Commander's Critical Information Requirements: The Key To A Commander's Battle Image

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by

Major Susan P. Kellett-Forsyth
Signal Corps

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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MAJ SUSAN P. KELLETT-FORSYTH

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ATTN: ATZL-SWV
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This monograph examines and explores the concept of Commander's Critical Information Requirements (CCIR). The analysis focuses on ways a commander can manage information overload to effectively deal with uncertainty and to ultimately ensure timely decisions are made. It examines the relationship between command and control, decision making, and information management.

Part I discusses how current doctrine defines CCIR and evaluates the adequacy of this doctrine for today's commander. This examination also presents several studies that focused on the development and identification of CCIR. Part I also looks at limitations that affect a commander's decision making abilities.

Part II examines how commanders in the field define, develop, and use CCIR. Four commanders were interviewed; Brigadier General Randolph House, Brigadier General John Sylvester, Lieutenant Colonel Terry Tucker, and Lieutenant Colonel Pat Ritter. Each of these officers commanded forces in combat during Operation Desert Storm. The interviews were concerned with each individual's general definition of CCIR, the development of his critical information requirements for specific tactical events, and the impact of the availability of the applicable CCIR.

Finally, the conclusion examines and analyzes the findings in Parts I and II. As a result of this analysis, recommendations are made to enhance the management of information to support effective decision making on the battlefield.

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Major Susan P. Kellett-Forsyth

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Approved by:

Robert H. Berlin
Robert H. Berlin, Ph.D — Monograph Director

FOR Terry Tucker LTC
Colonel James R. McDonough — Director, School of Advanced Military Studies

Philip J. Brookes
Philip J. Brookes, Ph.D. — Director, Graduate Degree Program

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> How disastrously the conditions of warfare have changed, making a commander as impotent as a ragdoll! Where now the battlefield that was no wider than one man's field of vision, across which he could gallop to a faltering commander and summon him to his side. Alexander Solzhenitsyn, August 1914.[1]

> Where, oh where are the good old days of the simple wars when, as the hour of battle approached, the commander got on his white horse, someone blew the trumpet, and off he charged toward the enemy. General Moshe Dayan[2]

Introduction

A battlefield that was no wider than one commander's field of vision has long been relegated to the past. Today's commander has the requirement to continuously visualize the battlefield. "Command means visualizing the current and future states of friendly and enemy forces and then formulating concepts of operations to accomplish the mission."[3] It is the commander's ability to visualize the battlefield that allows him to make the decisions that mean success on the battlefield.

The key to effective command and control is identifying and collecting the critical information that allows the commander to clearly visualize the battlefield. Martin Van Creveld in Command in War describes command and control as "a process that makes use of information in order to coordinate people and things towards the accomplishment of their missions."[4] This information is central to the commander's ability to make sound and timely decisions that will lead to the successful accomplishment of his mission.

Timely information gives the commander the ability to reduce the uncertainty that is characteristic of the environment in which he commands. Van Creveld asserts "From Plato to Nato, the history of command in war consists essentially of an endless quest for certainty."[5] This quest for certainty can be understood in terms of a race between the demands for information and the ability of command systems to meet this demand.[6]

Today, one of the greatest challenges to commanders in combat is the magnitude of available information. Modern technology has inundated commanders at all levels with thousands of bits of information. Their challenge is to assimilate this information to gain a picture or visualization of the battlefield in order to make sound and timely decisions to achieve victory.[7]

As armies have grown more complex, so has the amount of information made available by advanced communications technology. This exponential growth was illustrated by the command, control, and communications (C3) architecture designed to support the Persian Gulf War.[8] "The communications network established to support Operations Desert Shield and Desert Storm was the largest in history."[9] The final architecture established extremely complex linkages to the National Command Authority (NCA), sustaining bases in the United States, the military components of Central Command (CENTCOM), coalition forces, and other subordinate command

elements. "At the height of the operation, this hybrid system supported more than 700,000 telephone calls, 152,000 messages a day, and used more than 35,000 radio frequencies."[10] The capabilities of this communications structure illustrate the vital importance of information to the performance of military forces. This emphasis is evident in the following remarks made by command, control, and communications expert, Alan Campen:

> Armies that seek victory by fighting smarter-and this is now the foundation of U.S. Military doctrine-will quickly falter and die if the flow of battle information is interrupted or distorted....Accurate, precise and timely information lies at the heart of military endeavors on the battlefield.[11]

The C3 architecture of Desert Storm illustrates the complexity of an information rich environment and means greater challenges for today's commander. Operating in this environment is not just a challenge for military leaders. There is a general appreciation for the problem of identifying and managing critical information. In September 1993, the campaign operations group of the School of Advanced Military Studies at Ft. Leaveneworth, received a copy of a letter from Vice President Albert Gore's National Performance Review address to the Defense Intelligence Agency. The letter requested the identification of combat intelligence systems a commander would require to support combat operations. This subject illustrates the growing awareness of the looming problem of identifying critical information in an information rich environment. It recognizes that while technology has

drastically improved the ways to collect and transmit information, the processing and analysis of this information has lagged behind. Command and control technologies are striving to develop systems that will more readily provide the commander with the critical information he needs.

Despite this situation of information overload, the commander still has the responsibility to make decisions that will cause his forces to ultimately defeat the enemy. The commander must understand what information he needs to help illuminate the battlefield. FM 101-5, Staff Organization and Operations (Draft, 1993) states "the demands of modern warfare compel commanders--decision makers--to become effective information managers."[12] The commander's ultimate goal is to get the right information to reduce uncertainty so he can make effective decisions.

One tool a commander can use to help reduce this uncertainty is the Commander's Critical Information Requirements (CCIR). FM 101-5 (Draft, 1993) defines CCIR as "unknown but needed information of such critical importance to a commander's decision making process that it directly affects the successful execution of operations."[13] These critical information requirements are determined by the commander to reduce this mass of information to those elements that are critical to the commander's ability to make decisions. By identifying and selecting critical requirements, the commander is better able to visualize both the battlefield and the

outcomes of current and future operations. .CCIR is much like the focusing of a lens. It narrows the scope by reducing the abundance of information to that "critical" information needed to make timely and accurate decisions. Decision making is a vital component of command and CCIR is critical to the commander's ability to make decisions.

The purpose of this monograph is to examine and explore the concept of CCIR. Today's commander continues to have the problem of identifying critical information requirements in an information saturated environment. This problem is exacerbated by technological advances in communications systems which have significantly decreased a commander's time to make decisions. A commander is barraged with new and often very perishable information. If he decides not to immediately use the information to make a decision, the information may lose its timeliness and value to the current situation. As a result, he may need additional information before making a critical decision. Thus, the commander must be able to identify specifically what pieces of information he needs in order to make decisions that will cause the defeat of the enemy.

