The Manual Wargaming Process:
Does our Current Methodology Give Us The Optimum Solution?

A Monograph
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The Manual Wargaming Process: Does Our Current Methodology Give Us the Optimum Solution?

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MONOGRAPH APPROVAL

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Title of Monograph: The Manual Wargaming

Process: Does Our Current Methodology Give Us The Optimum Solution?

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ABSTRACT


This monograph analyzes the manual wargaming portion of the U.S. Army's decision-making cycle in order to determine if the process deduces the optimum course of action. The monograph begins by examining game theory, which is the theoretical basis for wargaming. This examination establishes that game theory provides two theoretical models for decision-making, one based upon enemy capabilities and the other on enemy intentions. The analysis continues by examining the historical development of wargaming and its incorporation as a decision-making tool. Using theory-based criteria, the monograph reviews current American, German, British, and Soviet war gaming methods at the division level. The three criteria analyze how well a methodology provides a rational opponent, considers friendly and enemy intentions, and uses rational control or rules.

The monograph concludes that the current U.S. wargaming method does not give us the optimum solution, largely because it is difficult to discover enemy intentions before a decision is made by the friendly commander. If a friendly commander knew what the enemy's intentions were, he would choose the appropriate course of action to counter it. However, since the commander can only base his decision on enemy capabilities—or what his enemy can (vice will) do—he course of action choice becomes merely a "best guess." The monograph then suggests remedies to bring us closer to an optimum course of action.
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I. Introduction

The increasingly complex demands made by modern forces and by modern warfare . . . have led to an explosion in the amount of data processed by any given command system to carry out the mission. As the quantity of data rose, the difficulty of interpreting it in preparation for decision-making grew . . . .

Martin Van Creveld
Command In War

Decision-making is a process rather than just a goal.¹ Specifically, military tactical decision-making is a dynamic, continuous cycle. In addition, decisions about current and future operations often occur simultaneously.²

The United States Army endorses a standardized, tactical decision-making process that serves as a methodology for guiding tactical commanders and their staffs in the application of Air-Land Battle doctrine. Army Field Manual 101-5, Staff Organization and Operations, is the primary doctrinal source that describes that decision-making process.

Within the military decision-making process is a procedural step called the "Estimate of the Situation," which includes steps to analyze and compare a commander's courses of action. The decision-maker develops a course of action using the criteria of feasibility, suitability, and acceptability. A feasible course of action is "doable"; it offers a reasonable expectation of success. A suitable course of action should result in the desired effect. Finally, an acceptable course of action means the expected results are worth the estimated cost of executing the course of action. After a course of action is developed, it is analyzed using wargaming.³
Wargaming is the process of systematically thinking about the chain of events that occur as a unit executes a course of action. Wargaming tries to visualize the flow of a battle.

By using friendly strengths and dispositions, enemy assets, possible friendly and enemy courses of action, and a set piece of ground, wargaming attempts to foresee the action, reaction, and counteraction dynamics of a battle.4

Thus, the wargamer first determines friendly actions. These are simply any feasible friendly moves against an enemy. This step leads to the next part of the sequence, or the enemy reaction. The reaction procedure considers all moves the enemy might make to counter the friendly move. The wargamer asks himself, "If I do this, what can and will the enemy do?" By answering that question, the wargamer then must move into the counteraction step to determine answers to the question, "If he does this, what should and can I do?"5

The tactical commander's visualization and evaluation of courses of action through wargaming is important. To win on the battlefield the commander must first thoroughly understand all the options available to him in defeating the enemy.6 Then he must choose a course of action from those options that will allow him to best accomplish his mission.7

Because I am not sure that our wargaming process achieves that end, this monograph will try to answer the question: Does the current United States Army manual wargaming process determine the optimum course of action for the tactical commander? I will attempt to solve that problem by first examining the theoretical basis for wargaming; this examination should help me determine
criteria for analyzing the current wargaming methodology. Next, my investigation of the historical evolution of wargaming should illustrate how and why wargaming became an accepted part of the decision-making process. Finally, I will analyze the current United States Army tactical decision-making process, using my criteria, to evaluate how well we perform the wargaming process. I will limit my inquiry to the division level due to space limitations.

By conducting these analyses I hope to determine whether or not our wargame process is consistent with theory. If not, I hope to determine if this inconsistency gives us a less than optimum solution. Simultaneously with my analysis of the U.S. process, I will also analyze the current division level, Army decision-making processes of Germany, Britain, and the Soviet Union. I will attempt to discover any advantages or disadvantages of their wargaming processes which might improve U.S. Army wargaming.

Several assumptions are necessary in order to answer the research question. First, wargaming will continue to be an integral part of the tactical decision-making process since commanders must have a methodology to decide which course of action is best. A second assumption is that manual wargaming—as opposed to automated methods—will continue to be the process of choice at the division level. Perhaps the Army will someday field a useful, automated wargaming system. A 1989 Army Research Institute (ARI) experiment, which compared manual versus automated wargaming results, determined that automated means had no
significant advantages over manual processes.  

II. GAME THEORY

War gaming is a derivation of a mathematical theory known as gaming. While this section is but a brief overview of game theory, it is necessary to examine this theory to grasp how war gaming originated as a decision-making tool.

Game theory is a branch of mathematics developed to deal with conflict of interest situations in the social sciences. Its origins go back to the mid-1920's, to articles written by Emile Borel and John von Neumann. Von Neumann and Oskar Morgenstern later established the field of gaming in 1953, when they published *Theory of Games and Economic Behavior*. This book, hailed as a major scientific achievement, is still the primary work in the field.

Game theory is not about games as most people think of them. Game theorists define a game as any social situation involving two or more players in which the interests of the players are interdependent. According to the noted game theorist, Frank Zagare, "While poker and parchesi are games, so are wage bargaining, ... arms races, and war."

The crux of the von Neumann/Morgenstern theory of games is that one player can select an optimum strategy from a number of possibilities without knowing the strategies of the other player. A "payoff," or the benefits accrued from a particular strategy, may be positive, negative, or zero. Thus, given any interaction with your opponent, you always win, lose, or draw. This concept, known as a "zero-sum" game, means your gains equal your
opponent's losses and vice versa; if neither side gains or loses, the game ends in a draw.12

Interactive gaming, according to von Neumann and Morgenstern, needs three basic components: a rational actor, rational control, and strategies that consider the opponent's actions as well as friendly ones.13 These components will later form the basis of my criteria for evaluating the U.S. wargaming process. A rational actor is someone who looks out for his own interests and pursues a strategy (course of action) to achieve those interests.14 In pursuing this strategy, the rational actor opposes any move by an opponent which might prevent him from accomplishing his goal. Similarly, his rational opponent also anticipates where he might be blocked from his goal and acts to prevent this.

The rational actor concept is basic to the von Neumann/Morgenstern theory of gaming. The game cannot exist if either player is irrational. Von Neumann notes that an irrational opponent is not governed entirely by reason in reaching his decisions. An irrational opponent does not know what he wants, fails to define his goals, and does not seek the attainment of those objectives.15 Thus, there cannot be a game, if one player is not cooperating.

Von Neumann and Morgenstern define rational control as rules or principles to which actions or procedures must conform or intend to conform.16 While many wargaming rules can be used for decision-making, they tend to fall into one of two categories: rigid or free-form.17

Rigid games specify all rules before game start. Rigid
games include chess, poker, and other similar interactive games. Because a finite number of moves exist for any situation, mathematical analysis determines which moves provide an optimum solution under given circumstances. In chess, for example, because a player can only move one piece per turn, his future moves can be mathematically forecasted using probability theory.18

Free-form games, on the other hand, are loosely defined and imaginative. They are "diplomatic" in nature; that is, consensus frequently determines results. An example of a free-form game is the child's game of tag. The players execute the game differently each time by varying the rules to suit the conditions. Free-form games, according to von Neumann and Morgenstern, closely mirror the realities of our interactive world because these games are how actors analyze complex situations, select strategies, and then make and implement decisions.19

The process of considering both friendly and opposing actions is the last required component for a game. These actions fall into either of two categories: capabilities or intentions.20

Capabilities are strategies that either you or an opponent might take. By considering an opponent's capabilities, an actor must consider all likely (theoretically, all possible) options available to himself and an opponent because he is uncertain as to which option his opponent will choose. For instance, both players can attack, defend, withdraw, or do nothing.21

Intentions, meanwhile, are strategies that have already been selected for execution. The decision to commit to a strategy creates indicators that might cue an actor that his opponent has
made a decision to execute a strategy. The actor then formulates a counter-strategy to stop his opponent's intended action.22

Von Neumann and Morgenstern developed two theoretical models dealing with the process of determining strategies based upon 1) whether or not an opponent is capable of doing something (the minorant or maxi-min game), or 2) intends to take some kind of action (the majorant or mini-max game).23 Both theoretical models try to select a minimal-risk option from available choices, given the time available to collect information regarding an opponent's intentions. If an actor knows little about an opponent's intentions and must make a decision with available information, von Neumann and Morgenstern recommend the maxi-min model. If an actor has the time to deduce an opponent's intentions, then von Neumann and Morgenstern suggest the mini-max model.24 Why we use these particular decision models will be explained later in this section.

