INNOVATION IN THE 21st CENTURY:

RECONCILING TECHNOLOGICAL EXPERTISE WITH MILITARY GENIUS

A Monograph
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ABSTRACT

INNOVATION IN THE 21ST CENTURY: RECONCILING TECHNOLOGICAL EXPERTISE WITH MILITARY GENIUS
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As the United States Army prepares for the 21st Century, few things are as certain as the tremendous influence that emerging technologies will have on military capability. The purpose of this monograph is to establish how you reconcile technological expertise with military genius.

To resolve this question, the monograph begins by examining definitions and theories for genius, expertise, technology and innovation. This includes an investigation of the effects of technology on the battlefield, and a redefinition of tactical innovation. Next, the "directed telescope" innovations of Field Marshal Montgomery and General George S. Patton Jr. are analyzed. A comparative analysis examines the Army Battle Command System and the directed telescope. Finally, synthesis is achieved through formulation of a theoretical model that casts light on the innovative process of the battle commander in combat. "The Battlefield 500" model parallels the battle commander in combat, exploiting opportunity through innovation.

This monograph suggests that reconciliation of expertise and genius occurs as part of the battle commander's innovative process. To leverage technology, the battle commander must combine his military genius with technological expertise to become an innovator -- a modern age genius.

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CHAPTER 1
INTRODUCTION

The current explosion in technology, especially in the area of information and communications, has vast military implications. However, the power of these technologies are only relevant to the extent that they enable the battle commander to negotiate successfully the chaos, fog, and friction inherent to war. In this relationship lies the significance of reconciling technological expertise with human genius. The purpose of this monograph is to establish whether innovation by the commander serves as a means for reconciling technological expertise with human genius. This monograph is relevant to the U.S. Army's quest to leverage the decisive nature of advanced technologies employed by skilled battle commanders. Rapprochement of technological expertise with human genius is necessary if the Army is to realize its concept for battle command. Battle command relies on a harmonious marriage of scientific systems and processes with the commander's genius for decision making and leading. An optimal relationship is one that combines the two in a synergistic fashion rather than by simple accumulation. Achieving this kind of relationship requires that technological expertise be reconciled with human genius. This research investigates the innovation process of the commander as a means for reconciliation.

Following this introduction, the methodology divides into three major sections. The first section presents basic definitions and theories for genius, expertise, technology, and innovation. Although not exclusively, the characterization of genius is primarily Clausewitzian. The discussion of technology and its relation to warfare is traced to the logic upon which each is founded. The effects of technology on the battlefield are discussed using a basis provided by Franz Uhle-Wettler. The basis is modified to incorporate effects associated with information age technologies. Lastly, theories outlining the innovation process are discussed. These definitions are bound together as the classical form of military genius is extended to incorporate technological expertise -- a necessary evolution for genius in the modern age.

The second section introduces the "directed telescope" system as a product of the commander's ability to innovate. The directed telescope innovations of Field Marshall Montgomery and General George S. Patton Jr. are investigated as a means to control the future by exploiting opportunity on the battlefield. The foundation of definitions and theories presented in the first section forms the basis for analysis and synthesis.

The third section offers a synthesis of the definitions, theories, and case studies into a coherent whole. A theoretical model entitled "The Battlefield 500" is presented. This conceptual model is a metaphor that parallels the modern battle commander navigating the chaos, fog, and friction of combat. As such, it provides insight into how reconciliation between technological expertise and genius occurs.

The presentation of "The Battlefield 500" model is followed by conclusions regarding the commander's ability to innovate as a means for reconciling technological expertise with military genius. Implications focus on how the Force XXI efforts to leverage technology might capitalize on the findings of this research.

CHAPTER 2
DEFINITIONS AND THEORIES

The following chapter establishes basic definitions and theories for genius, expertise, technology, and innovation. In addition it presents the effects of technology on the battlefield. These definitions and theories make up the building blocks used in the development of the monograph. Discussion of genius is primarily Clausewitzian. Definitions and theories of technology, as well as those items that are of a technical nature in general, are from Van Creveld. The section outlining the innovation process relies on theories from Stephen Peter Rosen, while the effects of technology on the battlefield are derived from Gen (Ret) Franz Uhle-Wettler. The paper does not claim that these provide incontestable definitions. However, it does suggest that they provide descriptions that are academically rigorous and accepted as credible in the field of military theory. Hence, they are proposed to establish an acceptable common understanding upon which to base this research.

GENIUS

"Any complex activity, if it is to be carried on with any degree of virtuosity, calls for appropriate gifts of intellect and temperament. If they are outstanding and reveal themselves in exceptional achievements, their possessor is called a 'genius'."[1] With this statement, the great military theorist Carl Von Clausewitz begins one of the most articulate, insightful, and penetrating descriptions of military genius ever written.

Throughout his seminal work, On War, Clausewitz labors over the psychological factors necessary to negotiate the complex environment of war. These essential traits are captured in his concept of genius. The centrality of the concept identifies it as one of the timeless aspects of war he is so intent on capturing in his writings. The psychological elements of genius exposed throughout On War provide a basis for a finite set of characteristics of genius used for the purposes of this research.

Clausewitz presents two indispensable qualities of genius the battlefield commander must possess if he is to survive the tumult of war. They are coup d'oeil and determination. The first is an ability to identify critical elements, establish advantages and disadvantages, and come to a rapid decision. The second is an issue of courage, or more precisely an act of temperament. Clausewitz lists these explicitly, then proceeds to distill them further, and five additional characteristics of genius finally emerge. Although the seven characteristics are listed separately here, it must not be lost that genius is always exercised in a combination of all of these elements. At times, one characteristic of genius may be dominant, but never at the expense of the others. Their relative importance is situation dependent, but not their existence. An overview of the seven characteristics of genius begins with a description of the most pronounced, determination.