Decision making is most important to the command and control process which relies on information to enhance the commander's ability to make sound and timely decisions.[14] This monograph considers ways a commander can manage information overload to effectively deal with uncertainty and to

ultimately ensure timely decisions are made. It examines the relationship between command and control, decision making, and information management. Central to this monograph is the commander's ability to visualize the battlefield. It also considers how a commander can best acquire information to form this image of the battlefield.

The monograph begins by examining the evolution of the concept of CCIR. Part I discusses how current doctrine defines CCIR and evaluates the adequacy of this doctrine for today's commander. This examination also presents several studies that focused on the development and identification of CCIR. The first studies focused on developing a listing of the critical information requirements that commanders needed. This part illustrates why a standardized CCIR is not relevant. Subsequent studies considered the development of critical information requirements in a different way. They looked at these information requirements as a way for the commander to be better visualize the battlefield. Instead of establishing a laundry list of critical information requirements, information was developed to illuminate the commander's battle image. This approach is presented through an examination of the study, Understanding Commanders' Information Needs. Part I looks at limitations that affect a commander's decision making abilities. Since information management is closely linked to decision making, it is important to consider other

factors that may affect the decision maker besides the lack of critical information.

Part II examines how commanders in the field define, develop, and use CCIR. Four commanders were interviewed; Brigadier General Randolph House, Brigadier General John Sylvester, Lieutenant Colonel Terry Tucker, and Lieutenant Colonel Pat Ritter.[15] Each of these officers commanded forces in combat during Operation Desert Storm. General House and General Sylvester were brigade commanders while the other two officers commanded at the battalion level. The interviews were concerned with each individual's general definition of CCIR, the development of his critical information requirements for specific tactical events, and the impact of the availability of the applicable CCIR. The monograph also examines how the commanders acquired their CCIR and evaluates the effectiveness of the information delivery systems. Part II also compares some of the differences between commanders. One major difference concerned how commanders dealt with the chemical threat.

Finally, the conclusion examines and analyzes the findings in Parts I and II. As a result of this analysis, recommendations are made to enhance the management of information to support effective decision making on the battlefield.

> Many intelligence reports in war are contradictory; even more are false, and most are uncertain. What one can reasonably ask of an officer is that he should possess a standard of judgment, which he can gain only from knowledge of men and affairs and from common sense. . . . In short, most intelligence is false, and the effect of fear is to multiply lies and inaccuracies. Carl Von Clausewitz, On War.[16]

Part I

The concept of CCIR emerged during the development of automated command and control systems. In this development, automation was seen as effectively supporting the command and control actions for the commander. Automation would provide the commander with the ability to "see" the battlefield. In turn, CCIR would "identify the information elements required by the commander and provide the catalyst for his accurate decision making during the Airland battle."[17] In 1985, The United States Army Combined Arms Center Combat Development Activity (CACDA) conducted a study that identified the critical information requirements needed for decision making at the division commander's level. This CCIR established the baseline information requirements needed for the automated command and control systems. A follow-on study expanded this concept and proposed a set of CCIR for use at corps, brigade, and battalion levels as well. This study's underlying purpose was to ensure that once the minimum information requirements were identified, they were embedded in the data base of the automated command and control systems. At the time, the Maneuver Control System (MCS), was the automated command and

control system used in the execution of airland battle doctrine.[18] The effort seemed to be in developing CCIR that would fit the command and control system rather than the reverse.

While efforts continue to fully automate the command and control process, the concept of CCIR has endured and evolved into doctrine. The new 1993 draft of FM 101-5, Staff Organization and Operations, includes CCIR as one of the three categories of information in chapter 6, Combat Information Management. These categories consist of routine, CCIR, and exceptional information.[19]

"Routine information is the standard, repetitive information essential for day-to-day unit operations."[20] Unit Standard Operating Procedures are a major source of routine information. Routine information is usually used between staffs and very little of this information is needed by the commander. If the commander requires some aspect of routine information, he categorizes it as critical or exceptional information.

"Critical information directly affects the successful execution of operational or tactical operations."[21] The commander is responsible for developing his own critical information requirements. His identification of required information focuses the efforts of his staff. The staff continues the development of the CCIR by further categorizing it into three components: priority information requirements

(PIR) or how the commander sees the enemy; essential elements of friendly information (EEFI) or the information the enemy needs to affect the friendly forces actions; and friendly forces information requirements (FFIR) or the information the commander needs to make decisions about his own forces.[22]

The final category of information is exceptional information.

> Exceptional information is specific and immediately vital information which directly affects the success of the current operation by signaling the occurrence of one or more unpredictable, extraordinary events--either an unforeseen opportunity for success or an early warning of a pending emergency. It is strictly commander's business.[23]

What makes exceptional information different from CCIR is not altogether clear although it appears to be its time sensitivity and the way it is transmitted. While CCIR is normally transmitted over command channels, exceptional information is "transmitted directly to the commander in as near real time as possible by whatever means is immediately available, skipping echelons if necessary."[24]

Officially, the concept of CCIR is not yet published as doctrine. The current FM 101-5, dated May 1984, does not discuss a commander's critical information requirements. Its discussion of information puts the impetus on the staff to provide the commander with the information that they think he needs. The draft version of FM 101-5 identifies and describes the term CCIR. Commanders in the field have started using the term in their planning. This may be a result of being exposed

to the staffing of the draft or as a result of newly assigned officers who just completed the Command and General Staff Officers Course. CCIR is now included in the curriculum and is espoused in the school's manual, Student Text 100-9, The Tactical Decision Making Process.[25] LTC Scott Carey, a command and control observer-controller for the Battle Command Training Program (BCTP) has seen some commanders reference CCIR in their operations orders during BCTP conducted "Warfighter" exercises. However, there has been no consistent use of this concept.[26] During a review of intelligence and command and control battlefield operating systems summaries for 75 percent of the National Training Center (NTC) rotations during 1992, no references were made to CCIR.

This inconsistent use illustrates that there may be a problem with this concept of information. Since the concept of CCIR is not yet approved doctrine, there may be an unwillingness to implement it. Or the process for developing CCIR may not be understood very well. Commanders know that they need certain pieces of information to make critical decisions but the CCIR process as written may not help them develop the required information. It is likely that commanders identify these pieces of information without referring to them by the doctrinal name of CCIR.