In 1951, Colonel Oliver Haywood, USAF, wrote a RAND paper entitled *Military Doctrine of Decision and the von Neumann Theory of Games*. Haywood's paper applied von Neumann/Morgenstern's game theory to military decision-making and became the basis for how we perform wargaming today. Haywood deduced that a friendly military commander equated to a rational actor because they both establish objectives, pursue courses of action to achieve those objectives, and block an opposing commander's attempts to keep them from their goal. Haywood assumed, as game theory assumes, that a rational enemy opponent behaves in a similar manner. Therefore, Haywood concluded that any decision-making process
must consider a rational enemy opponent.25

Moreover, Haywood believed that "The Estimate of the Situation," an analytical method for military problem-solving, was identical to game theory's rational control concept. Haywood noted that the estimate process made commanders conform to an analytical method for decision-making. By conforming to an accepted decision-making process, military commanders were, in effect, following established norms. Thus, Haywood concluded that the estimate process equates to von Neumann/Morgenstern's rational control criterion because it establishes rules.26

Furthermore, Haywood believed that a commander seeking a decision wants a course of action (von Neumann/Morgenstern's "strategy") that has more advantages than disadvantages with respect to the enemy's ability to oppose it. In the example in Figure 1, Haywood used the von Neumann/Morgenstern maxi-min model to develop a sample matrix based upon enemy capabilities:

![Figure 1](image)

In this situation, the friendly commander created a matrix based upon limited available information regarding his opponent; specifically he only knew his enemy's capabilities, but not his intentions. The friendly commander, in this case, developed
three possible friendly and enemy courses of action (COAs); naturally, he could have developed more or fewer COAs. He then estimated the effect of enemy capabilities on the probability of success of each of his possible COAs. Haywood identified possible payoffs—or degrees of predicted friendly success, given each enemy COA—as superior, excellent, good, fair, failure, and defeat.27

The friendly commander's problem is to choose the COA that has the best chance of success. He expects that his rational enemy will try to do the same. Since he does not know what the enemy intends to do, and vice versa, the friendly commander can only make a decision based upon enemy capabilities. Given only enemy capabilities, the friendly commander cannot determine which of his COAs has the best chance of success, because he lacks sufficient information about his enemy to do so. Being conservative, the friendly commander scans his matrix looking for his worst case result for each enemy COR. However, the friendly commander does not want to be overly cautious, so he picks the best of the worst cases, thus "maximizing his minimums" (maxi-min).28

Von Neumann and Morgenstern viewed the maxi-min model as a less than optimum solution for selecting COAs. They believed that a friendly actor making decisions that are dependent upon an opponent's capabilities must make the first COR decision. His opponent could then gain an advantage by developing a countermove. Haywood agreed with this belief, noting that,

Decisions based upon enemy capabilities require us to view the situation from our perspective only. We then assume . . . we are deciding first, for we do not know which
enemy course of action our opponent might select. Selecting . . . first gives us a significant disadvantage.29

Haywood, however, describes a second type of decision-making process, one where the commander visualizes the situation from the enemy's point of view, determines enemy intentions, and develops an optimum COA to counter it. As another example, Haywood developed the sample table, shown in Figure 2.

**Figure 2**

<table>
<thead>
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<th>ENEMY COURSES OF ACTION</th>
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<tr>
<td>FRIENDLY COA I II III</td>
</tr>
<tr>
<td>1 failure excellent excellent</td>
</tr>
<tr>
<td>2 good fair fair</td>
</tr>
<tr>
<td>3 excellent defeat superior</td>
</tr>
</tbody>
</table>

MAX OF COLUMN excellent excellent superior

This mini-max game considers reduced commander uncertainty but is still conservative. Here the friendly commander assumes the enemy commander made his decision first, because he has indicators of that decision. For example, the friendly commander received reports that the enemy moved his command posts forward, massed his artillery units, and cleared passage lanes forward through his own minefields. These indicators of enemy activity have led the friendly commander to assume that the enemy intends to attack; however he is not absolutely certain as to what the enemy will do. He knows the enemy commander has three probable—and closely related—COAs, but does not know which one the enemy selected. Because he has indicators of what the enemy
will do—as opposed to what he can do, the friendly commander
optimistically selects, for each enemy CDA, a CDA that will give
him his best "payoff." The maximum value of each column is the
best outcome the friendly commander can imagine achieving against
that particular enemy CDA.

Thus, the friendly commander, by choosing a CDA after the
enemy has supposedly selected his, is in a position to choose the
optimum CDA. If the enemy commander selects CDA I, for example,
than the friendly commander selects CDA 3, which is the best or
optimum outcome against the opposing CDA. On the other hand,
because he is uncertain as to what the enemy will do, the
friendly commander balances optimism with conservatism by choos-
ing the "worst of the best" cases.30 The worst outcome the
friendly commander, a conservative, can foresee is the minimum
value of the maximums found in the fourth row.31 In this case,
the friendly commander can choose either CDA 1 or 2.

Decisions based upon intentions rather than capabilities
give the decision-maker an advantage over an opponent. As Hay-
wood puts it,

Making decisions on the basis of enemy intentions indicates
an outcome more optimum than one based on an estimate
of enemy capabilities. The advantage of deciding second is
significant.32

In summary, my review of game theory identified three
required components of a game: rational actor, rational control,
and the recognition of friendly and enemy actions (capabilities
and intentions). However, with respect to the last criterion,
selecting an optimum CDA to thwart enemy actions depends more
upon knowing enemy intentions than knowing just capabilities. Therefore, my third criterion now becomes recognition of friendly and enemy intentions, vice actions, because recognizing intent should provide the optimum solution. By using these components as criteria, I plan to analyze current wargaming methods to arrive at an answer to my research question.

III. HISTORICAL EVOLUTION OF WARGAMING

Before analyzing whether or not the U.S. Army's wargaming method gives the optimum solution, a review of the historical evolution of wargaming from the 1820's to the present can illustrate why wargaming has become such an important part of the decision-making process.

Prior to the 1820's, decision-making was primarily a commander's responsibility, and did not have much staff input. Because officers varied greatly in professional ability, military decisions were left to a few skilled individuals. Some commanders, such as Napoleon, used toy soldiers upon maps to visualize how battles might be fought. The Prussians, however, conceived the idea of developing professional staff officers who could assist commanders in tactical planning. Thus, the wargame evolved from the need to train better staff officers.33

The Prussians first produced a set of wargaming rules in 1824. The wargame focused on maneuvering units on a map. It soon became a tool to help not only staffs, but also commanders practice and sharpen their tactical skills by visualizing battles from start to finish.34

By 1828, a young lieutenant named Helmuth von Moltke became
an avid fan of wargaming. Molke promoted the importance of wargaming after he became the chief of staff in 1837.35 Wargaming continued as a tactics trainer until the 1860's, when the Prussians began using the game as an aid to decision-making. Prussian commanders studied tactical situations, arrayed and moved forces on maps, and then visualized the execution of various COAs in their heads. The commanders then selected the best COA for execution based upon the wargame results.36

The Germans impressed the world in 1870 with their swift victory over the French. As a result, many nations studied German successes and adopted German staff procedures, including wargaming. Wargaming soon became a favorite decision-making tool for many European armies between 1871 and 1914. The U.S. Army also borrowed the German decision-making process, but failed to describe how to use a structured framework to analyze COAs until 1910.37

Russian commanders also used wargaming for decision-making. A Russian wargame played in April 1914 visualized a Russian invasion of East Prussia. This wargame resulted in two Russian armies being separated by terrain—and subsequently defeated in detail. The lesson, however, was ignored because the two Russian commanders argued with the umpire over how fast the German opponent could countermarch. The umpire capitulated and slowed the German countermarch, which allowed the Russian commanders to mass on the German player and destroy his army. Later that year, the same two Russian armies, separated by terrain, suffered defeat in detail at the battles of Tannenberg and the Masurian Lakes.38
Wargaming declined in popularity after World War One, primarily due to the excessive manpower required to perform a wargame. Specifically, wargames had grown from simply being a decision-making process on a map into major field exercises with hundreds of controllers and additional staff participants. During this interwar period, however, the U.S. Army developed Field Manual (FM) 101-5 to help staffs conduct a logical investigation of battlefield information in order to arrive at the best COA for the situation. This manual focused on developing COAs, but did not mention how the staff should analyze them.

Despite the lowered level of interest elsewhere, wargaming continued to be popular in Germany. In the 1930's Adolf Hitler incorporated a wargaming process into his decision-making. Hitler demanded that German attacks be agonizingly wargamed to determine friendly COAs, enemy reactions, and resulting German variations to the basic plan. In 1939, the Germans wargamed their planned 1940 attack into France; by so doing, they rediscovered an important march axis through the Ardennes. During World War Two the Germans continued to wargame major operations such as "Sea Lion," the planned invasion of England. Hitler's generals believed in the wargaming process so much that they talked Hitler out of invading England after the wargame continually produced disastrous results.

Since the end of World War Two, the German wargaming system has undergone many refinements, not only by Germany, but also by other nations as well. In Europe and the United States, decision-making using wargaming shifted from just being a map
exercise to including a formal analytical process. Using this logical process became both the norm and a necessity because rapid technological change and improved weapons lethality meant less time to make decisions.44

In the 1950's, new decision-making techniques that employed game theory were developed to cope with the exponentially increasing flow of information.45 Game theory, as discussed in the previous section, provided the structure for making wargaming a formal process within the decision-making cycle. In 1957, U.S. Army FM 101-5 made it clear that commanders needed to visualize enemy COAs, and then reach decisions about how they would defeat those enemy COAs by using maps and military symbols as aids.46

From the 1960's until today, numerous nations refined their decision-making processes by including wargaming. During this time, however, U.S. Army wargaming procedures differed from the European methodology.

While the European methods of wargaming remained primarily a commander's assessment of the situation, the U.S. Army process became a command and staff action.47 For example, in 1968 the U.S. Army defined wargaming in FM 101-5 to be a method for the commander and his staff to visualize friendly and enemy COAs as the troops moved from current dispositions to the objective.48 Later on, the 1972 FM 101-5 took a prescriptive approach. Wargaming would now be performed around a situation map, with the staff recommending three feasible friendly COAs for the commander to consider.49 No mention was made as to how many enemy COAs should be considered.
The 1984 FM 101-5 eliminates some prescribed requirements and—as did the 1972 version—cites wargaming as a method for analyzing COAs. However, the 1984 version fails to describe how to conduct wargaming. The Command and General Staff College (CGSC) attempted to fill this void by publishing Student Text (ST) 100-9 in 1989 and 1991. These non-doctrinal CGSC products discuss the wargaming process, specify the rules of wargaming, and delineate how a COA should be analyzed to produce the best solution under the given conditions.

In summary, wargaming began as a training device to teach tactics to Prussian officers; however, it eventually transitioned into a firmly ingrained decision-making aid. The reason for this rise in importance is because wargaming helped commanders to not only visualize possible battlefield events, but also better analyze the advantages and disadvantages of friendly COAs versus enemy COAs. While European wargaming remains primarily a commander's function, the U.S. Army's method is both a commander and a staff procedure. Whether or not either method is more advantageous than the other will be examined in the next section. Finally, while FM 101-5 is not specific as to how one goes about wargaming COAs, CGSC ST 100-9 does describe this process in detail.