Determination

Determination has two components, courage and intellect. Determination is courage and intellect working together and not as separate elements. This combination is the most distinctive characteristics of Clausewitz's genius. It distinguishes the military genius from one who merely possesses immense intellectual capacity by asserting that determination comes "from a strong rather than a brilliant" mind.

The courage component of determination comes in two forms. The first concerns personal danger while the second relates to acceptance of responsibility. Courage with regard to personal danger has temporary and permanent states. The temporary kind is emotion driven. Ambition, enthusiasm, and patriotism lead to a temporary state of courage that fosters boldness. The permanent form results from habit or an individual's constitution and is a more dependable form of courage. The highest form of courage is a combination of both. In addition to facing personal danger, courage is an acceptance of responsibility.

The idea that one must bear the burden of decision alone and does so willfully, is courage. This is not a courage that can be possessed by members of a staff, as they merely advise. This form of courage is reserved for an individual with the ultimate authority over decision, the commander. The significance of the courage component of determination is that it reveals genius as an act of temperament.

The second component of determination is intellect. The role of intellect is to arouse determination. Emphasis on war as the realm of chance limits the utility of pure intellect. Faced with a difficult situation where adequate information is not at hand, the most brilliant mind can prove incapable of decision. Therefore, while intelligence is required, it is not required in exceptional levels. The more important element is that of reflection. In order to exhibit genius one must reflect on the decision. According to Clausewitz, "One who acts without hesitation is not necessarily determined, for without reflection, there can be no torment of doubt."

The role of determination in genius is to arm the commander against doubt and second guessing that paralyze the ordinary man. Determination provides the strength to act despite inadequate motives. If the situation does not require determination to resolve it, then it follows that genius is not called for.[2]

Presence of Mind

Presence of mind is "an increased capacity to deal with the unexpected."[3] War is the domain of the unexpected. Presence of mind is simply a positive aspect of the ability of one's intellect to come to the rescue. Just as with intellect, Clausewitz focuses on the genius's ability to produce results, not on exceptional performance. Presence of mind is deemed adequate if it sounds the alarm and calls forth one's intellect in sufficient time to be useful.[4]

Coup d'oeil

Clausewitz suggests that coup d'oeil is the "quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection."[5] The phrase originated as reference to a capacity for rapid evaluation and quick decision regarding the time and space elements of a tactical event. This interpretation assumed the individual's presence at the event evaluated. Over time coup d'oeil took on a strategic interpretation where a keen "inward eye" substitutes for physical presence in determining the situation. Like Clausewitz, Jomini, in spite of his effort to develop a scientific theory of war, also suggests *coup d'oeil militaire* as a desired trait in the commander.

Jomini asserts in The Art of War that coup d'oeil is the most important quality for a commander to possess. Without it, even the finest theories of war are lost on him as he cannot achieve the rapid and certain grasp of the situation necessary for action. Jomini's decisive point is illustrative. Strategic coup d'oeil facilitates the determination of the decisive point in order that it can be acted upon.[6]

Coup d'oeil is a sixth sense, a sense that alerts to truth like smell to odor, or touch to texture. Clausewitz called it "an act of imagination" describing it as "the faculty of *quickly and accurately grasping the topography of any area* which enables a man to find his way about at any time."[7] In this cryptic description, Clausewitz describes an ability having more to do with war as a whole than with merely the earth's surface.

> Every war is rich in unique episodes; each is an uncharted sea beset with reefs. The commander may suspect the reefs' existence, without ever having seen them; now he must steer past them in the dark.[8]

Using topography as a vehicle for explanation he articulates an almost indescribable ability to fill the voids in situational information with a powerful imagination. Like an old puzzle missing half of its pieces, the gaps obscure the picture beyond recognition. The genius's sense of locality enables him to fill the voids. Through employment of his potent imagination, fed by experience and intellect, the picture presents itself before him as if no pieces were missing at all.

Ambition

Ambition is a "thirst for fame and honor." It drives one to seek all means to distinguish oneself. Ambition is the motivation to excel beyond expectation. It manifests itself in a desire to uncover, understand, and pursue any and all knowledge that will lead to extraordinary accomplishments.[9]

Strength of Will

Strength of will, or character, is the ability to maintain perspective and calm in the midst of overwhelmingly stressful or emotional circumstances. Strength of will is self control. It is the ability to remain objective when others succumb to powerful emotions.

In his writing, Clausewitz defines strength of will partially by contrasting it with obstinacy. "Strength of character turns into obstinacy as soon as a man resists another point of view not from superior insight or attachment to some higher principle, but because he objects instinctively."

Speaking on military genius, Clausewitz suggests that "the deep anxiety which he must experience works on his strength of will and puts it to the test." This is one of the more pronounced examples that the military genius and the commander are one in the same. Many of the burdens of command stem from the moral responsibilities associated with the commander. Strength of will is the commander's armament against emotional assaults on his objectivity.[10]

Staunchness and endurance are closely related to strength of will. Considering them separately adds specificity to the definition of genius.