Exceptional information, as a new category of information, also confuses the issue of CCIR. If commanders

have identified CCIR as the critical information requirements they need, it is difficult to discern how exceptional information differs. CCIR has been further defined by its subcategories of PIR, EEFI, and FFIR, and has become confusing and less responsive to the needs of the commander. A simple concept, CCIR, has been made more complicated by increasing its range of available information options. Doctrine writers need to relook the issue of CCIR and exceptional information. There is too much similarity between the two types of information and unless each type is better explained, neither form of information will be used appropriately.

The three categories of information outlined in FM 101-5 (Draft), represent a means to manage information. There appear to be two schools of thought on how to satisfy a commander's information requirements. One method explores ways to identify and prioritize a listing or menu of required information options. Several studies were conducted that attempted to develop a list of commanders' critical information requirements based on studies that identified those critical items most frequently used. The second method of information management presents ways to better share the commander's image of the battlefield. A commander has a certain visual image of the battlefield. His ability to communicate this image to his subordinates drives his information requirements. If his subordinates share his image

of the battlefield, they can more easily identify the critical information requirements the commander is missing.

Several studies support each method of information management. The United States Army Combined Arms Center Combat Development Activity (CACDA) published "Division Commander's Critical Information Requirements (CCIR)", a study that developed a listing of commander's requirements, in April 1985. In 1984, the Army Vice Chief of Staff had directed CACDA to identify and update a commander's critical information requirements. With this tasking, CACDA developed a three phase research methodology. The first phase surveyed "all active component division and corps commanders and commandants of branch schools to determine if there [was] a consensus on a set of critical information requirements."[27] During phase 2, a general officer working group convened to discuss and validate a CCIR product. The results of the survey conducted in phase 1 helped to focus the working group's efforts. Phase 3 searched for additional sources that contributed to the development of CCIR. The results of this study constituted "the first documented specification of a commander's critical information requirements."[28]

The study found "there [was] a finite set of information elements critical to a division commander's decision making process."[29] The study acknowledged the importance of CCIR and stated "CCIR must take priority in

information distribution throughout the command and control system."[30]

Advanced technology in the automation of command and control systems provided the impetus for this study. In order to effectively automate command and control systems, the commander's baseline information requirements had to be identified. These requirements, CCIR, were then compared to the database definition document used for all objective command and control systems, the Force Level Information Requirements Plan (FLIRP).[31] Accordingly, the FLIRP was adjusted in order to include those critical information requirements identified in the study, but not a part of the original FLIRP.

A follow-on study, "Development and Analysis of Commanders Critical Information Requirements," used the division CCIR developed by CACDA as a baseline and extended the CCIR concept to the corps, brigade, and battalion level.

> This study had two major objectives; the first objective was to identify a candidate set of CCIRs that would be consistent in format and amenable to automation; and the second objective was to validate the proposed CCIR by enlisting the collective experience of incumbent commanders and staff officers.[32]

The study made several key observations relating to critical information. First, "commanders at each of the three echelons assessed, corps, brigade, and battalion expressed similar information needs regarding friendly units, enemy intentions and vulnerabilities, and status of friendly combat units."[33]

Second, the study found that battalion commanders required more detail than the other two levels of command. The study also found that

> both the battalion and brigade commanders felt they were close enough to the battle to know all they had to know about the enemy situation and acknowledged that they were the primary source of intelligence information, to be reported up to division and corps through their S2 cells.[34]

The brigade and battalion commanders also observed the intelligence products available from higher were delivered in a timely manner and were normally regarded as history.

While these studies have identified the commander's information baseline requirements, they focused on establishing requirements to automate for effective command and control systems. Despite this focus, advanced technology has been unable to fully develop an automated command and control system that implements these critical requirements and supports the commander's information needs. Certainly, systems have been developed to automate command and control functions and several systems are currently under development that may allow the commander to select the information he needs from an up-to-date data base. However, until a more responsive automated command and control system is designed and distributed, the commander still faces the dilemma of identifying and attaining the critical information he needs to make timely decisions.

While many studies try to develop an all inclusive list of a commander's critical information requirements,

several studies offer a different approach to information management. This method looks for ways to effectively support the commander's image of the battlefield.

> The commander seeks a dynamic image of the battlefield that will lead him to understand what action needs to be taken. The meaning of any information gained by the commander is driven by the image that frames it, and the value of the information is determined by the manner in which it fits into the image.[35]

Understanding Commanders' Information Needs is a study that examines how information best supports the commander's image of the battlefield. The Arryo Center conducted the research and analysis for this report and published in June 1989.[36] The project's sponsor was the Commander, Combined Arms Combat Development Activity (CACDA) who also conducted the studies that produced the reports, "Division Commander's Critical Information Requirements" and "Development and Analysis of Commanders Critical information Requirements", discussed earlier in this monograph. CACDA's sponsoring of the new study demonstrates the previous method of identifying CCIR was not adequate to meet the needs of the commander. The introduction of the report addresses this very issue.

> These studies [referring to those mentioned above], most of which resulted in lists of commanders' information needs, have conceptual and methodological flaws that severely limit their usefulness. More important, we maintain that these studies have missed the main point of the problem. Commanders' information needs are rarely specific pieces of data but are instead highly variable and human-intensive elements.[37]

This study examined information from the perspective of information science and social psychology. The study's authors observed command posts at Army group, corps and division level during 12 different exercises. During these observations, they focused on the content and flow of command and control communications and tried to ascertain why individuals communicated information and to what ends the information was used.[38]

The study developed the idea of the commander's image being central to his information needs. Not only was the commander's image the mental model of the battlefield, it also included a variety of other aspects to include military, political, and psychological considerations. The commander developed his information needs in the context of this image coupled with a corresponding understanding of the capabilities of his staff. Since the value of any particular piece of information could not be determined out of context, it was impossible to construct any abstract measure or prioritization of the commander's information needs. The commander developed his image of the battlefield mainly through an analysis of his mission, the enemy, terrain, his own troops, and the time available (METT-T). This analysis created the basic image. The commander filled out this image by applying his past battlefield experience and ability to anticipate future operations and extended the image over time as well.

The study identified three modes of information exchange that a commander uses when assessing his battle image. The study identifies them as the pipeline, the alarm, and the tree modes.

"The pipeline mode of information exchange is a largely one-way transmission of information that proceeds according to a set order and a set format."[39] When a commander receives a formal decision briefing, he is operating in the pipeline exchange mode of information. He receives the information in a set format and makes a decision. Standardized reports and forms are another example of pipeline information exchange. Pipeline exchange is inadequate when certain information is not included in the pipeline. Since this is a standardized way of processing information, only specified information is passed and anything out of the ordinary is not readily available.