IV. CURRENT ANALYSIS

The purpose of this section is to analyze, using the previously identified criteria, the tactical wargaming processes of the U.S. Army, Germany, Britain, and the Soviet Union. After a short review of the U.S. Army decision-making process (detailed
descriptions of the German, British, and Soviet division-level
decision-making steps are in Appendix A), I will analyze each of
the wargaming methods to provide a foundation for understanding
the U.S. wargaming process. These analyses will determine an
answer to my research question by 1) ascertaining how effectively
the U.S. Army wargaming process analyzes COAs, and 2) whether we
can learn anything from the way other countries wargame.

The U.S. Army Tactical Decision-making Process

The decision-making process begins with receipt of a new
mission, either from higher headquarters or one deduced by ana-
lyzing the current operation. Army FM 101-5 and CGSC ST 100-9
stipulate four steps:

o Mission analysis. This is a command and staff action to
gather facts, make assumptions, analyze the higher headquarters' 
mission and intent, and focus the staff for planning the mission. 
This step ends when the staff briefs the commander about the cur-
rent situation. The commander then approves a G3-derived
restated mission, which incorporates the essential tasks from the 
higher headquarters' mission and intent; and then issues planning 
guidance for developing COAs to accomplish the mission.51

 o Course of action development. The staff now focuses on
any information necessary for the commander to make decisions
about COAs. The staff analyzes the current situation by
computing relative friendly/enemy force ratios, arraying initial
forces on a map, developing a scheme of maneuver that meets the 
commander's guidance (or if it cannot, the staff reports why it
cannot), and preparing COA sketches and statements to help the
commander visualize each COA. The staff develops as many varied, feasible COAs as time allows, giving the commander as many options as possible from which to choose. The staff also considers whether or not the COAs are suitable and acceptable. This step ends with the staff recommending COAs to the commander, who decides which COAs to analyze in the next step.

- Course of action analysis. The staff uses wargaming to analyze the COAs chosen by the commander. It analyzes each COA separately and then compares them using criteria established before the COAs were developed to determine the best option, given the current conditions. The "best" COA is the one that has the highest probability of success against the enemy COA of greatest concern to the friendly commander. This step ends with the staff briefing the results of each of the wargames to the commander, followed by the staff recommending a COA for the commander's approval.

- Decision/execution. The commander decides upon a COA, followed by the staff preparing the order or plan to implement the selected COA.

Given this overview of decision-making, the reader should now understand how a U.S. division commander makes his COA decisions. This understanding is necessary for comprehending the wargaming process and the role it plays today in the overall U.S. decision-making process.

The Wargaming Process

A brief examination of step three of the decision-making process, to see how COAs are analyzed, seems in order.
detailed explanation of each step is found in Appendix B.

CGSC ST 100-9 describes six wargaming steps for analyzing a course of action. These are:

- Gather the tools. "Tools" are aids for conducting wargaming. They consist of friendly situation information, the areas of operation and interest, the current enemy situational templates, and a map showing current friendly unit locations.

- List all friendly forces. All available assets and units that are available for the mission are compiled for use in the wargame.

- List the assumptions. Any information that is not known to be a fact—such as enemy strength—but is necessary for COA execution is incorporated into planning assumptions.

- List critical events and decision points. Critical events are tasks that are essential for mission accomplishment. An example is a passage of lines. A decision point identifies in time and space where a commander must make decisions. Decision points help to synchronize friendly assets to have the maximum effect upon the enemy.

- Select a wargame method. ST 100-9 recommends three techniques: the avenue-in-depth, the belt, and the box. These methods organize the battlefield for analysis. The avenue-in-depth and belt techniques, while examining avenues of approach in great detail, are slow. The box technique focuses on only a specific area (such as a river crossing site), but is faster than the other two techniques. Each wargame method is more fully explained in Appendix C.
Select a technique to record and display the results. ST 100-9 recommends two methods to record wargaming results: the narrative and sketch note techniques. A detailed example of each technique is in Appendix D.

Wargame the battle and assess results. The staff identifies tasks to subordinate units and visualizes a subordinate commander's use of forces to accomplish his tasks. The staff goes through the action-reaction-counteraction sequence—visualizing friendly actions necessary to accomplish a task, determining how the enemy might react to each action, and then creating counteractions to check the enemy moves. The wargame continues until the entire friendly COA is analyzed. The staff then restarts the sequence using the same friendly—but now a different enemy—COA. Wargaming continues until all friendly and enemy COAs are analyzed.

ST 100-9 notes that the wargame process should result in several findings. For example, the wargame process discovers branches to the plan. Branches are options for changing friendly dispositions, orientations, or directions of movement; and for accepting or declining battle. In other words, they give commanders flexibility. Wargaming also helps identify additional tasks to maneuver units and estimates how long an operation might continue. This information assists in Combat Service Support (CSS) planning, helps the G2 plan intelligence collection requirements, and identifies COA advantages and disadvantages. Finally, wargaming can help determine the risk associated with various actions during the action-reaction-counteraction sequence.
sequence. Although risk is only a "best guess," the staff should continually assess the likelihood that a COA will not accomplish either the mission or a critical portion of a mission.60

As soon as the wargame process ends, the staff uses previously developed criteria to compare COAs to determine the one having the highest probability of success.61 Criteria are factors that pertain to the mission, enemy, terrain, troops available and time. They also consider such factors as commander's guidance, critical events, and principles of war.62 Certain staff officers construct a decision matrix—using their criteria—to determine the advantages and disadvantages of each COA from their particular viewpoint. An example of such a decision matrix is in Appendix E.

Each of those staff officers, led by the chief of staff, then presents his information to the others for consideration. The staff as a group reaches a consensus on a recommended COA. If the staff cannot agree, the chief of staff listens to the facts and decides which COA to recommend to the commander.63

Armed with this overview of U.S. Army decision-making and wargaming, I can now better analyze the wargaming process using my three criteria.

RATIONAL OPPONENT. I mentioned previously that a decision-making game must have a rational opponent, one who will pursue a COA that will achieve his best interests. Accordingly, ST 100-9 requires the wargamer to visualize the battle, starting with initial unit locations and following a logical sequence of friendly and enemy actions within the method (box, belt, avenue)
selected for organizing the area of operations. Furthermore, ST 100-9 specifically mentions that visualizing the battle means examining battlefield flow from the friendly perspective and estimating how the enemy might employ his forces within his capabilities.64 In this approach, the wargamer must think and act as though he were an enemy commander.

However, ST 100-9 does not say what expertise is required to "fight" as an enemy commander. Moreover, a wargamer may or may not be familiar enough with the enemy to adequately determine an opponent's reaction to a friendly action. A wargamer's lack of enemy expertise could skew the wargame results by under- or over-estimating enemy capabilities and assets. A key question that arises is: Can we have a wargamer who can realistically estimate and play enemy capabilities? One possible solution is ST 100-9's optional technique called "adversarial" wargaming, where the G2 plays the opposing commander.65 In this method, the G2—hopefully the "expert" on the enemy—must think and act as an enemy would under the given circumstances. However, this is not as simple as one might think, since the G2 might, in a contingency situation, be an expert on another enemy. Also, the doctrine for all potential enemies is not always available for study. In Desert Storm, as the 3d Army G2 put it, "[Enemy] template production was a major team effort."66

So what can we expect from the G2? Most G2s are trained in a process called thinking "red". This process, delineated in FM 34-3, Intelligence Analysis, means seeing the battle from the enemy's viewpoint.67 The G2 prepares himself for the wargame by
asking such questions as what is the enemy’s doctrine? what are his tactics? and how is he equipped?68 The G2 uses this check-list to develop a data base and personal mental framework to better assume the role of a credible enemy commander.

While any commander or staff officer can consider enemy capabilities during wargaming, the G2 usually has the most training to perform this function. Using the G2 as an “adversary” provides a more balanced wargame because he can best replicate enemy assets and capabilities.

My analyses of German, British, and Soviet wargaming show that their commanders all consider a rational opponent in a way similar to the U.S. Army. However, there is much less staff involvement. The German and British commanders use their G2s only to provide doctrinal enemy information; the G2s do not wargame ideas with the commander. The Soviet commander uses his chief of staff in lieu of a G2. However, the Soviet chief of staff, like the German and British G2s, does not participate in wargaming.69

The German, British, and Soviet commanders examine the battlefield from both a friendly and enemy view, and they consider which enemy COA is best from the enemy’s perspective. Each commander assumes that his opponent will use his assets within his capabilities to achieve his purpose. European commanders then visualize moving their forces using maps or other aids, determine possible enemy reactions, and figure out friendly countermoves.70 While European commanders consider enemy intentions, the lack of a “smart adversary” can skew the wargaming results.
In summary, ST 100-9 notes that wargaming relies heavily on tactical judgment and experience. Perhaps the best we can expect is that experience with one threat will carry over to another, and that the personnel asked to replicate a rational opponent will have the time to fill in any knowledge gaps. Thus, while our wargaming method considers a "thinking" opponent, it appears as if our ability to meet this criterion depends on the amount of available expertise.

The European commanders consider the enemy in much the same way as the U.S. Army does. The difference, however, is that, as mentioned earlier, the commander analyzes COAs by himself. By not using an "adversary" during COA analysis, European commanders may unwittingly insert bias into their wargaming conclusions. If, however, they use a qualified intelligence expert to replicate an enemy commander during adversarial wargaming, they might have a fairer analysis, which could produce a more optimum solution.

RECOGNITION OF FRIENDLY AND ENEMY INTENTIONS. Intentions, as mentioned previously, are COAs that have already been selected for execution. For example, the ST 100-9 wargaming process compares friendly COAs (capabilities) against enemy COAs (capabilities). The commander then choses the COA he wants to execute. By committing to a specific COA, he now intends to pursue the COA to meet his objectives. Thus, as in game theory, friendly intentions result from a commander selecting a COA and deciding to execute it.