Staunchness

Staunchness refers to the ability to withstand a single blow. Here emotion is the key element. Strong resistance is necessary to withstand short duration emotional shocks.[11]

Endurance

In contrast to staunchness, endurance connotes a sustained resistance. Intelligence is the key factor regarding endurance. The play of staunchness gives way to endurance as the operation expands in time. The commanders intellect becomes his armament against distracting factors.[12]

Summary on Genius

Prior to ending this refinement of the term genius, there exists one point where this monograph humbly diverges from Clausewitz's characterization. In On War, Clausewitz reserves the title "genius" for those "excelling in the highest positions...since here the demands for intellectual and moral powers are vastly greater."[13] His logic stems from the nature of warfare in the Napoleonic era. The statement is accurate taken in context with the time. Only men in the highest positions were confronted with intellectually and morally significant problems. This research suggests that Force XXI battle commanders at all levels, operating in a compressed often overlapping spectrum of warfare, from the strategic to tactical levels, face situations of immense intellectual complexity and moral impact. Thus, tactical commanders, as well as the operational and strategic commanders of Force XXI who successfully negotiate the fog and friction of war will require the attributes of Clausewitzian genius.

The seven characteristics presented here, further refine coup d'oeil and determination -- that is "all those gifts of mind and temperament that in combination bear on military activity. These, taken together, constitute the *essence of military genius*."[14]

The characterization of genius presented is fundamentally Clausewitzian. While this definition establishes the common understanding of genius to be used throughout this research, there is another closely related subject in the civilian sector that should be addressed. A brief review of the civilian sector concept of the "expert" provides clarification and may serve to spark interest in those involved in tangential disciplines. The more important suggestion is that in our world of high technology the expert may be viewed as replacing the genius.

EXPERTISE

In the civilian sector, the labels of genius and expert connote a wholly different ability than that intended by Clausewitz. The difference is important in that the desired trait of genius in the battle commander is the characterization prescribed in Clausewitz's notion of genius.

Characterizing one as an expert in civilian disciplines, often referred to as a "domain expert," describes a member of a particular field that possess unusual intellectual abilities. These abilities produce a high level of performance in the particular domain of expertise. The expertise consists of extensive domain knowledge, heuristic methods of problemsolving, and metaknowledge. When combined, these qualities manifest themselves in great economy of skilled performance.[15]

As an illustration, knowledge-based systems attempt to capture and replicate the extraordinary abilities of the expert. These systems attempt to replicate the "superior intelligence" of a human expert in an automated system.[16] What is apparent from a survey of this process is that strength of will, strength of character, and determination are virtually absent from the modeled decision process. This is not a criticism, but it does identify a clear distinction between the expert and Clausewitz's military genius. While the first relies heavily on virtually exhaustive knowledge in the domain of expertise, the second is highly influenced by determination and courage.

Technology

Simply stated, technology is the application of scientific, or technical knowledge, to produce practical capability. There are two aspects of technology. One is an all encompassing abstract view, independent of time and domain. The other is a perspective relative to specific application. The first view is more pertinent to this research as we wish to pursue a general phenomenon. For our purposes, the meaning of technology is best understood by investigating its foundation in technical knowledge. From these underpinnings, an appreciation develops for the clash that arises when technical solutions are applied to problems of warfare. Martin van Creveld discusses this point in his book entitled Technology and Warfare.

Van Creveld suggests that the logical underpinnings of technology present obstacles to technically based solutions when applied to the problems of warfare. Two characteristics of technology reveal this truth. First, technology is founded on the physical world where repeatability is possible and predictable. The same results will be achieved given that identical conditions are reproduced. The second is that efficiency is always the objective of technically derived solutions. These two characteristics, repeatability and efficiency, have little application to the logic of war.

The logic of war is founded on chaos, deceit, unpredictability, and inefficiency. War often punishes those who, upon facing repeated circumstances, conduct similar actions. When facing an intelligent opponent, logic based purely on efficiency often proves fatal.

Moreover, in war, in order to deceive one's opponent it is often necessary to conduct oneself in a deliberately sub-optimal fashion. This is the second way in which technical logic conflicts with the logic of war. The most direct route between friendly and enemy forces is the most efficient path of attack but certainly not necessarily the preferred.

> Since technology and war operate on a logic which is not only different but actually opposed, nothing is less conducive to victory in war than to wage it on technical principles -- an approach which, in the name of operations research, systems analysis, or cost/benefit calculation (or obtaining the biggest bang for the buck), treats war merely as an extension of technology. [17]

The explanation of technology and its reliance on technical logic does not intend to belittle its impact on warfare. Rather, it establishes a realistic expectation for the contribution of technology in war. Additionally, it focuses attention on the interaction of technology with military genius as opposed to military expertise. To understand this interaction, one must first contemplate how technology effects the battlefield.

Effects of Technology on the Battlefield

The introduction of technology on the battlefield alters the environment of war. These changes become influential as they are exacerbated by the increased speed at which new technologies develop beginning in the mid-nineteenth century. This underscores the increasingly important role that expertise plays during this period. Until this period, the limited technical capacity of the world's scientific community restricted change to a digestible rate.

> At an earlier time, a commander could be certain that a future war would resemble past and present ones. This enabled him to analyze appropriate tactics from past and present. The troop commander of today no longer has this possibility. He knows only that whoever fails to adapt the experiences of the last war will surely lose the next one. Accordingly, one of the most important tasks of the peacetime soldier is to draw appropriate tactical conclusions from technical development.[18]