The alarm mode is used to provide information by exception. The commander makes certain inferences and has alarms set to trigger the transmission of specific information if an event occurs. "Making an inference is a psychological activity; it consists of drawing a conclusion from evidence, of arriving at certain opinions or beliefs on the basis of others."[40] There are two ways to set alarms. Commanders may explicitly state what events trigger an alarm for information or subordinates, who clearly understand the commander's image, may set the alarms for the commander themselves. A

commander's CCIR is one example of setting explicit alarms. "The key to successful alarm mode rests on whether the commander's image is shared; only then can the system respond appropriately to image violating events."[41]

Finally, the tree mode is "an inquiry-based, demand-pull means of searching for and acquiring information."[42] The commander uses the tree mode to test the validity of his image. Pipeline or alarm provided information triggers the commander's need for additional information to either clarify or alter his image. His demand for information and the data he receives may then trigger new requests again. "The tree mode is the most interactive and iterative mode of information exchange."[43]

These three information modes work in concert to help the commander construct and maintain his image of the battlefield. This system of information management was designed to enhance the commander's ability to share his image of the battlefield with his subordinates. It takes a different approach to how commanders may develop their critical information requirements. Instead of focusing on what makes up a critical requirement, it examines how to develop these requirements.

Regardless of how critical information requirements are developed, their primary purpose is to help the commander make better decisions. FM 100-5, Operations, identifies decision making as one of the vital components of command.

"Decision making is knowing if to decide, then when and what to decide.[44] A commander must visualize the effects that his decisions may cause. His decisions shape the battlefield and set the conditions for success. Decision making is not just focused on the final outcome, but includes the lengthy, complex process of collecting and analyzing the information that precedes the final decision. Once a decision is made, it is translated into action. The commander is the key link in this process. He transforms the information he receives into decisions which in turn direct specific actions.

> In an important sense, all decision is a matter of compromise. The alternative that is finally selected never permits a complete or perfect achievement of objectives, but is merely the best solution that is available under the circumstances.[45]

The effectiveness of the decision ultimately depends on the commander. With this dependence comes certain limitations. Linked to the commander's ability to make decisions is the theory of bounded rationality formulated by Herbert Simon[46]

> The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world- or even for a reasonable approximation to such objective rationality.[47]

This theory recognizes the cognitive limitations of human decision makers as one of the determinants of an organization's performance. Some of the consequences of bounded rationality are the decision maker uses simplified internal models of situations in order to deal with these

situations, and social and organizational forces largely determine the procedures and limits used in this decision making process.[48] Studies have examined the possibility of identifying the bounded rationality constraint which sets an upper limit on the amount of information that can be processed.[49]

An individual can only handle a finite number of variables before his performance begins to decline. A commander can only assimilate so many items of information before his ability to make decisions is impaired by the volume of information. While information is crucial to effective decision making, too much can cause a decline in performance. This presents a dilemma for the commander who must achieve a balance between the amount of information he receives and the amount he needs. It becomes a necessity to identify those critical information requirements that allow the commander to make timely decisions and at the same time, not create an overload.

> We must have the moral courage to make tough decisions in the face of uncertainty-and accept full responsibility for those decisions-when the natural inclination would be to postpone the decision pending more complete information. To delay action in an emergency because of incomplete information shows a lack of moral courage. We do not want to squander opportunities while trying to gain more information.[60]

Part II

Commanders must make tough decisions in the face of uncertainty. Their ability to visualize the battlefield is essential to making sound and timely decisions. Based on their training and experience, commanders are able to identify the information that is critical to effective decision-making.

Part II examines how different commanders developed and applied critical information to their decision making process. Each commander interviewed led his unit in combat during Operation Desert Storm. Each commander had to deal with uncertainty and attempted to reduce this uncertainty by obtaining critical information, in a timely manner, to make effective decisions. For the most part, the four commanders'; Brigadier General House, Brigadier General Sylvester, Lieutenant Colonel Tucker, and Lieutenant Colonel Ritter, view of critical information requirements were quite similar. While their process and emphasis may have differed, each commander used information to better 'see' the battlefield.

Brigadier General Randolph House, an infantry officer, commanded the 1st Cavalry Division's 2d "Black Jack" Brigade. The brigade began deploying to Saudi Arabia on 16 September

1990. After linking up with its equipment at the Saudi port of Ad Dammam, the brigade moved to its first assembly area 160 kilometers west of the port. In January 1991, the brigade moved to a tactical assembly area located in northern Saudi Arabia in the vicinity of the Wadi al Batin. The brigade moved further north again to a position just north of the city of Hafar al Batin. By 26 January, the brigade took up defensive positions approximately 30 kilometers south of the Iraqi border, just outside of Iraqi artillery range.[61] "The primary focus of the Brigade Battle Task force was the defense of the high speed avenue of approach down the Wadi al Batin and the Ruqi road."[62] An Iraqi attack was a very real possibility and a preemptive attack along the Ruqi road, a high speed avenue of approach that led to a major logistics base located at King Khalid Military City, would seriously affect any future offensive operation.

The 2d Brigade, besides serving as a part of the theater reserve, was also a key player in the overall deception plan.

> While VII Corps was positioning forces to the west in preparation for the huge flank maneuver that was to commence on ground day, (G-day), 2d Brigade was planning a series of pre-ground day combat operations designed to convince the Iraqis that the main attack was coming up the Wadi [al Batin], diverting attention from the main effort to the west. These feints were brigade level combat operations involving the synchronization of all combat multipliers.[63]

The interview with General House focused primarily on his critical information requirements during these brigade level

operations that were later referred to as the Battles of the Ruqi Pocket.

Brigadier General House described the development of his critical information requirements as an intuitive process. This was gained from his interaction with soldiers, both in and out of his brigade, to get a "feel for what was important."[54] He defined CCIR as "any item that would affect accomplishment of the mission, protection of the force, or cause him to make a major decision other than business as usual."[55] General House used CCIR as a tool to gain a battlefield and situational awareness which helped him acquire an image of the battlefield. He could only achieve this image by moving about the battlefield and gathering information from a variety of sources. As he gained an appreciation for the situation, he developed other CCIR to further clarify his visualization of the battlefield. General House did not stay in the tactical operations center (TOC) since the reports in the TOC were normally 24 hours behind and did not give him the same appreciation or feel for the situation that moving among his units did. During Desert Shield and Desert Storm, General House put 15,000 miles on his HMMWV, another 1,000 on his tank, and another 1,000 on his command vehicle.[56]

Every night, during operations in the Ruqi Pocket, General House would drive up to the knoll where his scouts and ground surveillance radar were located. From their position, they could see ten kilometers north, down the Ruqi road ,and

would be the first to see any large Iraqi force approaching the brigade's sector. Each night, General House would emphasize the criticality of their mission and would tell the team that if anything went wrong, their equipment failed or they lost communications, they were to come to his tank, parked close by, and wake him up. He considered this nightly ritual to be part of his CCIR since their information was critical to the brigade's ability to respond to an Iraqi attack. Before falling asleep, he would call his operations center and tell them specifically what he wanted them to track and if they received other specific items of information, to wake him up.[67] This idea corresponds to the alarm mode of information discussed in Determining Commanders' Information Needs.