ST 100-9 then asks the wargamer to visualize the battle,
given what the enemy might do. The battlefield visualization process begins with the staff initially comparing friendly and enemy combat ratios. ST 103-9 views the comparison process as necessary for drawing some conclusions about friendly and enemy capabilities as they pertain to the tactical situation, but offers nothing about ways to determine enemy intentions.73

Friendly and enemy capabilities are the COAs a unit can undertake. ST 100-9 recommends having the division-level commander and staff conduct a detailed study of available friendly and enemy personnel and weapons systems to determine capabilities. By current doctrine divisions maneuver battalions; therefore, the commander or staff considers all combat assets within both friendly and enemy battalion-sized units that are available for the upcoming mission in order to determine capabilities.74

Within the friendly division, the staff uses its reporting system to gather the detailed information necessary to determine friendly capabilities. The types of reports differ from unit to unit, depending upon local tactical field standard operating procedure (FSOP), but they usually include the commander's situation report, as well as personnel and logistics reports.75

Enemy capabilities, however, are determined by the G2 through the Intelligence Preparation of the Battlefield (IPB) process. FM 34-3 describes enemy capabilities as COAs that the enemy might take—attack, defend, reinforce, or retrograde. In effect, capabilities describe "what the enemy can do, when and where the enemy can do it, and in what strength the enemy can do it."76
ST 100-9 specifically notes that calculating friendly and enemy capabilities is not precise because many factors are unknown about both opposing forces. For example, while the process of comparing force ratios does account for quantifying personnel and weapons systems, it is difficult to be absolutely sure at any given moment how many people or how much equipment is available for use by either side. Additionally, human factors such as morale and leadership cannot be quantified with any degree of accuracy. Thus, while ST 100-9 accounts for enemy and friendly capabilities, it is only an estimate for the staff to use in planning. The friendly and enemy capabilities data are then used in the wargaming process.77

In von Neumann/Morgenstern game theory, and as discussed by Colonel Haywood, the optimum solution is to base decisions upon enemy intentions because one gains an advantage by knowing which COA the enemy commander has chosen. How, then, does the friendly commander discover enemy intentions before he decides upon a friendly COA? Doing so depends upon "tactical judgment, experience, ... time available, ... enemy indicators [my emphasis], [friendly] commander fatigue, and the commander's personality and ability."78

Most division commanders probably have reasonable competency, good judgment, and get enough rest to make logical decisions about enemy intentions. I base this assumption upon personal observation of five Battle Command Training Program War Fighter exercises.79 It appears, however, that a commander's experience and enemy indicators are more important prerequisites
for discerning enemy intentions.

ALPHATECH, a behavioral science research corporation,
observes that experienced commanders make faster decisions
because they ask the right questions to fill in enemy information
gaps. The commander's questions focus the division intelligence
collection effort on those priority enemy indicators necessary
for command decisions. Inexperienced commanders have trouble
conveying what is important; therefore, intelligence collection
becomes diluted as the staff tries to find out everything.80

Moreover, the GE has the problem of discerning enemy
"truth," even if he receives focused commander intelligence
priorities. Intelligence analysts get confusing indicators of
enemy decisions due to enemy deception, random enemy activity, or
the ever-present "fog of war." FM 34-3 recommends that, when
confronted with conflicting indicators, analysts must determine
enemy intent by weighting some enemy indicators more than oth-
ers, since some are more "indicative" of intent than others.81

The process for weighting indicators is in Appendix F.

As with commanders, intelligence analysts vary in their
experience levels. An experienced intelligence analyst tends to
quickly assess a situation and pick out key activities that
indicate what the enemy intends to do. An inexperienced analyst
waits longer to confirm an enemy indicator, and steals time from
the commander by doing so.

However, no analyst can ever be absolutely certain that he
is right. Consequently, the analyst's degree of uncertainty
contributes to the commander's risk. FM 34-3 mentions that
uncertainty plays a key role in the evaluation of the enemy and the amount of risk accepted.

Since neither the commander nor his G2 are absolutely certain of what the enemy intends to do, it appears wargaming depends upon how much risk a commander is willing to accept. ST 100-9 plays it safe by telling the friendly commander to base his COA analysis upon enemy capabilities, and then wargame all possible enemy options—as time allows. Thus, the friendly commander must choose his COA before he knows enemy intentions. By basing his decision upon enemy capabilities, the friendly commander commits himself to a strategy before he knows which COA the enemy is executing. This committal by the friendly force triggers indicators which the enemy commander can now use to select his optimum COA. On the other hand, if the friendly commander bases his decision upon enemy indicators, he in effect "knows" what the enemy intends to do, and thus can better counter an enemy move.

When a commander focuses his intelligence assets and has experienced intelligence personnel, he should discover enough enemy indicators to wargame a COA that will defeat the enemy's intent. On the other hand, a commander might fail to focus his intelligence priorities, might have poor intelligence sources, or may simply run out of time. In those cases it appears the best he can do is to prioritize enemy COAs based upon enemy capabilities, wargame as many options as time allows, and execute the best option under the circumstances once the battle begins.

German, British, and Soviet commanders, meanwhile, also begin
their analysis of enemy COAs by looking at capabilities. Some differences in these three processes, however, are worth noting.

The German commander uses enemy capabilities to formulate his plan while continuing to try to discern enemy intentions through indicators of enemy activity. He carefully arrays known enemy and friendly force locations on a map and calculates friendly-to-enemy force ratios within his area of operations. Once the German commander calculates friendly-to-enemy force ratios, he mentally estimates friendly and enemy combat effectiveness, or the ability of his and the enemy's forces to accomplish their missions. This process, performed solely by the commander, relies heavily on his experience and judgment. However, the German army is confident that its commanders have the expertise, based upon years of training and experience, to perform a credible effectiveness assessment. Once the combat effectiveness assessment is complete, the German commander compares the results with enemy indicators. He then uses his judgment to deduce what he believes are enemy intentions.

Once the German commander deduces the estimated enemy intent, he then selects the best friendly COA that he believes—based upon his experience and judgment—fits the current situation. Because the enemy intent is only an estimation, the German commander must accept risk. His staff continues, however, to develop other options (similar to U.S. Army branches) in case the commander is wrong. Once the commander makes the decision, however, the staff formulates and issues the operations order.
The British commander's estimate of the situation is almost identical to the German method, except his analysis is very methodical. The British commander determines friendly and enemy capabilities by analyzing "factors"—terrain, time available for a friendly decision, weather, comparison of forces, logistics, and morale. The British commander and his G2 focus their efforts on comparing each of the above factors against the purpose or "aim" that the friendly commander wants to achieve. Once the commander understands friendly and enemy capabilities, and the effect of the factors upon his accomplishing the aim, he moves into the next step—determining enemy options.86

In determining enemy options, the British commander now assesses each possible enemy COA by mentally visualizing what the enemy commander, given his capabilities, might do. This process is very similar to the U.S. Army method, except the commander does it without staff assistance. The British commander then tries to deduce the enemy commander's most dangerous COA, which is the one that impacts most upon friendly mission accomplishment. Deducing the enemy's "most dangerous" option is a product of the commander's experience and his judgment in using the information at hand.87

Once the British commander determines the most dangerous enemy option, he personally examines those COAs that attain the "aim". He mentally weighs the advantages and disadvantages of each COA against the enemy's most dangerous COA, and selects the best option available under the circumstances. The commander's weighing of advantages and disadvantages is based upon his
personally chosen criteria. For example, he might favor a plan that is simple, fast, and makes the best use of terrain. Once the British commander selects the most advantageous option, he briefs his staff as to why he selected it. The staff then produces and issues the operations order. 88

The discussion of Soviet tactical decision-making procedures within this paper addresses only known doctrinal methods and capabilities. Recent political turmoil within the Soviet Union makes it difficult, at best, to assess what capabilities the Soviet Army has either lost or retained. Thus, while this paper addresses Soviet decision-making in the present tense, it is possible that Soviet methods might be under revision.

The Soviet commander first considers his mission, instructions from his senior commander, and factors such as available decision-making time, the current friendly and enemy situation, and the capabilities of his subordinate commanders. The initial analysis of the current situation enables the Soviet commander to begin a detailed—yet rapid—analysis of available COAs using mathematical norms and scientific principles. 89

Soviet commanders probably have the same experience and judgment capabilities of any commander we have looked at so far. However, the Soviet decision-making process differs from the previous processes by giving the commander charts and tables, called "nomograms," to perform mechanical calculations that commanders in the United States, Germany, and Britain do mentally or analytically. Nomograms, which are based upon World War Two statistics, are designed to rapidly calculate the capabilities of
friendly and enemy units. The commander's calculations include determining the proper number of artillery pieces, tanks, people, and aircraft necessary for the appropriate correlation of forces—or what he needs to accomplish his mission. An example of a nomogram is in Appendix G.

The Soviet commander then weighs his capabilities against the enemy's capabilities, and chooses the best option for accomplishing his mission. The Soviet commander's criteria for weighing options, similar to his Western counterparts, are based upon experience and judgment. After he chooses the final option, his staff issues the order.

Soviet commanders, unlike their Western counterparts, are less concerned with determining enemy intentions because they believe they have enough mass to overpower an opposing force. The Soviets view being able to discern enemy intentions as the ideal; however, time, deception, and other factors impact greatly upon deducing enemy intent. The Soviets use their robust reconnaissance and intelligence system to accurately template enemy assets and deduce enemy capabilities; they then use mass to offset this lack of battlefield certainty regarding enemy intentions. In effect, mass substitutes for finesse.

To sum up, U.S. Army wargaming does not meet this criterion because U.S. division commanders make decisions based upon enemy capabilities rather than intentions. However, none of the other countries meet the criterion either, for the same reason. The problem lies with an inability to discern enemy intentions.

Time and the level of acceptable risk seem to impact most
upon COA analysis. Although commanders need time to read and confirm enemy indicators, they may not have enough time. Therefore, since sufficient time is not always available, a commander must accept risk by wargaming enemy capabilities, vice intentions, to reach a decision.

Moreover, success in deducing enemy intentions is highly dependent upon an experienced commander who clearly defines his priority intelligence requirements (PIR) and conveys them to his subordinates. If the commander fails to focus his intelligence collection assets, then it seems that the best one can do is to 1) base decisions upon enemy capabilities and 2) have options available to counter any enemy move.