In his paper on the dangers of overreliance on technology, Gen. (Res.) Franz Uhle-Wettler warns that without due consideration of all of the effects that technology produces on the battlefield, one is likely to fail to adapt satisfactorily new technologies to future wars. Uhle-Wettler's position is not anti-technology. His argument merely intends to persuade the German government and military establishment to consider the effects of technology holistically. According to Uhle-Wettler, the effects of technology on the battlefield are seven-fold. They are: fighters become rare; fighters become poorer in quality; increased dependency on resupply; specialized mobility; specialized firepower; difficulty with maintenance and replacement of major items of equipment; and armies become smaller.[19] These effects have an essentially mechanized focus by virtue of Uhle-Wettler's concern for Germany and the battlefields of Central Europe. They are, however, readily adjusted to incorporate informational technology. An Uhle-Wettler-like list of effects that encompasses informational technologies adds the following effects: the commander is "distanced" from front line conditions; an information burden is placed on staffs and commanders; and operations must become hyper-synchronized. The paper entitled "Battlefield of Central Europe: Danger of Overreliance on Technology by Armed Forces" provides detailed discussion of Uhle-Wettler's seven effects. Elaboration on the three effects imposed by information technologies presented here uses findings from an Advanced Warfighting Experiment (AWE). Underscored by Uhle-Wettler, and further emphasized here, is the idea that the true military expert must recognize the dangers of technology in his own domain. This caliber of technical expertise, a kind that understands the capabilities, limitations, and dangers of technology, together with Clausewitzian genius, forms a powerful innovative capacity in the battle commander.

Information Technology on the Battlefield.

Operation Desert Hammer VI (ODH-VI), a digitized task force rotation at the National Training Center (NTC), provides additional substantiation of the three effects that informational technologies have on the battlefield. Following the 93-10 NTC rotation which addressed company level digitization with the intervehicular information system (IVIS), preparations began for NTC rotation 94-07, the testing of a digitized Task Force (TF). TF 1-70, 194th Separate Armored Brigade was designated as the digitized task force for ODH-VI. The task force would participate in conjunction with the 3rd Bde, 24th Infantry Division during rotation 94-07. A detailed description of the digital warfighting hardware and software systems used during ODH-VI are included in the ODH-VI Final Report.[20] Using findings from this training and evaluation exercise for substantiation, a discussion of the three additional effects imposed by informational technologies follows.

Informational technologies afford the commander the ability to carry out two of his three command responsibilities from remote locations. The leadership aspect of command demands presence -- the deciding and directing functions do not. While presence is not necessary for decision, there is evidence that as technology is employed to overcome distance, it may in fact retard the commander's ability to decide by "distancing" him from a sensing of front line conditions. One result of the "empty battlefield," itself induced by technology, is that technical solutions evolve over time allowing the commander the ability to make decisions and direct forces he can no longer view from a single point.[21] The commander bases decisions on, and takes action in accordance with, information passed through numerous human and technical filters. The stimulation induced by this synthetic reality varies from one acquired by personal witness due to these embedded filters. This enabling aspect of technology to overcome distance is afforded at the cost of "distancing" the commander from personal sensing of front line conditions. Operation Desert Hammer VI provides indications of this.

While "digital systems provide a commander unparalleled situational awareness...TF 1-70's M1A2 tank and Bradley commanders found there is a balance to be struck between visual situational awareness and digital situational awareness."[22] The commanders reiterated that "digital situational awareness cannot be expected to be as complete or timely as that situational awareness which the commander observes for himself." The findings go on to suggest that "leaders at different levels will need a different balance between digital situational awareness and visual."[23]

The second addition to the effects of technology on the battlefield is that an information burden is placed on staffs and commanders. Simply stated, the ability of technology to gather, store, and disseminate has potential for harm as well as productivity. While intelligent application of technology or process modifications can facilitate proper management of information overload, overload is present in the system non-the-less. Regardless, the effect on the battlefield is information overload, managed or unmanaged. Here again, TF 1-70's experience provides insight.

The TF 1-70 staff had great difficulty managing the voluminous information made available by ASAS, brigade and below command and control (B2C2), and the IVIS. In most cases the staff, primarily the S-2, was unable to sift through available information, glean pertinent facts, and convey them to the battle commander to facilitate his visualization of the battlefield. This was commented on by observer controllers and participants throughout the exercise. The capabilities of the digital intelligence systems clearly overwhelmed the S-2 and the Battalion Information Control Center (BICC).[24] The difficulty is in deciding what is relevant information. Availability is a secondary problem. Even under a "pull-system" where information is not force fed, but is made available upon request, significant increases in volume exacerbate an unaided search for relevant information. Calls for fire is another area where information overload surfaced in the operation.

Due to digital enhancements the number of potential observers and subsequently calls for fire revealed dramatic increases. Thirty-three vehicles from TF 1-70 could digitally call for fire (M1A2s, IVIS equipped Bradleys, and FIST-Vs). Findings suggest that the volume and density of incoming requests could prove problematic.[25] The ability of system developers to facilitate such voluminous increases in information through future modifications or enhancements is not in question here. These findings do, however, establish further evidence of the effect that increased amounts of information being available have on the battlefield. In summary, information overload is present on the battlefield by virtue of the technology. The means by which one manages the overload is an important, but separate issue. One effect of technology on the battlefield remains for discussion -- operations tend to become hyper-synchronized.

Information technology provides the commander and his staff the capability to weave intricate operations that may result in fragile and inflexible operations. Just as the railroad made possible Von Moltke's rigid, virtually optimal mobilization and Aufsmarch or deployment schedule, information technologies induce a *digital Aufsmarch* schedule. Though the capacity for digital equipment to enhance synchronization is phenomenal, chaos, fog and friction remain constants of war that place a high premium on flexibility. While a June 1994 RAND study of NTC rotations, including 94-07, concluded that the majority of TF plans were rated as technically feasible or "doable," other evidence compiled revealed an increase in complexity and frailty.[26] The comments of a platoon sergeant of TF 1-70 are remarkably insightful.