Other critical information requirements focused on the enemy. In order to attain the level of detail he required and to stress the importance he placed on learning about the enemy, General House tasked his staff to find out the names of the enemy commanders opposing him. As a force protection issue, he also wanted to know about any enemy artillery that could range any of his units.

During the Gulf War, General House felt that while he was inundated with information, he mainly had the information to make four star decisions, but not what he needed to make brigade command level decisions. This obviously put him in a quandary since he commanded a brigade. His mission was to

focus the enemy efforts on the wadi and not allow them to move west. From national intelligence assets, he received extremely accurate overlays that depicted the Iraqi defensive positions in very high resolution. On these overlays, directly in front of his brigade's positions, was a five mile fire trench that did not show any of the normal supporting positions. This did not make sense, so General House tried to find out more about this particular fire trench just over the hill. Every night an unmanned aerial vehicle (UAV) would fly north over his head taking pictures of this particular fire trench. Day after day, he tried to get the information from the UAV to no avail. It was not until he launched his reconnaissance in force operation, Knight Strike, prepared with bridging equipment to breach the trench, that he discovered the fire trench was a newly asphalted road!

General House used CCIR to fully develop his image of the battlefield. By moving around among his units and checking with his peers, superiors, and subordinates, he was better able to validate and clarify his image. Based on his awareness of the battlefield and the situation, it was his decision to plan for a reconnaissance in force up the wadi. This decision proved fortuitous as he had less than 12 hours to plan and conduct an operation to move up the wadi.

General House also developed CCIR by visualizing an entire operation and identifying the critical aspects of the operation. As the brigade prepared to move 300 kilometers

west, it was evident that fuel would be a critical issue to support the move. When General House could not communicate with the officer in charge of the fuel tankers, he sent his executive officer (XO), a lieutenant colonel, to locate the tankers. Once his XO found the tankers, General House instructed him to stay with the tankers until they reached their appropriate destination. As a result of identifying the status of the fuel tankers as a critical information requirement, 2d Brigade had enough fuel to take make the move and to refuel several other units that had failed to anticipate the requirement. General House's ability to visualize the operation, combined with his battlefield awareness, allowed him to identify and pursue the critical information requirements needed for success.

Brigadier General John Sylvester, an armor officer, commanded 2d Armored Division's 1st "Tiger" Brigade. Initially scheduled to be inactivated in 1990, the Tiger Brigade was tasked to round out the 1st Cavalry Division. The National Guard Brigade that normally rounded out the division was not immediately activated and General Edwin Burba, Commander of Forces Command, made the decision to send the Tiger Brigade in its place. When the ground war began on 24 February 1991,

> the Tiger Brigade was under the operational control of the 2d Marine Division, preparing to breach the first of two Iraqi obstacle belts between the Kuwaiti fields of Umm Gudair and Al Manquish. Their mission, after penetrating Iraqi defensive positions, was to attack and destroy enemy reserve forces in the

> northwestern quadrant of occupied Kuwait, sever supply lines to Iraq and seize the tactically significant terrain to the northwest of Al Jahra, a northern Kuwaiti City that served as a nexus for the Iraqi III, IV, VI and Special Gulf Corps holding Kuwait.[68]

The focus of the interview with General Sylvester was on the development of his critical information requirements as he breached the Iraqi obstacle belts and moved forward to complete his mission.

General Sylvester felt his information support was inadequate during Desert Storm. He believed that this problem of not enough information was due in part to his unit's attachment to the Marines. While he had sufficient amount of information to make effective decisions prior to the start of the battle, once he breached the Iraqi defenses he had problem figuring out the difference between the truth and the result of someone else's best guess. General Sylvester developed and designated CCIR to his staff and subordinate commanders. His most critical information requirement was finding out about the enemy's use of chemicals. It was the one unknown that would instantly get his attention. This critical information requirement was expressed in his commander's intent as well. His subordinate commanders and his staff clearly understood the importance of the use of chemicals. To illustrate the emphasis he placed on this CCIR, the first question that General Sylvester asked of captured senior Iraqi officers was "what is the chemical threat?"[69]

General Sylvester discussed what he considered to be one of his failures during the war. In order to prepare for his brigade's combat missions, he had thought his way through the battle and had visualized how the brigade would conduct operations. What he had failed to visualize, however, was the change in nature of the threat. Following the war, he spent time trying to better understand the enemy in depth. Using a framework developed by Training and Doctrine Command (TRADOC), General Sylvester examined the enemy's doctrine, training, organization, materiel, his leaders and their leadership, and his soldiers. What he discovered was that the enemy was arrayed in three defensive belts on the battlefield.[60] It was almost like fighting three different enemies. The critical information he developed and looked for on the battlefield had changed as the enemy changed. Since General Sylvester had not recognized the difference between the defensive belts, he had not adjusted the indicators he used to identify the enemy.

The first belt consisted of poor soldiers who were draftees and conscripts. They were mainly led by mediocre leaders, had poor quality equipment, and used a doctrine that combined Iraqi and Soviet tactics. General Sylvester encountered this first striation on day one of the ground war. Once his brigade had made it through the breach, he pushed out as far forward as his limit of advance. At this time, the Marines called a halt in operations in order to bring the remainder of their forces on line. From his position, General

Sylvester was able to observe enemy armor maneuvering to his front, but could not move to engage it since it was beyond his limit of advance.

The next morning, he asked and was granted permission to move forward. As he prepared to move, he received a call from the commander of the 10th Marine Artillery who had been taking enemy artillery fire all night. The Marine commander requested support from Brigadier General Sylvester's Multiple Launch Rocket System Battery (MLRS) in order to mass artillery fires on the enemy's artillery position. General Sylvester approved the request and continued to prepare for his attack by moving a TOW section forward to cover his flanks. As these weapon systems fired on and destroyed the enemy's armored vehicles, several hundred Iraqi infantry men came out of their defensive positions and began surrendering. As the surrendering Iraqis began moving towards the friendly forces' positions, they walked right into the massive artillery fires that had been coordinated earlier.