The European commanders all base their decisions upon enemy capabilities. Consequently, their processes do not offer ways to improve our ability to deduce enemy intentions. However, the commander-driven wargaming process might be useful for reducing time to make decisions when using friendly and enemy capabilities. Moreover, Soviet-style nomograms might help staffs do routine calculations faster before COA analysis begins, thereby allowing more time to be spent on wargaming.

o RATIONAL CONTROL. ST 100-9 identifies five wargaming rules the wargamer must observe.93 The manual does not define the term "wargamer," but ST 100-9 notes that staff members analyze COAs, thereby implying that staff members are wargamers.94 Rules, then, apply to staff members who "wargame". The rules discussed below appear to be von Neumann/Morgenstern's rigid form, in that they are "specified in advance."95
The first rule requires the wargamer to list advantages and disadvantages as they become obvious during the wargaming process. ST 100-9 fails to explain what "obvious" means, or to offer any method for recognizing what is an obvious advantage or disadvantage.

Army Research Institute (ARI) believes that the ability to recognize obvious advantages and disadvantages comes from recognition patterns established from years of practice in viewing events. Recognition patterns make it obvious as to what can be accomplished, what dangers exist, what critical cues must be monitored, and what expectations should be formed.96 Thus, the ability to understand and recognize obvious advantages and disadvantages comes from experience and judgment.

The second rule asks the wargamer to remain unbiased, keep an open mind, and avoid influences by other staff officers or his own prejudices. This appears to be unrealistic. ALPHATECH finds that decision-makers weigh any evidence which supports prior beliefs more heavily than evidence which contradicts them.97 ALPHATECH also finds that experienced decision-makers reduce bias by seeking information to disconfirm their beliefs. Less experienced decision-makers, however, seek information to confirm their beliefs, which increases bias in their decision-making process.98

Experience and beliefs affect wargamer bias. As ARI describes it, people "are poor decision-makers at best."99 People are influenced by their past experiences, pre-conceptions of reality, and personal preference. Rules number one and two,
however, rely greatly upon experience and judgment. Therefore, rules one and two seem to contradict each other.

Rule number three asks the wargamer to assess the feasibility of the COA to see if it meets mission requirements. The wargamer is then asked to reject any COA that is not feasible. A feasible COA is one that is "doable"—either you can or cannot do it. A COA that "meets mission requirements" means it is suitable, or results in the desired effect. An acceptable COA means the expected results are worth the estimated costs. If the COA under consideration is not feasible, the wargamer throws it out. However, if the COA is neither suitable nor acceptable, what does the wargamer do? The rule does not cover this situation.

The wargamer needs criteria regarding mission requirements to decide what is suitable and acceptable. Mission requirements criteria come from the commander's intent, any command guidance, and other instructions from a higher headquarters. The staff determines these criteria during the mission analysis portion of the decision-making cycle. Thus, if the wargamer understands the mission criteria, then he should know how to judge the suitability or acceptability of the COA. However, if the wargamer fails to understand the mission criteria, he will have difficulty assessing mission suitability and acceptability.

The fourth rule requires the wargamer to avoid comparing one COA with another during the wargaming of the individual COAs. Accordingly, the wargaming process assists in avoiding premature comparisons of COAs by designating a comparison phase, which occurs after COAs have been analyzed in isolation.
then compares feasible COAs to identify the one with the best chance of success. 103 This rule appears to be enforceable, provided that the wargamers have enough discipline to avoid early COA comparison.

The last rule requires the wargamer to avoid drawing premature conclusions and then presenting facts to support those conclusions. Unfortunately, ST 100-9 offers no help in suggesting ways to elude this problem. Premature conclusions occur if a situation seems similar to past situations. 104 However, an experienced wargamer will realize that each tactical situation is different and that he must analyze each situation independently of past experience. A less experienced wargamer makes a rapid decision based upon past experience, fails to analyze all the facts, and arrives at a premature conclusion. Because this rule requires experience and judgment, it is susceptible to the same failings as rules one and two.

The German, British, and Soviet decision-making processes do not address specific rules for wargaming. European commanders mentally visualize the execution of each possible COA using the decision-making steps in Annex A. However, some of their decision-making procedures might be considered rules.

The German commander, for example, is required to follow three sequential steps in determining his comparison of forces. These steps are: compare friendly and enemy combat effectiveness, examine possible changes in relative strengths, and compare friendly COAs against their chances of success. I can find no specific guidance on how these steps are accomplished, or what
criteria constitute a "chance of success;" however, an interview with a German officer confirmed the steps are done in sequence and the commander's judgment determines the criteria for success.105

The British commander must rigidly follow the sequential decision-making process described in Annex A. This process is supposed to help the commander follow a logical, methodical thought process to accomplish his "aim".106

Finally, the Soviet commander must use nomograms.107 The commander mentally visualizes the current situation, then selects the nomograms which fit. However, selecting nomograms to fit a situation is somewhat similar to free gaming, since the situation constantly changes as to which nomograms are necessary to determine a tactical answer. However, because the data which produce nomograms do not change, nomograms themselves are not only rigid but probably antiquated.108 The process of choosing nomograms to meet the requirements of a situation is very similar to a U.S. Army "playbook." A playbook consists of pre-determined branches to a plan, that are detailed enough to execute, if necessary.109 Thus, a Soviet commander, by choosing which "norms" fit the situation, takes a "playbook" approach toward analyzing the situation he faces.

In summary, U.S. Army wargaming rules do not meet this criterion because they are vague and conflicting. The rules attempt to establish some general conformity, which is good; however, wargamers must rely heavily upon experience and judgment to comply with them. Wargamers must not only define unclear and
conflicting rules but, by being human, the wargamers are subject to personal biases and are subject to making premature conclusions as well. More specific rules and clearly defined wargaming terms might help. Reducing wargamer bias and premature conclusions is difficult at best; however, ST 100-9 could be more specific on how a wargamer avoids these problems.

European rules are prescriptive guidance for following certain procedures during decision-making. However, since there are no specific rules associated with the mental wargaming process, I cannot make an assessment whether or not the European methods are better than ours.

V. CONCLUSIONS AND IMPLICATIONS

I began my research by asking, "Does the current manual wargaming process, as practiced by the U.S. Army, determine the optimum course of action for the tactical commander?" My investigation shows it does not—and probably cannot because of uncertainty. My overall findings are that while wargaming considers a rational opponent, it does not analyze COAs by considering enemy intentions, nor is rational control precise enough to preclude human bias and premature judgment. Furthermore, analyses of the current German, British, and Soviet processes demonstrate that their processes are probably no better than the U.S. Army's process. Besides my overall conclusion, some others are also worth mentioning.

First, wargaming relies upon experienced wargamers who understand the doctrine of a rational enemy. Therefore, lack of expertise about the enemy might bias the wargame results.
However, the G2 should be the staff subject matter expert on enemy doctrine; therefore, he must be able to provide the best possible information about the enemy.

Second, and closely related to the previous conclusion, the use of adversarial wargaming helps reduce the bias in wargaming results by incorporating the best possible representative of the enemy, the G2.

Third, game theory views recognition of enemy intentions as the optimum way to choose a friendly COA. However, in the "real world," getting the optimum solution is difficult because commanders are under such limitations as time, uncertainty, a possible unwillingness to take risk, and because they have difficulty formulating useful PIR. While the intelligence community does its best to help with these problems, divisions currently do not have the assets to produce the "near-real time" intelligence the commanders need to make decisions.110

Fourth, we can learn from the German, British, and Soviet processes. The first lesson is that their processes require more commander involvement, which seems to reduce the time needed to analyze COAs. Accordingly, ST 100-9 recommends an option to shorten the decision-making process by involving the commander more when time is critical.111 The second point is that the Soviets are particularly effective at simplifying staff calculations through the use of nomograms. While nomograms do not speed up wargaming, per se, they might assist in rapidly performing mission analysis so that more time is available for COA analysis.
My final conclusion is that U.S. Army wargaming rules do not provide an effective structure for analysis; they are vague and conflicting. The rules rely too much upon experience; as such, they are subject to misinterpretation and bias.

Having reached some conclusions about wargaming, I can now deduce some corresponding implications. First, the G2 will need extensive training to replicate a rational opponent through adversarial wargaming. This concept should be taught in U.S. Army schools and units must practice it in the field. Second, we must do a better job training officers on the development of PIR. Because they focus the intelligence effort, PIR must be more than just a "check the block" requirement during training exercises. Third, the intelligence community will need to develop methods to provide commanders with near-real time imagery to help commanders deduce enemy intentions and reduce risk by answering the PIRs. These first three implications would seem to be my most important ones. Fourth, the U.S. Army school system should emphasize the concept of more commander involvement in wargaming in order to reduce COA analysis time. Fifth, we must look at the practicality of time-saving templates to ease the staff burden of computing the data the commander needs for decisions. Finally, FM 101-5 needs to be rewritten to include the detailed wargaming process found in ST 100-9. Until FM 101-5 is revised, however, ST 100-9—which is not doctrine--will need to be revised to include the applicable changes recommended in this paper.

Helmuth von Moltke ("The Elder") said that, "You will usually find that the enemy has three courses open to him, and of
these he will adopt the fourth.\textsuperscript{112} Thus, no matter what the commander does, he cannot escape uncertainty completely. While our wargaming process has its problems, it does provide a method for helping the commander cope with this "fog of war." However, it can and should be improved, since the ability of a commander to visualize and analyze friendly COAs against enemy COAs just might be the deciding factor on the battlefield.
Appendix A: Selected European Army Decision Models

References: TRADOC Report The Command and Control System of the German Army, 1977, pps. 1, 2; and interviews with German CGSC students.

1. German Army. The German Army uses a five-step estimate of the situation. The commander may move between steps in no particular order.

- Analysis of the mission. The commander and staff identify important tasks from the higher commander, any conditions or limitations placed upon possible friendly courses of action, and perform an analysis of the current situation.

- Estimate of the Friendly and Enemy Situation. The estimate of the friendly situation includes determining friendly combat power and estimating friendly effectiveness. Combat power is determined by staff estimates, normally personnel and material strengths, equipment readiness, supply status, and current status of command and control means (in-place communications and liaison). The German commander also considers troop morale, level of training, and the physical condition of his troops. The commander develops and analyzes enemy courses of action based upon possible enemy capabilities and the current enemy situation. The German commander mentally visualizes what the enemy commander is capable of doing, then compares capabilities to known enemy locations on his situation map. The German commander continually updates and analyzes the enemy situation throughout the process.