During the NTC digitized task force rotation 94-07, a platoon sergeant of TF 1-70 aired his concern over the expectation for the combat vehicle crew members "as their role and individual importance to the battle outcome is increased with future warfighting and synchronization made possible by FBC." The AWE report asserts that "each combat system will become a key player in the FBC force's main effort when future warfighting and combat synchronization is realized." It goes on to acknowledge that the issue is currently unresolved and emphasizes the need to address it in future AWEs.[27] This suggests that digitization technology affords increased combat potential through synergistic effects. While this synergism is likely to produce decisive combat power on the battlefield in theory, it is heavily reliant on a sophisticated synchronization schema down to combat vehicle level. This technical logic conflicts with the platoon sergeant's experience with the reality of combat.

Another synchronization enhancement concerns the leader decision cycle. The AWE assessed the digitized task force's potential for improvements in decision turnaround. An analysis of the observe, orient, decide, and act phases provides evidence. Potential to "observe" was increased by Pointer Hand Launched Unmanned Aerial Vehicle (HL-UAVs), All Source Analysis System (ASAS), and second generation forward looking infrared (FLIR). IVIS displays and laser designation capability increased the potential to "orient." Battle Command Vehicle (BCV) capabilities provides an enhanced environment for the battle commander to "decide." Lastly, Future Battle Command (FBC) systems such as Positive Navigation (POSNAV), Bradley Stinger Fighting Vehicle (BSFV), and laser target designation "should have increased the synchronization of BOS[s] and improve[d] the ability to 'act'." The report further suggests that "these improvements should be additive, each one complimenting the next."[28] Technologies that enable a shorter decision cycle are clearly desirable. However, adaptations that mandate a shorter decision cycle than warranted by circumstances induces hyper-synchronized effects and a tendency to over-control.

Whether or not the risk associated with increased complexity in synchronization is warranted by large gains in combat potential is not at issue here. The suggestion here is that technology effects the battlefield in the form of a more complex synchronization schema by creating more information and affording more rapid data transactions.[29]

This discussion of the effects of technology on the battlefield has composed a set of ten effects. The basis is derived from the works of Uhle-Wettler, with three additional effects encompassing the effects of informational technologies. These effects of technology, together with the characteristics of genius presented earlier, permit us to conceptualize the interaction of technology and genius in a more refined way. An analytical framework for this conceptualization is included as Appendix A.

INNOVATION

Military innovation at the tactical level is the function of managing uncertainty in combat. Peter Rosen, in Winning the Next War, writes "innovation is strongly characterized by the need to develop strategies for managing uncertainty."[30] The word innovate is defined as: the act of introducing something new -- a new idea, method, or device; to effect change or; to do something in a new way.[31] Military innovation manifests itself in three forms: changes in organization; methods of fighting; and weapons and systems.[32] The first two are related by their mutual association to social innovation and organizational behavior, while the third primarily concerns technological innovation. These forms of innovation are exercised in an attempt to manage uncertainty in the regenerative process of combat.

Combat is a regenerative process. In 1911, Major General Baron von Freytag-Loringhoven suggested that:

> Successive acts of war are not premeditated acts; they are spontaneous, dictated by military intuition. The problem is in every special case to discover the situation, in spite of the fog and uncertainty; to evaluate correctly what is known and to estimate what is unknown; to reach a decision quickly, and then carry it out powerfully and unhesitatingly.[33]

From a set of initial conditions, assessments are conducted, followed by evaluation, decision, and action. The resultant defines a new and highly non-deterministic state of affairs. A new iteration begins. Innovation is the means by which one manages uncertainty in hopes of moving the organization to a more favorable state of affairs. This is a search for opportunity, a deliberate attempt to manipulate the future. At the tactical level, these uncertainties are highly influenced by two factors: the evaluation of costs and benefits associated with a new order and the accurate assessment of military situations. These are addressed in order.

In combat, tactical innovation seeks a favorable payoff in terms of investment. Investment comes in the form of time, risk, material, and manpower. Capturing a reliable pattern, or meaningful cost benefit expression, is difficult at best. Establishing a cause and effect relationship is often hampered by problems associated with identifying an unambiguous measure of the value for the 'output' of military innovation. This precludes one from establishing an optimal path for successful innovation. While "combat power" appeared to have promise, attempts to quantify it have been less than fruitful. To date, it remains a highly subjective characterization of output.[34] This supports the suggestion that "it might be reasonable to give up the search for an optimum strategy and concentrate instead on ways of living with the uncertainties."[35] Concerning the Vietnam War, Van Creveld makes the following observation:

> Thus, in the end, the effort to minimize the cost-benefit ratio by the coordinated action of thousands of little cogs, all to be interconnected and fine-tuned to the performance of their missions in the hands of the supreme management team, backfired.[36]

The other uncertainty bearing on tactical innovation concerns accurate assessment of military situations.

Assessing conditions such as the strength of an enemy force, or the condition of ones own front line troops, is fraught with uncertainty. Reliable information is at a premium in combat. Many renowned military theorists have recorded the importance of these assessments over time but none more adroitly than the ancient theorist Sun Tzu in his dictum:

> Therefore I say: Know the enemy and know yourself; in a hundred battles you will never be in peril. When you are ignorant of the enemy but know yourself, your chances of winning or losing are equal. If ignorant both of your enemy and of yourself, you are certain in every battle to be in peril.[37]

This speaks not only of the uncertainty surrounding enemy forces, but also of the uncertainty pertaining to one's own condition -- the latter provides relevance to the former. With confidence one can say that Sun Tzu speaks of managing rather than eliminating uncertainty. Other theorists have commented, not only on the importance of the assessment, but to the difficulty of its conduct as well. As Clausewitz points out, war exacerbates the difficulty associated with assessments because efforts are not directed at inanimate matter, but rather toward an object that reacts.[38] An uncooperative enemy sows seeds of uncertainty in the fertile soil of chaos. Innovation, devised to manage uncertainty is difficult at best under these conditions.

