soldier system observations. Research Note, U.S. Army Research Institute, Alexandria.

Salter, Margaret S., and Kelly B. Rich. 2002. Preliminary user feedback of a prototype Bradley fighting vehicle M2A3/M3A3 embedded training system (BETS). Research Report, U.S. Army Research Institute, Alexandria.

Severn, Theodore R.1988. Air-land battle preparation: Have we forgotten to train the dismounted mechnized infantryman? Study Project, U.S. Army War College, Carlisle Barracks/

Shin, Sunguk. 2012. Interview by Changho Lee. September 2.

Spigelmire, Michael F. 1990. Commandant's note: Bradley platoon organization. *Infantry* (January-February): 2.

Sterling, Bruce S. 1996. Relationship between platoon gunnery training and live-fire performance . Research Report, U.S. Army Research Institute, Alexandria.

Strasel, H. C., D. C. Lockhart, R. E. Hilligoss, and J. A. Fusha. 1984. Analysis of gunnery training for the Bradley infantry fighting vehicle. Research Product, U.S. Army Research Institute, Alexandria.

The Korea Defense Daily. 2010a. K-21 infantry fighting vehicle (1). *The Korea Defense Daily*. January 11. http://kookbang.dema.kr/kdd/ToPrint.jsp?writeDate=20100125&kindCd=2001&mnSe... (accessed April 23, 2012).

———. 2010b. K-21 Infantry fighting vehicle (6). *The Korea Defense Daily.* March 8. http://kookbang.dema.kr/kdd/ToPrint.jsp?writeDate=20100308&kindCd=2001&mnSe. (accessed April 23, 2012).

U.S. Army Infantry School. 1980. Special Text 7-7-1, *The mechanized infantry platoon and squad.* Fort Benning, GA: United States Army Infantry School.

Urbina, Diane L. 1999. Lethal beyond all expectations: The bradley fighting vehicle. In *Camp Colt to Desert Storm: The history of U.S. Armored Forces*, edited by George F. Hofmann, and Donn A. Starry, 403-431. Kentucky: The University Press of Kentucky.

Whang, Joonsung. 2010. *Sports Seoul.* September 21. http://news.sportsseoul.com/read/economy/878759.htm (accessed April 23, 2012).

Zaloga, Steven J.1986. *The M2 Bradley infantry fighting vehicle.* London: Osprey Publishing.

Zaloga, Steven J., and James W. Loop. 1982. *Modern American armor: Combat vehicles of the United States Army today.* Harrisburg: Arms and Armour Press.

INITIAL DISTRIBUTION LIST

Combined Arms Research Library
U.S. Army Command and General Staff College
250 Gibbon Ave.
Fort Leavenworth, KS 66027-2314

Defense Technical Information Center/OCA
825 John J. Kingman Rd., Suite 944
Fort Belvoir, VA 22060-6218

Mr. Nathaniel Stevenson, Jr.
DJIMO
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Mr. Wayne C. Sodowsky
DTAC
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Dr. Timothy R. Hentschel
DJIMO
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Mr. Paul D. VanGordon
DJIMO
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301

Dr. Frank James
DTAC
USACGSC
100 Stimson Ave.
Fort Leavenworth, KS 66027-2301