- Evaluation of Environmental Conditions. This step is simply terrain analysis, which may be combined with the step above. Terrain is evaluated as favorable, conditionally favorable, or unfavorable in relation to both friendly and enemy forces and their equipment, weather, and previous use of chemical or nuclear munitions.

- Formulation of Own Courses of Action. The German commander first compares his friendly force analysis against the enemy force. He determines, in his judgment, which force is more capable than the other. He then performs a projection as to what possible enemy or friendly strength changes might occur that could affect his mission. The German commander determines which courses of action are feasible by mentally wargaming each possible course of action against each enemy course of action. He discards non-feasible courses of action.

- Comparison of Each Course of Action. The commander evaluates each friendly course of action as to advantages versus disadvantages using criteria he considers important (i.e., use of time or deception). He then uses his judgment to select the best one, and his staff prepares the execution order.
Appendix A: Selected European Army Decision Models (continued).

Reference: Organizational Handbook of the British Army, 1990, pp. 2 to 7 and interviews with British CGSC students and British and Canadian students at the Canadian Staff College 1990-91.

2. British Army. The British estimate is called an "Appreciation". There are five steps. The commander must finish one step before he moves to the next.

- **Step One.** The British commander and staff analyze the current situation, guidance, and mission from higher headquarters, and any assumptions which impact upon the plan.

- **Step Two.** The commander specifies his "aim", or what is to be attained. The aim is the crux of the appreciation; it must be right or the entire process might be skewed. There is only one aim. The commander deduces his aim by considering the current situation, to include friendly and enemy forces, their locations, training status, equipment readiness, and the enemy's most probable threat (i.e., ground attack, terrorism, to name a few). The aim is never qualified by limitations; it must be attainable given the means at hand.

- **Step Three.** The commander considers all relevant factors—time and space, weather, comparison of forces, ground (terrain), logistics, morale, and others as the commander’s experience dictate. He then weighs each factor against the aim to ensure that his aim is feasible, suitable, and acceptable (same as U.S. criteria). He then considers all enemy courses of action developed by his G6 that might affect selection of any friendly course of action. The commander considers enemy options from his viewpoint and how the enemy options might impact on his attaining his aim. He then "worst cases" the situation and identifies the enemy’s most dangerous or immediate threat.

- **Step Four.** The commander considers all feasible courses of action that attain his aim in relation to the most immediate enemy threat. The commander mentally wargames each course of action against the most dangerous enemy option to visualize his plan and develop counteraction (batteries). Each friendly course of action is considered separately, with the commander determining the advantages and disadvantages of each using his own criteria (i.e., best use of ground, surprise, speed) in regards to attaining the aim.

- **Step Five.** The commander decides which friendly course of action, in his judgment, attains the aim. He briefs his staff as to why he chose the course of action that he did and issues guidance; the staff then prepares the order.
Appendix A. Selected European Army Decision Models (continued).
Reference: Fundamentals of Tactical Command and Control, 1977, p. 188.

3. Soviet Army. The Soviet commander follows the process as diagramed below.

Note: The extent to which the commander details measures for political work, types of combat operations support, and organisation of command and control depends on the availability of time and other circumstances.
Appendix B. United States Army Wargaming Process

Reference: United States Army Command and General Staff College
Student Text 100-9, Techniques and Procedures For Tactical Decisionmaking, 1991, pps. 4-1 to 4-10.

- Gather the tools. The commander decides, based upon the G2's current situation estimate, which enemy course of action he wants to wargame first. The staff then posts the map with the area of operations, which came from higher headquarters. The staff next posts the area of interest, as determined by the G2 from his Intelligence Preparation of the Battlefield (IPB). The G2 posts the current enemy situational template, also derived in the G2 IPB process, on the map. G3 personnel then post current friendly unit locations on the same map as the enemy template.

- List all friendly forces. The staff compiles all available forces, assets, and priorities of support such as air sorties and nuclear/chemical packages. The list prevents overlooking a resource during wargaming.

- List the assumptions. In wargaming, assumptions help to shape a course of action. Not everything is known as the course of action is formulated; therefore, wargamers develop logical assumptions concerning enemy activities, enemy strengths, and other factors beyond friendly control. An assumption is considered valid, for wargaming purposes, if it answers the questions:
  1) Is the assumption necessary to solve the problem?, and
  2) Would the result change if the assumption were not made?

- List known critical events and decision points. The G3 identifies critical events and decision points based upon the current situation and/or commander's guidance. Critical events are specified or implied tasks, the completion of which are essential for mission accomplishment. Examples of critical events are passages of lines, river crossings, and deep operations. Decision points identify events in time and space that require a command decision to ensure synchronization. The wargame process may identify additional critical events and decisive points.

- Select a wargame method. This means choosing from several recommendations in ST 100-9 or using one of your own. Wargame methods organize the battlefield so it can be analyzed by the wargame process. ST 100-9 recommends three techniques: the avenue-in-depth, the belt, and the box. The avenue-in-depth and belt techniques, while detailed, are also time consuming. The box method analyzes a small, critical area of the battlefield—such as a river crossing site—and is faster. Each technique may be used separately or in combination. A detailed explanation of these techniques is found in Appendix C.

- Select a wargame technique to record and display the results. Recording the results of wargaming is a key factor in synchronizing the battlefield. Wargaming results help determine
Appendix B: United States Army Wargaming Process (continued)

task organization changes, the maneuver sub-paragraph of the operations order, and a course of action sketch, which becomes the operations overlay. There are two recommended methods for recording the wargame: the narrative and sketch note techniques. The narrative technique describes the operation from start to finish in "story" form. The sketch note technique uses brief notes concerning critical locations and tasks. These notes might be recorded on maps, a wargame worksheet, or on a synchronization matrix. Examples are found in Appendix D.

o Wargame the battle and assess results. The crux of the wargame process is the last step where the staff, led by the G3, wargames the battle. The wargame process begins with the staff identifying tasks to subordinate commanders one level down (brigade), and assets two levels down (battalion). The staff mentally visualizes how a subordinate commander might use his allocated forces. The staff simultaneously considers the subordinate's use of combat, combat support (CS), and combat service support (CSS) assets to accomplish assigned tasks. For example, the division plans on tasking 1st Brigade to attack to secure an objective. The staff mentally visualizes how the brigade commander might array his combat, CS, and CSS assets to cross the line of departure (LD). The staff next arrays unit symbols depicting all the 1st Brigade assets on the wargaming map. This process repeats itself for each of the division major subordinate commands and division troops. The sequence of action-reaction-counteraction now begins.

The division staff uses this sequence for any type of operation, but, as an example, I will use an attack. The staff begins by first visualizing the brigades and their subordinate battalions in their initial positions and then moving the representative unit symbols on the map to the LD. The staff focuses on those actions the subordinate units must take to accomplish movement to the LD. The staff simultaneously considers all elements of the offensive framework (deep, close, rear, flank security, and reserves to weight the main effort) and records all actions taken by division and subordinate units across the battlefield operating systems (command and control, maneuver, fire support, intelligence and electronic warfare, mobility-countermobility-survivability, combat service support, and air defense) using a recording technique. Once each action is determined for moving to the LD, the second part of the sequence begins—the enemy reaction.

The enemy reaction considers all possible enemy forces the G2 identifies that could counterattack the division. It is important to use all enemy assets available so the friendly course of action can be adequately tested. The staff records enemy actions on the same document as the friendly actions. This leads into the third part of the sequence—the counteraction.
The staff now examines what actions the division headquarters takes in response to the enemy reaction. Some examples of counteractions might be shifting of priority of fires from one brigade to another or jamming enemy command and control nets. The G3 allocates assets to execute the counteraction and lists them in the same fashion as in the action and reaction sequence. The analysis of moving to the LD is now complete. The analysis continues in the same manner until the division reaches its objective. The process then restarts with a different enemy situational template but with the same friendly course of action. War gaming continues until all friendly and enemy courses of action are analyzed.
Appendix C. U.S. Army Wargame Methods.

Reference: United States Army Command and General Staff College Student Text 106-9, Techniques and Procedures For Tactical Decisionmaking, 1991, pp. 4-2, 4-3.

Step 5. Select a wargame method. A number of techniques can be used to organize the area to be analyzed. Three possible methods are the avenue-in-depth techniques, the belt technique, and the box technique. These are explained below:

1. Avenue-in-depth technique. This technique focuses on one avenue at a time starting with the main effort. It is a good technique to use for offensive courses of action or in the defense where canalizing terrain exists.

2. Belt technique. This technique divides the battlefield into areas that run the width of the sector; it analyzes the subcomponent battles sequentially across the width of the sector. This is the preferred method as it ensures simultaneous consideration of all forces that could affect a particular event. The exact shape of the belt is based on analysis of the battlefield. Any belt may include more than one critical event.

In the offense, the planner considers the assault or penetration phase, the exploitation phase, and, finally, the pursuit phase. In the defense, the planner examines in sequence the battle in the covering force area, in the main battle area (MBA), and, finally, in the rear area. This technique is most effective when the terrain is broken into well-defined cross compartments, i.e., good to use if the operation is phased; includes amphibious assaults, river crossings, airborne and airborne operations; or if the enemy is in clearly defined belts or echelons. Belts can be drawn adjacent to or even overlapping one another for complete visualization of the battle.

When time is short, a modified belt technique may be used. The modified technique, in both the offense and defense, divides the battlefield into not more than three sequential, but not necessarily adjacent or overlapping, belts that run the width of the sector and focus on actions throughout the depth of the area of operations.

As a minimum, the belts should include initial contact either along the line of departure (LD), line of contact (LC), or in the covering force area; initial penetration or initial contact along the FEB; and passage of the reserve or commitment of a counterattack.

3. Box technique. The box technique is a micranaalysis of a few critical areas, such as an engagement area, a river-crossing site, or a flank avenue of approach into the sector. The planner isolates the area and focuses the battle in that terrain area. This technique is less time consuming. An initial assumption is made that the friendly units can handle most of the situations on the battlefield and the planner can focus on the most essential tasks. This technique is useful if the task is apparent, e.g., attack or counterattack of a major enemy unit. This technique is used when time is extremely limited such as in a hasty attack.