Tactical innovation, in light of its relationship to genius and expertise, is therefore redefined as the exploitation of uncertainty in combat. It is accomplished by the commander seizing and leveraging opportunities to his advantage. While expertise promotes implementation of technology, genius alone is concerned with opportunity. Tactical innovation pursues successful outcomes on the battlefield through changes in organization, methods of fighting, and weapons and systems. This discussion on innovation concludes an analysis of the various components pertinent to this research.

SUMMARY

This chapter has established definitions for genius, technological expertise, and innovation. It has also listed and briefly described the effects of various technologies on the battlefield. The presentation of these definitions and theories is based on an analysis of the literature and represent academically rigorous definitions. Their acceptance as viable definitions for the purposes of this research is assumed as there are many and varied opinions on such complex topics. The question still remains, however: How does the commander actually exploit uncertainty - innovate - using his genius and technological expertise?

CHAPTER 3

THE DIRECTED TELESCOPE

The directed telescope system provides historical evidence of the commander's ability to innovate in an effort to exploit the future by seizing opportunity. As such, the directed telescope sheds light on a means by which the commander reconciles his genius with technology. While the directed telescope dates back to the *somataphylaxes* (a group of young officers who assisted in command and control acting as couriers and observers) of Alexander the Great, the system is most relevant to this monograph in the post-industrial revolution era. A brief description of the phenomenon is presented, followed by two examples of implementation -- one by the Field Marshall Bernard Montgomery, the other by General George S. Patton Jr.[39]

Study of the directed telescope innovation in a post-industrial revolution setting is appropriate in light of two major changes in warfare resulting from the revolution. The first is the increased significance of technology in war, and the second is the emergence of large, distributed operations. Implications of the first with regard to the research topic are self-evident. As for the second, "unlike classical conditions the distributed deployment of forces creates a greater variety of unexpected or unanticipated tactical and operational possibilities."[40]

Without fear of exaggeration, one can say that the rate of growth in the complexity of warfare during this period approaches the exponential. In order to achieve success on the modern battlefield, the unexpected and unanticipated situations must be exploited by the battle commander. His willingness to shape the future by seizing opportunity is the key to success in battle.

Some of the changes in warfare following the Industrial Revolution provide increased opportunity for exploitation by the commander's innovative ability. The evolution of the basic unit of "real time" from Napoleon to the present has changed dramatically.[41] "The railroad and the telegraph - and more recently the telephone and wireless continued to play havoc with traditional notions of time, space, and timing."[42] The ability of the battle commander to "peer ahead," has become increasingly difficult, but remains critical to his success.[43] Uncertainty escalates just as the battle commander's ability to create "vision through perceptual speed" becomes increasingly important.[44] For these reasons, and others, the post-industrial revolution is most appropriate with respect to the innovation of the directed telescope.

The directed telescope is "the use of specially selected, highly qualified, and trusted young officers as special agents or observers for the commander."[45] By World War II, the conditions on the modern battlefield were such that exhaustive search methodologies were not viable techniques for gathering information for decision. Mobile warfare was at the heart of these changes. "New tactics and technology obviously demanded increased decentralization" which "would risk battlefield chaos."[46] The commander's requirements for information were not adequately supported by signal technologies, organizational structure, or reporting procedures. "In order to offset the decentralization trend, effective state-of-the-art means of enhancing command and control were eagerly sought."[47] Hence we witness battle commanders innovating in an effort to satisfy their informational requirements in a manner requisite with their genius. The "directed telescope" is one such innovation. This chapter presents two illustrative examples from WWII: the British Army's Phantom Service and General Patton's Household Cavalry. Here we witness two of the great, modern army battle commanders deliberately attempting to manipulate the future through their innovative employment of the directed telescope.

MONTGOMERY AND THE PHANTOM

The PHANTOM system of liaison officers provided Field Marshal Sir Bernard L. Montgomery with a means to manage the increased uncertainty and chaos associated with decentralized operations driven by mobile warfare. State of the art signals technology consisted of two-way radios, telegraph and teletype equipment, including radioteletype, as well as telephone amplifiers and repeater sets which increased ranges to hundreds of miles. Technology had created a situation requiring decentralized control of highly dispersed, large tactical organizations using the above mentioned signals technologies piped through a hierarchical reporting system. Regardless, Field Marshall Montgomery reconciles the inconsistency between the technology and organization of the Allied forces and the demands of his genius by creating a system that allows him to exploit situations as they unfold. The system he created would, by design, to allow him to shape his future on the battlefield. For that matter it even allowed him to influence his future within the Allied war plans themselves.

Originating as the General Headquarters Liaison Regiment in 1939, the British Army's Phantom Service served Field Marshall

Montgomery extensively during World War II. In an attempt to offset the increased potential for uncertainty and chaos associated with decentralized mobile warfare, the PHANTOM system of liaison officers was created to gather information critical to command decision. The information was to pass directly to higher headquarters for use by battle commanders. Their placement on the battlefield was most often with tactical units well forward. On occasion PHANTOM detachments would find themselves behind enemy lines. Essential to their function was access to timely front-line information. Personal observation, in conjunction with orders to transmit only the facts void of opinion or personal conclusions, guaranteed a high degree of accuracy. The placement of these liaisons is cardinal to their ability to properly function.