Based on this incident, General Sylvester made the decision not to fire artillery preparations prior to an attack. He did not want to kill surrendering Iraqis with artillery. This was important since he had observed that all he had to do was kill the enemy's armor and the infantry soldier would surrender. He failed to recognize, however, that he had made this decision based on his information of the first defensive belt of soldiers. He did not start leading

with artillery again until an incident killed several of his soldiers. As per established procedure, his unit had killed all of the enemy's armor and had moved in to clear out the area. As they moved into the positions, enemy infantry started firing from the positions unexpectedly and killed one of his soldiers and wounded several others.

General Sylvester's men had encountered a new striation of soldiers that were better trained, equipped and led. His inability to visualize the battlefield throughout its depth had caused him to make a decision that he would not have made given the information of the three striations of enemy forces.

Lieutenant Colonel (P) Terry Tucker, an armor officer, commanded 3rd Armored Division's 4th Squadron of the 7th Cavalry. As part of VII Corps' Frag Plan 7, which provided "a blueprint for wheeling the corps to the east and hitting the Iraqis in the flank", 4/7th Cavalry screened the division's 1st Brigade's front in the east and along the division's southern boundary.[61] Elements of 4/7th Cavalry became engaged in a fierce fire fight and would lose several soldiers and vehicles before the 1st Brigade was able to move safely forward. Their mission was to identify the defensive security positions of the Tawalkana Division that preceded its main defensive belt.

The plan was to pass 1st Brigade, with its superior fire power, through the Division's cavalry before it came into

contact with the Tawalkana's main defense. Unfortunately, this did not occur. "The Americans, blinded by the shamal [a terrible storm with 30 knot winds and visibility that rarely exceeded a few hundred yards], had rambled into an Iraqi kill sack, closing to within six hundred yards of the enemy guns."[62] The interview with LTC Tucker focused primarily on his critical information requirements during this battle. It also looked at the way he developed his squadron's plan to achieve the division and brigade commanders' critical information requirements as well as his own internal CCIR.

Lieutenant Colonel Tucker defined a commander's critical information requirements as the information he needed as a squadron commander to make decisions to plan and fight. As a cavalry squadron battalion commander, his mission was unique because he had to provide the division and brigade commanders with information to satisfy their own critical information requirements. LTC Tucker accomplished this mission by clearly understanding his division and brigade commanders' intents and by receiving one on one guidance from these commanders. LTC Tucker said that he never had a problem knowing what his supported commanders wanted and he always sought to provide current, accurate, and useful information to aid them in their decision making process. He believed that there was an inherent problem with the overall intelligence system. Combat intelligence was antithetical to information gathered by the cavalry in that it was debated and analyzed

until it became historical and therefore, not really useful to the commander. While he was developing information to answer his superior's CCIR, he also had to develop his own internal CCIR to support this search for information. LTC Tucker's own critical information requirements focused on force protection. Simply, he wanted to know the location of the enemy, his capabilities, and his intentions.[63]

LTC Tucker took his commanders' intents and guidance and translated it into action. He spent weeks prior to the ground war doing detailed reconnaissance of the division's route from King Khalid Military City (KKMC) to the Wadi al Batin, across the pipeline up to the Iraqi border. This detailed reconnaissance helped the commanders make critical decisions in preparation for the offensive fight of the ground war.

Prior, collective training was essential to the abilities of LTC Tucker's subordinate commanders when faced with making decisions in combat. The two to three months together before the start of the ground war gave LTC Tucker the luxury of working closely with his commanders on each of the squadron's missions. He ensured that each of his commanders understood the mission, his guidance and his intent. He spent a great deal of time talking about intent and made sure they were very clear on his intent due to the nature of the cavalry mission. Due to the sheer distances, his commanders were often out of communications range and had

to make decisions based on the commander's intent. Their training in problem solving prior to the ground war assisted them in their decision making during combat.

Not only was his subordinates training essential to their ability to make decisions, but LTC Tucker also felt that his ability to effectively command in combat was due to his extensive training base developed at the National Training Center (NTC) and the Combat Maneuver Training Center (CMTC) at Hohenfels, Germany. What he learned at the decision maker level during his four rotations to the NTC and three rotations to the CMTC, was to concentrate on being a rational decision maker during difficult and uncertain situations. He had to figure out what he knew, what he did not know, and then went with the "gut feel" which he described as being purely a matter of experience. When LTC Tucker's unit came into contact with the Tawalkana Division's main defenses, he found himself thinking about how he would fight the battle at the National Training Center. During the direct fire engagement, he tried to stay one step ahead of the current fight. He asked himself: What was going to happen next? Where was the enemy artillery? Where was the enemy located? This series of questions sought to elucidate the battlefield situation. Following this mental process, LTC Tucker queried his subordinate commanders with these same questions. During the firefight with the Tawalkana Division, LTC Tucker called the assistant division commander (ADC) and asked the ADC what he

thought was in front of his forces. He wanted to alert the division on his need for critical information to make effective decisions.

Like LTC Tucker, LTC Pat Ritter commanded at the battalion level. An armor officer, commanded 1st Battalion, 34th Armor. Part of the "Big Red One", 1st Infantry Division, LTC Ritter's mission was to pass through the breach of the Iraqi defenses in the west and assault an Iraqi Company located behind the defensive lines. Following the breach, his battalion was to become part of the theater reserve force. The decision was made, however, to move elements of 1st Infantry Division, LTC Ritter's battalion included, to pass through and relieve the 2nd Armored Cavalry Regiment who was in contact with the Tawakalna Division. "Ritter and the other two battalion commanders in his brigade were told that they would have to locate the 2nd Cavalry in the pitch black night, edge through the regiment's rear forces while it was fighting the Iraqis, pick up the running tank battle, and continue until the Tawakalna division was destroyed."[64] LTC Ritter's battalion conducted an orderly passage of lines through the 2nd Cavalry Regiment and attacked and destroyed one of the Tawakalna's battalions with a loss of only one soldier. The interview with LTC Ritter focused on his critical information requirements during the conduct of this attack. It also examined the way he developed his CCIR in preparation for the start of the ground war on 24 February 1991.

LTC Ritter said that his CCIR during Desert Storm was driven by his commander's intent which mirrored both his brigade and division commanders' intents. In fact the words at all three levels were exactly the same. Simply, his intent said, "when your organization has passed through an enemy organization, the enemy's equipment will be destroyed, his soldiers will be in one of three conditions: killed, captured or buried."[65] His intent drove what he needed to know for CCIR and these requirements did not change from the breaching operation, to the movement to contact, to the passage through 2nd ACR and the subsequent attack(s). The CCIR that was first and foremost for LTC Ritter was the location and intent of enemy. His intelligence officer knew that this was critical and expended all of his efforts attempting to get this information. For the breach operation, LTC Ritter had all the information he needed. He knew the exact location of where he was going to breach and what enemy forces were in that vicinity. Following the breach, however, he did not have enough information. The only intelligence he had about the Tawakalna Division forces he was to attack, were three grid coordinates that marked the center of mass of three enemy battalions in his zone. Luckily, the first battalion he came into contact with was located at one of the three coordinates which validated the information and helped clarify LTC Ritter's visualization of the battlefield.