You may use these techniques separately or in combination, or you may use your own method.
Appendix D. U.S. Army Wargame Recording Techniques.

Reference: United States Army Command and General Staff College Student Text 100-9, Techniques and Procedures For Tactical Decisionmaking, 1991, pp. 4-4 to 4-6.

NARRATIVE WAR GAME
CORPS DEFENSE
CRITICAL EVENT: Corps Counterattack—Box 1

As the follow-on tank division approaches the FLOT, the MBA units will both have fought significant fights but will be well disposed along the FEBA. The threat will probably commit the tank division along the avenue that has produced the most significant results. We feel that this will be along the avenue just to the north of the division-sep mech box boundary. The MBA division may have sufficient combat power to defeat this tank division if the disruption efforts of the corps deep operations campaign have been successful. While we hope that this will be the case, we feel that the threat is most likely to penetrate our defenses vic Obj BLUE. The corps counterattack force, Div (-), will plan a counterattack to destroy any force making a significant penetration into this area. As this is the area where we feel the threat will more than likely come, we are well prepared for it by the initial placement of the counterattack force. The MBA division will support the counterattack by holding the shoulders of this penetration. The penetration will be shaped so that the div (-) attacks the southern flank while the MBA div blunts the penetration. At the conclusion of this operation, the corps will defend along the FEBA with the MBA div in the north, the corps counterattack force, div (-), in the center, and the sep mech box in the south. Priority of engineer support to the MBA div to prep positions to hold the shoulders of the penetration. Then to ensure mobility of the counterattack force. Avn bda be prepared to support counterattack into Obj BLUE. ADA priority to protecting the move of the counterattack force.IEW assets confirm the committment of the threat into Obj BLUE, identify any follow-on forces.
### WAR GAME WORKSHEET

**Corps Defense**

**CRITICAL EVENT:** Covering Force Battle—Part 1

<table>
<thead>
<tr>
<th>Sequence</th>
<th>ACTION</th>
<th>REACTION</th>
<th>COUNTERACTION</th>
<th>ASSETS</th>
<th>TIME</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Move next position.</td>
<td>Conduct return to find BPs and gun to co-acting force area.</td>
<td>Conduct permanent operation. Bring away army, div., &amp; regt.</td>
<td>ACR, maneuver bde, target area.</td>
<td>H-36 to H-1</td>
<td><strong>Remarks:</strong> Corps ARTY, 8 FA bde, H-1 ADA.</td>
</tr>
<tr>
<td></td>
<td>Monitor dispersion.</td>
<td>Think TAR from front and enemy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Prep for ground attack.</td>
<td>Conduct FA prep on BP, CPs, FA locations, Jam enemy fire units, and ADA-locating system. Add with fixed and fast CF S.</td>
<td>Less FA, firing positions and units. Employ CA and ADA.</td>
<td>FA prep per lane, ADA bde.</td>
<td>H-7 to H</td>
<td><strong>Remarks:</strong> Priority move to MBDA, DGS.</td>
</tr>
<tr>
<td></td>
<td>Launch air attack.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Think regt AFV to support next AFV to support next AFV.</td>
<td>ACR holds on area A.</td>
<td>Maneuver bde holds on area B &amp; C. Movement to area D. Move from lead div to connect 54th regt to ID units effort.</td>
<td>ACR, maneuver bde.</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Think enemy AFV on def.</td>
<td>ACR, moves units to area B &amp; C.</td>
<td></td>
<td>ACR, maneuver bde.</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*From maneuver and interference planning line (RIPL)—A phase line which defines the corps area of responsibility. The RIPL is drawn on the operations map to delineate the area forward of the corps fire support coordination line into an area for the corps to target BAI missions short of the RIPL and an area for the army group/allied tactical air force to target AI missions beyond the RIPL. (This is a NATO term only.)*
SYNCHRONIZATION MATRIX - Division Offense

| Time | -18 | -12 | -10 | -9 | -7 | -5 | -3 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|------|-----|-----|-----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Enemy Actions | | | | | | | | | | | | | | | | | | |
| Formation Plans | | | | | | | | | | | | | | | | | | |
| Phase | | | | | | | | | | | | | | | | | | |
| Security | | | | | | | | | | | | | | | | | | |
| Open | | | | | | | | | | | | | | | | | | |
| Reserve | | | | | | | | | | | | | | | | | | |
| Base | | | | | | | | | | | | | | | | | | |
| Air Defense | | | | | | | | | | | | | | | | | | |
| Forward | | | | | | | | | | | | | | | | | | |
| EW | | | | | | | | | | | | | | | | | | |
| Engaged | | | | | | | | | | | | | | | | | | |
| Environmental | | | | | | | | | | | | | | | | | | |
| C2 | | | | | | | | | | | | | | | | | | |

Diagram of SYNCHRONIZATION MATRIX - Division Offense.
Appendix E. U.S. Army Decision Matrix.

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>w1</th>
<th>w2</th>
<th>w3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Surprise</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Speed</td>
<td>5</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Mass</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Combined Arms</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Security</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CSS</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Objective</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>CI</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Offensive</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>21^6</td>
<td>26</td>
<td>29</td>
</tr>
<tr>
<td>Weighted total</td>
<td>35^7</td>
<td>48</td>
<td>61</td>
</tr>
</tbody>
</table>

1Criteria are any factors that pertain to the mission (options include specific elements of commander's guidance, battlefield operating systems, benefits of AirLand Battle, OCOKA, critical events). They may be assigned by either the commander or staff. If the criteria are qualitatively the same for each course of action, they may not need to be distinguished.

2Courses of action are those that are selected for war gaming.

3The principal staff officers assign numerical values for each criterion after the courses of action are war gamed. These values reflect the relative advantages or disadvantages of each criterion for each course of action. In the example above, course of action 3 is clearly the best.

4The numbers are totaled to provide a subjective evaluation of the best course of action without weighting one criterion over another.

5Should the commander desire to emphasize one criterion as more important than another, he assigns weights to each criterion based on relative importance.

6The weights are multiplied by the initially assigned score in each column.

7The scores are totaled to provide a "best" course of action based on weights assigned by the commander.
WEIGHTING INDICATORS

Weighting indicators helps resolve ambiguity. In combat, intelligence analysts usually are confronted with conflicting indicators. Enemy forces may portray patterns associated with attack, defense, and delay simultaneously. Conflicting indicators result from--

- Deliberate deception.
- Bad execution.
- Temporary indecision.
- Transition between missions.
- Random activity.
- Incomplete or inaccurate information.
- Ambiguity of the indicator itself.

When confronted with ambiguous or conflicting indicators, analysts weigh some indicators more heavily than others to determine the enemy's actual intent. This is not a problem of simple mathematics. The enemy's actual course of action may not have the most indicators. Analysts develop a methodology for identifying those indicators which are most highly characteristic of a course of action. There are several techniques which, individually or in combination, assist in this process.

Origin of the Indicator

One technique of determining the enemy's intent is to consider the origin of the indicator; that is, the reason why the enemy force presents a particular pattern or tip-off. In brief, all indicators stem from either military logic, doctrinal training, organizational constraints, bureaucratic constraints, or the personality of the enemy commander.

Military Logic. Military logic implies, and military experts agree, that solutions to many military problems are obvious. For example, all modern armies employ artillery forward for attack and echeloned in-depth for defense. Violation of military logic usually implies the loss of combat power or support at some critical point during an operation.

Doctrinal Training. A nation's tactical doctrine includes military logic and much more. Most doctrine begins where military logic ends. Military experts sometimes disagree on the ideal solution to a specific military problem. For example, US and Soviet doctrine agree on deploying artillery forward in the attack, while they disagree on using artillery in a direct fire role. Just as terrain and weather are physical constraints on the enemy's adoption of a course of action, enemy doctrine and training are mental constraints. Soviet emphasis on detailed, repetitive training is designed to inbreed a sort of reflex action which enhances the value of doctrinal indicators. Though individual commanders display more or less
Appendix F. Weighting of Intelligence Indicators (continued).

Imagination and creativity in its application, indicators based on doctrine and training are generally reliable.

Organizational Constraints. Organizational structure represents a special case of doctrine. The ideal composition of a division (size, organization, weapons, and organic support) is debatable. The military experts have resolved this issue in radically different ways. Organization influences include a nation’s strategic commitments, economic resources, geography, threat perceptions, historical experience, alliances, personnel and equipment resources, and a myriad of other factors. The tactical organization resulting from these factors causes identifiable patterns to develop when employed. A US division generally has three subordinate maneuver headquarters contrasted with four in a Soviet division, and differences in the composition and structure of the division base imposes distinct patterns concerning US and Soviet operations.

Bureaucratic Constraints. Identifying bureaucratic constraints as a source of indicators shows that military units are large organizations and must establish routines and SOPs to function efficiently. This imposes patterns in planning, execution, logistics support, and other activities. Though there are general similarities in routines and procedures of comparable units, there are likely to be significant variations which can be identified and exploited locally.

Personality of the Commander. The enemy commander is the final source of indicators. Each commander has a unique history of personal training, experience, success, failure, and idiosyncrasies. Many are creatures of habit, prone to repeat what has worked in the past; others are creative and innovative. All are captives of their experience to some degree. It is the commander who must apply and mix military logic, doctrine, and organization to accomplish the mission. The commander’s personality is one major source of deviation from established doctrinal norms. The importance of personality is recognized in that biographic intelligence is a major component of strategic intelligence. US tactical OB doctrine classifies personality as a subcategory under miscellaneous factors.

In general, indicators are weighed, with the role of the commander being considered a variable. In the case of a strong, innovative, or eccentric commander (Patton or Rommel), personality is more important than doctrine or training; while the personality of a methodical, traditional commander ranks last.

Principle of Mass Indicators

Another technique is to weigh the indicators which reflect or are based on the principle of mass. Military units normally conduct deception operations with the same force constraints in which they accomplish their actual mission. The enemy commander often conducts deception with the least outlay of scarce resources. Indicators based on a major confirmed commitment of combat resources are more likely to reflect the true situation. In a nuclear environment, massing is not required to achieve a favorable combat power ratio; thus, mass is not a reliable indicator.
Appendix F. Weighting of Intelligence Indicators (continued).