Phantom liaisons were disbursed throughout in the field in a pattern conducive to proper focus of the directed telescope. Again, their existence and function was somewhat informal. This view was especially held by those units that they were liaison to. This created substantial friction at first, but effectiveness is great advertisement, and eventually they were considered a vital player by the conventional staffs and commanders with whom they worked. A typical distribution of liaisons consisted of: a PHANTOM regimental headquarters at army group, a PHANTOM squadron headquarters collocated with an army headquarters, PHANTOM detachments at corps level, and PHANTOM patrols at division and below. This network of young, poised, impartial, tactically minded officers with initiative and an acute sense of perception and ability to clearly articulate themselves, made up Montgomery's directed telescope.

The PHANTOM system was responsive and easily re-focused at the desire of the battle commander. By virtue of its informal nature, it could be focused virtually anywhere at a moment's notice in order to meet the needs of the commander. More importantly, this could be accomplished without disturbing a subordinate command, depriving it of capability. We witness this versatility as Montgomery, while attempting to shape Eisenhower's strategy to commit the bulk of Allied forces to an offensive north of the Ardennes, attempts to seize an opportunity presented by timing of the German's offensive. "Within hours after learning of it, he [Montgomery] sent teams of picked junior officers, known by the codename PHANTOM, who acted as his eyes and ears on the battlefields, hurrying to the Ardennes."[48]

As part of the directed telescope innovation, the PHANTOM liaison network produced a pull-like system for meeting information needs. It is based on two critical, yet simple, elements: monitoring and disciplined transmission. First, the system is heavily reliant on monitoring which produces simultaneous vertical and horizontal information flow. The primary obligation of the PHANTOM patrol was to forward the most reliable information available to its counterpart at army headquarters level. However, as a result of monitoring, the levels of the PHANTOM network that are bypassed "pull" the information and provide it to their respective commanders. This is heavily reliant on the second key aspect of the process. Only facts are to be transmitted. The PHANTOM liaisons are "required to transmit facts *not their own conclusions.*"[49] This not only expedites the flow of information, but it makes the information useful to all monitoring and not merely those with sufficient authority to request clarification. The design was an expedient for simultaneous horizontal distribution of information by virtue of a pull system.

A second aspect that facilitated a pull system was a procedure carried out by the British 'J' service intercept sections -- the practice of monitoring and "intercepting friendly radio traffic on unit command nets."[50] The British 'J' service, developed in the British Eighth Army in North Africa, capitalized on the information rich radio nets of units on the front line in contact with the enemy.[51] Later, in 1944, the 'J' service was formally indoctrinated into the PHANTOM and continued using interception as a pull mechanism.

Montgomery's PHANTOM system aided him in successful management of the uncertainty and chaos brought on by the mobile warfare in World War II. Using the directed telescope, Field Marshall Montgomery successfully exploited unforeseen opportunity to his benefit. He assessed his desired future state of affairs and created a means for getting there. Similar to Montgomery's PHANTOM, General George S. Patton Jr. devised a "Household Cavalry."

PATTON'S HOUSEHOLD CAVALRY

General Patton's situational awareness amidst the uncertainty of operations in Europe during World War II was to a large degree a function of his innovation of a PHANTOM-like directed telescope. Like Montgomery, technology had not only imposed the highly uncertain environment in the form of mobile warfare, but signal technology and organizational structures and procedures failed to sustain adequately his determination to remain cognizant of his situation. His ability to control his destiny in combat was inadequate. His innovative use of Colonel Fickett's 6th Cavalry Group (Mechanized) reconciled the difference.[52]

General Patton's "Household Cavalry" traces its origin in the United States version of the British Liaison Regiment known as the Signal Information and Monitoring (SIAM), itself an outgrowth of the British 'J' Service. These units were provisionally organized along the lines of the PHANTOM system. Radio monitoring teams were consolidated at army level and controlled by the army signal officer.[53] Patton's 6th Cavalry Group was organized to perform as a directed telescope as a result of the non-availability of a SIAM company for U.S. Third Army. It was transformed in order to maintain contact with his far-flung columns. Two squadrons kept Patton in touch with his scattered subordinate units. It would later become known as the Third Army Information Service (AIS). Eventually, SIAM and AIS fell under the single label of the Army Tactical Information Service (ATIS).[54]

The Household Cavalry was an innovative use of an existing cavalry organization in a different capacity from its intended design. The 6th Cavalry Group employed the 6th and 28th Cavalry Squadrons, supplemented with manpower and equipment in a new way. One squadron was to perform extensive command liaison missions with forward elements in contact passing information directly to Third Army headquarters. The other performed more conventional ground reconnaissance missions. Third Army also provided assets necessary to field a communications intercept capability for the directed telescope.

Although Patton's version of the directed telescope had numerous commonalties with Montgomery's PHANTOM, it differed in one area in particular.[55] The conventional staffs of the U.S. Third Army were energized in such a way as to promote the clarity and focus of Patton's directed telescope. Staffs throughout the command were encouraged and sometimes ordered to visit subordinate command posts. The familiarity that resulted amongst the staffs ultimately reduced the volume of information flow without a requisite loss of situational awareness. This differs from Montgomery's primarily liaison-based system.[56]

EXPLOITING OPPORTUNITY THROUGH INNOVATION

In a deliberate attempt to manipulate the future, battle commanders develop a means by which they can exploit situations and seize opportunities as they reveal themselves. The directed telescope, in its varied forms, is evidence of this caliber of innovation on the part of the battle commander. New organizations are formed, procedures are established and equipment fielded. Alexander, the Duke of Marlborough, Frederick, Napoleon, Wellington, and more appropriately here, Montgomery and Patton each called on their innovative abilities to quench their desire to control their destiny. While the phenomenon of the directed telescope predates the industrial revolution, the World War II implementations of the PHANTOM and Household Cavalry are most relevant as their development relied not only on their genius but on a mixture of genius and expertise. This combination of genius and expertise was manifested in the battle commander, producing an innovative capacity for reconciling technology with human genius.