For LTC Ritter, CCIR seemed to be obvious and clearly delineated by the commander's intent. The commander's intent painted a mental picture of what needed to occur and the critical information requirements became apparent as LTC Ritter mentally visualized accomplishing the commander's intent. During the interview, however, LTC Ritter realized that he had subconsciously developed a critical information requirement dealing specifically with the chemical threat. Although not published as one of his critical requirements, when he reviewed the current intelligence situation reports each day, he would always look first at the status of enemy chemical delivery systems and enemy chemical production and storage facilities which often had been destroyed or damaged. Based on his analysis of this information, he believed that chemicals were not a threat to his unit and as a result, he decided not to wear any protective outer garments or his protective mask when leading his battalion during combat operations even through the breach. He explained what he was going to do to all of his tank commanders and left the decision of wearing protective garments to their discretion.

LTC Ritter's belief that chemicals were not a threat and his decision not to wear chemical protective over garments sharply contrasted with the view of Generals House and Sylvester. For General House and General Sylvester, the threat of chemical attack was very real and one of their most critical information requirements. When General House

conducted his reconnaissance in force of the wadi, he was in MOPP two (wearing protective clothing, carrying mask and gloves) with his mask out of his carrier, ready to be donned at a moments notice. General Sylvester breached the Iraqi defenses in MOPP 3 which includes wearing gloves. Both commanders expected that chemicals would be used. While LTC Tucker did not disregard the chemical threat, he believed too much emphasis was being placed on the chemical threat to the detriment of other squadron missions and objectives. He decided that he would have adequate warning, if chemicals were used, to alert and prepare his troops. Perhaps the difference in emphasis is due to the level of command, since it was the brigade commanders who were so concerned about the chemical threat. Although, General Sylvester stated he knew that his battalion commanders shared his concern about the chemical threat. This difference in the analysis of the information and the threat show how CCIR differs between commanders. The chemical threat was a critical information requirement for three of the four commanders and with generally the same information available, totally different decisions were made.

> All actions in war take place in an atmosphere of uncertainty-the fog of war. Uncertainty pervades battle in the form of unknowns about the enemy, about the environment, and even about the friendly situation. While we try to reduce these unknowns by gathering information, we must realize we cannot eliminate them. The very nature of war makes absolute certainty impossible; all actions in war will be based on incomplete, inaccurate, or even contradictory information.[66]

Conclusions

The purpose of this monograph was to examine and explore the concept of CCIR. As a result of the foregoing analysis, several conclusions can be drawn from this study on commanders' critical information requirements.

First, it re-validates the requirement that commanders be able to visualize the battlefield and have the ability to see an operation from start to finish. The ability to visualize comes from experience, good intelligence, good cognitive skills by the commander, and just "getting out" to meet with the soldiers and subordinate commanders. FM 100-5, Operations, also makes the point that "commanders of neither large nor small units can visualize the battlefield and direct and synchronize the efforts of their units from a computer screen at the command post."[67] During this visualization process, critical information requirements will be identified in order to more clearly "see" the operation. General House's emphasis on the brigade's fuelers during the preparation for the 300 kilometer move north, allowed him to have adequate fuel on hand when he reached his objective.

Commanders must be able to communicate this image to their subordinates. This ability comes with experience and most staffs do not have the experience base. Commanders have the responsibility for training their subordinates. All commanders interviewed stated the time spent training together prior to the start of the ground war was significant and had a tremendous impact on the unit's ability to fight well together. Part of this ability had to do with subordinates clearly understanding their commanders' intents. The commander's intent drew a rudimentary mental picture of what was going to happen by clearly describing the desired end state. His intent created a framework so subordinate commanders could visualize the battlefield and ensuing operation. The time spent together prior to the start of combat operations developed relationships and understandings between commanders and subordinates who knew what would be expected under particular circumstances.

Today's personnel system of rotating individuals in and out of units has a debilitating effect on unit's ability to effectively work as a team. A former OPFOR company commander at the National Training Center recalled that the best blue force he had seen was an armored cavalry regiment during its rotation shortly after its return from the Gulf War. Two years later during another rotation, the same unit was performing at a much lower level. The personnel turnover had resulted in everyone in critical positions being new.

While longer stabilization periods would be advantageous to a unit's performance, drastic, revolutionary changes would have to be made to the current military system. A commander is much better able to share his image of the battlefield with subordinates that he has worked with over a longer period of time.

While there are advantages to continuity, interaction and face to face contact is also an essential element to effective decision making. All of the commanders interviewed discussed their close communications with their subordinates. General Sylvester talked face to face with his commanders at least once a day if not more often. One of the idiosyncrasies of fighting in the desert was the commander's ability to see all of his vehicles at once. This ability is unique to a desert environment and while formations are much more difficult to control in other types of terrain, it does not change the requirement for face to face communications. General House was emphatic when he described the development of CCIR as interactive as well as iterative.

There are no command and control systems that provide the commander the same type of feedback that he might receive from a personal exchange. Several of the commanders discussed the potential value of passing information graphically. Brigadier General Sylvester discussed the possibility of communicating using map boards that depicted the commander's intent in the same way that television sports broadcaster John

Madden illustrates football plays with his light pen on his televised chalk board. In the future, graphic displays could be transmitted that show the location of enemy and friendly units. This graphic depiction will greatly assist the commander in his own development of the battlefield image. While technology will assist the commander, it will not provide perfect intelligence. The human commander will always be in the decision making loop and will always seek critical information to make the best decision.

The way the commander receives this information is also important. LTC Tucker discussed the difference between information provided by the cavalry and information provided by the current intelligence system. The cavalry's mission was to provide accurate, timely, and useful information while the intelligence system provided information that had been debated and analyzed until it became historical information that was no longer useful to the commander. All commanders interviewed said that they had lacked sufficient information to make decisions. Perhaps the solution is to place the analysis and processing elements at the user's level and to transmit raw data down to the lowest level. This process would cause information to bypass other echelons of command. Furthermore, different processes would have to be developed that could track the status of current information at all levels.