Analysts identify the enemy's capability to concentrate fires of potential nuclear delivery systems.

Other Indicators

The last technique is to weight those indicators which are most difficult to take.

Quantify Probable Relationship. Quantify the probable relationship between the presence of specific indicators and the enemy's adoption of a particular course of action. If the enemy command intends to adopt a particular course of action, what is the probability that a specific indicator is present? The answer is subjective, but it is based on the analyst's knowledge of and experience with the enemy, the analyst's professional judgment, and to some degree, the mathematical probability of specific indicators associated with enemy courses of action.

Analyze the Time Sequence of Events. It takes time for an enemy force to prepare, move, and execute an operation. Time, mass, and space relationships are a major tool in exposing deception. Since deception is often conducted with the least outlay of combat resources, close analysis of information from different sources which report on the same location, at the same time, or concerning the same enemy unit may reveal significant discrepancies.

Assess the Enemy's Combat Effectiveness. Such assessments are based on an analysis of both tangible and intangible factors. Tangible factors include personnel and equipment strength. Intangible factors include morale, training, political reliability, and other factors. While combat effectiveness bears directly on a unit's capabilities and probable courses of action, there is no scientific method of determining it. It requires the analyst's subjective judgment of the impact of both the tangible and intangible factors.

WARGAMING FRIENDLY AND ENEMY CAPABILITIES

Consider the enemy G2's perception of the friendly force. Though enemy capabilities exist independently of their assessment of friendly forces, the enemy's choice of alternative courses of action does not. Determine the enemy's perception of friendly capabilities through analysis of the collection capabilities, known collection activities, and inadvertent disclosures by friendly forces which might have been monitored by enemy intelligence. Detailed analysis of potential disclosure enables the analyst to partially reconstruct the enemy G2's working SITMAP.

Mentally wargame advantages and disadvantages of identified enemy capabilities from the enemy commander's point of view. This is a valuable analytical technique, but potentially dangerous if it becomes mirror-imaging.

Avoid preconceptions. The analyst must remember that the objective is not to prove a prior judgment. Experience suggests that preconceptions are the analyst's principal nemesis. Even if the techniques recommended
above are creatively employed, there is a danger that the analyst who has reached and expressed a preliminary judgment unconsciously begins to seek and weigh evidence which confirms the initial estimate and dismisses or passes over inconsistent or conflicting information. The analyst should not be concerned about the answer, as long as it is the right answer. The analyst reserves judgment, maintains objectivity, remains aware of uncertainties, tolerates dissent, and constantly tests working theory against available evidence. Where practical, the analyst considers establishing a "devil's advocate" system to test, challenge, and think the unthinkable.
Figure 25. Graph for Determining the Required Time, the Extent of the Move, or the Troops’ Marching Rate.
ENDNOTES

1. G.I. Gibbs, Dictionary of Gaming, Modelling, and Simulation, (Beverly Hills, 1978), 37. Gibbs defines decision-making as "taking" decisions, but the intent is the same.

2. Command and General Staff College, Student Text 100-9, Techniques and Procedures For Tactical Decisionmaking, (Fort Leavenworth, KS, 1991), 1-1.

3. The Joint Chiefs of Staff, JCS Pub 0-1 National Defense Doctrine, Washington, D.C., initial draft, 1 Nov 1989, 1-10, and CGSC ST 100-9, Tactical Decisionmaking, p. 4-1.

4. Ibid, 4-1.


7. CGSC ST 100-9, 4-1.


10. Ibid, 9.


18. Ibid, 10. Shubik believes that chess and card games are rigid because the rules are specified in advance. As such the best game move for any given game turn is predictable due to the limited number of possible choices.

19. Von Neumann and Morgenstern, 12-16.


23. Von Neumann and Morgenstern, 75-80.

24. Ibid, 76.


26. Ibid, 6-10.

27. Ibid, 20.


29. Ibid, 23.


<table>
<thead>
<tr>
<th>Absolute Uncertainty</th>
<th>Enemy Capabilities</th>
<th>Enemy Intentions</th>
<th>Absolute Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-)</td>
<td>(p p p p p)</td>
<td>(p p p p p)</td>
<td>(+)</td>
</tr>
<tr>
<td>Ultra Conservative</td>
<td>Maxi-Min</td>
<td>Balance Point</td>
<td>Ultra Optimistic</td>
</tr>
<tr>
<td>Mini-Max</td>
<td></td>
<td>Mini-Max</td>
<td></td>
</tr>
<tr>
<td>P = Payoff</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the payoff model above, absolute uncertainty and certainty are opposite poles. In decision-making theory, the absolutes are seldom used. An ultra-conservative decision has minuscule payoffs and is deemed inappropriate, while the ultra-optimistic decision fails to consider losses and is overly audacious. Thus, decision-makers tend to balance between being too conservative and too bold. Which side of the balance point one uses depends upon available information regarding an opponent. For example, if all one can discern are enemy capabilities, then most decision-makers choose the best of the worst cases by using the maxi-min model, or somewhere between ultra-conservative and the balance point. The subsequent payoff is not as good when compared to a decision using intentions, but it is safer due to limited enemy information. In this case, moving further to the right not
only increases risk but also a theoretically more positive pay-off. On the other hand, a decision-maker who deduces enemy intentions chooses the mini-max model, accepts a reduced but larger payoff—but is still conservative in that he retains assets to deal with some uncertainty. If he is more optimistic, the decision-maker can move further to the right and increase his payoff (while increasing risk), or move further to the left, decreasing simultaneously both his payoff and his risk. Of course a decision-maker can ignore the models completely and be ultra-conservative, ultra-optimistic, or anything in between regardless of how much enemy information he has. Choosing to ignore the models depends upon the decision-maker’s experience and judgment, and how much risk he is willing to accept.

31. Haywood, 30.
34. Ibid, 2.
35. Ibid, 4.
36. Ibid, 5.
38. Staff of Strategy and Tactics, 5.
40. Michel, 7.
41. Staff of Strategy and Tactics, 5.
42. Ibid, 6.
43. Staff of Strategy and Tactics, 9.
45. Ibid, 3.
46. Michel, 7.
47. Ibid, 10.
48. Ibid, 8.
49. Ibid, 10.

50. ST 100-9 mentions being able to "read the battlefield" on page 2-1, and specifically the "best" course of action on page 4-1. The discussion on these pages indicates that commanders make decisions based upon current conditions that are known or assumed.

51. CGSC ST 100-9, 2-1 to 2-6.

52. Ibid, 3-1 to 3-6.

53. Ibid, 4-1.

54. Ibid, 5-1 to 5-2.

55. Ibid, 4-1.

56. Ibid, 4-1 to 4-2.

57. Ibid, 4-8.

58. Ibid, 4-8.

59. Ibid, 4-10.

60. Ibid, 4-10.

61. Ibid, 4-10.

62. Ibid, 4-11.

63. Ibid, 4-11.

64. Ibid, 4-7.

65. Ibid, 4-7.


68. Ibid, 5-9.


70. My information for this footnote appears in a number of sources. My primary German source is a Training and Doctrine Command Report on The German Command and Control System, 1977. I used various interviews with German CGSC students as well as my
over seven years of USAREUR service working frequently with German units. During 1986 I was a company commander attached to a German armored battalion where I watched this process in action over a one-week period. My British notes come from interviews with British CGSC students, a British student I met in 1991 on a visit to the Canadian Staff College, and the 1986 version of the Camberley Staff College manual Tactics. The Soviet method comes from a USAF translation of Fundamentals of Tactical Command and Control, 1977.

71. CGSC ST 100-9, 4-1.
72. Ibid, 3-2.
73. Ibid, 3-2.
75. I used these reports in my three years experience as a primary staff officer in a heavy division. As a Battle Command Training Program Observer/Controller I observed ten different U.S. Army divisions use the same methods for collecting data.
76. U.S. Army Field Manual 34-3, 6-1 to 6-2.
77. CGSC ST 100-9, 4-1.
79. I personally observed five division commanders go through the decision-making process during BCTP War Fighter Exercises between September 1989 and May 1990.
81. U.S. Army FM 34-3, 6-10 to 6-12.
82. Ibid, 5-4.
84. Author interview with a German officer during CGSC War Fighter 1991. I cannot give his name due to the CGSC non-attribution policy.
85. According to my German source, this is normal because war gaming "takes too long".

87. Interview with a field grade British officer during a Canadian Staff College exercise. I cannot use his name due to CGSC non-attribution policy.

88. Camberley Staff College, 1-6.

89. D.A. Ivanov, V.P. Savel'yev, and P.V. Shemanskiy, p. 185-186.


91. Ibid, 207 to 209.

92. Ibid, 40-46.

93. CGSC ST 100-9, 4-1.

94. Ibid, 4-1.

95. Shubik, 9-10.


98. Ibid, 24.


100. CGSC ST 100-9, 4-1.

101. Ibid, 2-1 to 2-6 and 4-11.

102. Ibid, 4-1.

103. Ibid, 4-10.


105. This is similar to the U.S. process where the commander determines what is important and bases his decision on his criteria.

106. Camberley Staff College, 1-6.

107. Ivanov, Savel'yev, and Shemanskiy, 207.

108. Shubik, 9-10.

110. Brown, iii. BG(P) Brown specifically states that "[t]he Army needs to develop an imagery architecture to provide near-real time photography to commanders".

111. CGSC ST 100-9, 6-1.

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British Officer at Command and General Staff College. Interview by author, 1 November, 1991, at residence, Leavenworth, Kansas. Name not given under non-attribution policy.

British Officer at Canadian Staff College. Interview by author, 5-8 February, 1991, during Exercise STALWART WARRIOR, Borden, Canada. Name not provided under non-attribution policy.

Canadian Officer at Canadian Command and Staff College. Interview by author, 5-8 February, 1991, during Exercise STALWART WARRIOR, Borden, Canada. Name not provided under non-attribution policy.

Two German officers at Command and General Staff College, 1990-91, Personal interview by author, 14-18 May 1991, Fort Leavenworth, KS. Students names not be published under non-attribution policy.