Finally, it is apparent that the development of experience in decision makers is critical. There will always

be some uncertainty in the face of making critical decisions, especially during combat. Most commanders discussed their intuition and gut feel of making the correct decision. They stated it was strictly experience based and had come with their training during all forms of training exercises. It was expressed that without this particularly strong training base, they would have been unable to make such effective decisions in the absence of better information. It is essential that commanders continue to be developed by providing them with realistic training.

Commanders are faced with the daunting task of making decisions in an environment of uncertainty. Critical information requirements delivered in a timely manner, to the right person, in the right place can mean the difference between an intelligent decision and an intelligent guess. It is incumbent upon the commander and the system to prepare individuals who can visualize the battlefield and who can develop, identify, and apply critical information requirementsto ensure effective decision making, and ultimately, success on the battlefield.

ENDNOTES

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2. Alexander H. Levis and Michael Athens, "The Quest for a C3 Theory: Dreams and Realities" (Washington, DC: AFCEA International Press, 1988), 6.

3. U.S. Department of the Army, FM 100-5, Operations (Washington DC: Government Printing Office, 1993), 2-14.

4. Martin Van Creveld, Command in War (Cambridge, Mass: Harvard University Press, 1989), 263.

5. Ibid., 264.

6. Ibid., 265.

7. U.S. Department of the Army, FM 100-5, Operations (Washington, D.C.: Government Printing Office, 1993), 2-14.

8. Department of Defense, Final Report to Congress: Conduct of the Persian Gulf War,Pursuant to Title V of the Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991 (Public Law 102-25) (Washington, DC: Government Printing Office, 1992), xiii, 8, 33, 73, 74.
The following is a brief synopsis of the Persian Gulf War as found in the preceding document
"Saddam Hussein's invasion of Kuwait on 2 August 1990, unleashed an extraordinary series of events that culminated seven months later in the victory of American and coalition forces over the Iraqi Army and the liberation of Kuwait." On 2 August 1990, Hussein's Iraqi Republican Guard Forces attacked and invaded Kuwait. United States President George Bush condemned the invasion. He characterized it as "naked aggression" and stated "this shall not stand." U.S.National policy objectives were:
-Immediate , complete and unconditional withdrawal of all Iraqi forces from Kuwait
-Restoration of Kuwait's legitimate government
-Security and stability of Saudi Arabia and the Persian Gulf
-Safety and protection of the lives of American citizens abroad
The Gulf War was divided into parts:
(1) Operation Desert Shield was defensive in nature with the following objectives:
-Develop a defensive capability in the Gulf region to deter Saddam Hussein from further attacks
-Defend Saudi Arabia if deterrence failed

-Build a militarily effective coalition and integrate coalition forces into operational plans
-Enforce the economic sanctions prescribed by UNSC Resolutions 661 and 665
(2) Operation Desert Storm departed from the deter and defend objective of Operation Desert Shield and focused on forcing Iraq to withdraw from Kuwait. Operation Desert Storm was a 4 phased campaign:
Phase I: Strategic Air Campaign (Commenced on 17 Jan 1991)
Phase II: Air Supremacy in KTO (Air supremacy declared on 27 Jan 1991)
Phase III: Battlefield preparation (Deception operations commenced 20 Feb 1991)
Phase IV: Offensive Ground Campaign (Commenced 24 Feb 1991, offensive operations ceased 28 Feb 1991)

9. Ibid., 559.

10. Ibid., 560.

11. Alan D.Campen, "Information, Truth, and War", in The First Information War (Fairfax, VA: AFCEA International Press, 1992), 89.

12. U.S. Department of the Army, FM 101-5, Command and Control for Commanders and Staff, (Coordinating Draft) (Washington, D.C.: Government Printing Office, 1993), 6-1.

13. Ibid., 6-4 - 6-5.

14. PRC Inc., Command and Control of the MAGTF Study, Interim Report 1 (Woodbridge, VA: PRC Inc., 1993), 29.

15. Brigadier General Sylvester was promoted shortly after he was interviewed in November 1993.

16. Carl Von Clausewitz, On War (Princeton, N.J.: Princeton University Press, 1989), 117.

17. U.S. Army Combined Arms Center Combat Development Activity (CACDA), "Division Commander's Critical Information Requirements (CCIR)" (Fort Leavenworth, Kansas, 1985), 2.

18. Ibid., 4.

19. U.S. Department of the Army, FM 101-5, 6-4.

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22. Ibid., 6-7 - 6-8.

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25. U.S. Army Command and General Staff College, Student Text (ST) 100-9 The Tactical Decision Making Process (Fort Leavenworth, Kansas, 1993).

26. Conversation with LTC Scott Carey, Command and control observer controller, Team B, BCTP, Fort Leavenworth, Kansas, September, 1993.

27. U.S. CACDA, "Division Commander's Critical Information Requirements (CCIR), ix.

28. Ibid, 9.

29. Ibid., ix.

30. Ibid., x.

31. Ibid., ix.

32. Thomas W. Herren and Donald W. Moak, "Development and Analysis of Commanders Critical Information Requirements (CCIR) (Draft)" (Fort Leavenworth, Kansas, n.d.), 2.

33. Ibid., 6.

34. Ibid., 7.

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36. The Arryo Center is "the United States Army's Federally Funded Research and Development Center for studies and analysis operated by The RAND Corporation.

37. Ibid., v.

38. Ibid., v - vi.

39. Ibid., vi.

40. Wesley C. Salmon, Logic (New Jersey: Prentice Hall Inc, 1973), 8.

41. Kahan, 44

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45. Herbert A. Simon, Administrative Behavior, 3d Ed (New York: The Free Press, 1967), 6,

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49. Anne Claire Louvet, Jeff T. Casey, and Alexander Levis, "Experimental Investigation of the Bounded Rationality Constraint" in Science of Command and Control: Coping with Uncertainty (Washington, DC: AFCEA International Press, 1988), 73.

50. Department of the Navy, FMFM1 Warfighting, (Washington, DC: Government Printing Office, 1989), 69.

51. J. Paul Scicchitano, "Night Strikes: Desert Storm After Action Review," Army Times, 23 Sept 1993, 15.

52. Department of the Army, 2d Brigade, 1st Cavalry Division, Subject: 2d Brigade Lessons Learned, 23 March 1991, 1.

53. Ibid., 1.

54. BG Randolph House interview, 8 November 1993.

55. BG House interview, 8 November 1993.

56. BG House interview, 8 November 1993.

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58. J. Paul Scicchitano, "Eye of the Tiger: Desert Storm After Action Review," Army Times, 10 June 1991, 12,

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60. In the interview with General Sylvester, he referred to these defensive belts as "striations."

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62. Ibid., 431.

63. LTC Terry Tucker interview, 12 November 1993.

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