Thus far, the problem has been adequately dissected into its component parts: genius, technology, expertise and innovation. In addition, two historical examples of the commander's ability to innovate have been provided. From here we proceed to synthesis in the form of a theoretical model. This is followed by conclusions regarding the commander's ability to innovate as a means to reconcile technological expertise with human genius.

CHAPTER 4

BATTLEFIELD 500: INNOVATION FOR THE FUTURE

This chapter presents a synthesis of the definitions, theories, and case studies into a coherent whole. A theoretical model of combat is presented to shed light on the process of reconciliation between technology and the battle commander's genius. The theory suggests an answer to the research question: How do you reconcile technology with military genius?

In order to reconcile technology with human genius, the battle commander must become an innovator. He must integrate expertise regarding technology with his genius for command. This combination transforms him into an innovator. As an innovator, the battle commander uses technology to recognize, seize, and exploit opportunities on the battlefield as a means for controlling the future. In so doing he imposes his will on the battlefield. As part of the conclusion, a conceptual model is presented. The model is a metaphor intended to aid understanding.

The theoretical model presented here suggests that the battle commander, using a combination of technical expertise and military genius, innovates in an effort to manage uncertainties in combat and ultimately exploit the future.

A THEORETICAL MODEL: "THE BATTLEFIELD 500"

"The Battlefield 500" metaphor parallels the battle commander armed with military units and technology, and guided by his expertise and genius, navigating the chaos of combat. To assist in the description a diagram is offered at Figure 1.

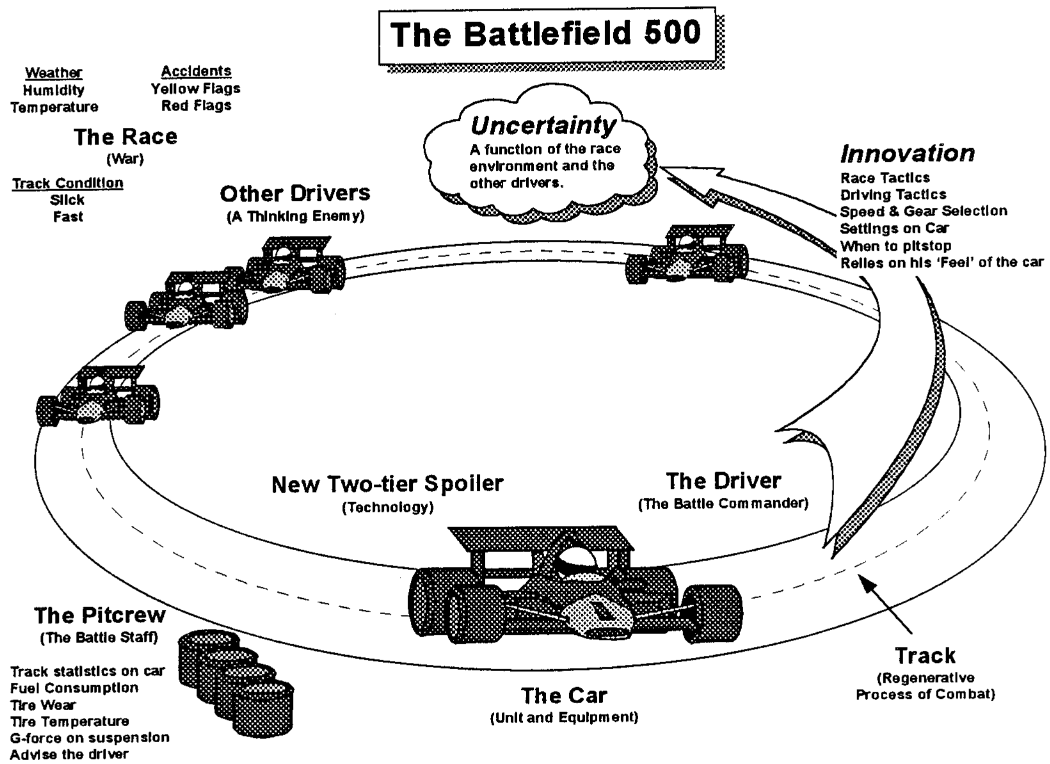

Figure 1

We begin the description of the model by setting the stage. The race as a whole represents war. The race environment is filled with chaos, friction, and ambiguity well beyond the control of those persons vested in the race. The weather, for example, influences the condition of the track. Sources of friction induce uncertainty only to be exacerbated by chance. In the race, chance manifests itself in accidents. Fear and anxiety result from the terrific speeds at which the cars travel. Again, the race as a whole represents the environment of war.

Central figures in the model are the driver and his car. The driver represents the battle commander armed with technical expertise and genius. The car represents his forces, equipment, and technology in general. A two-tier spoiler represents new technology. The driver has the overall responsibility for winning the race. His experience, intellect, and will make up his genius. The driver's understanding of the scientific and technical aspects of car racing is his expertise. He employs the car for the sole purpose of achieving victory. Just as the battle commander is not alone in battle, neither is our driver.

The pitcrew represents the staff. Led by the pitcrew chief, the crew assists the driver in his effort to win the race. They ensure his logistical needs are met and provide advice founded primarily on the science of racing. All of this, and yet the ultimate responsibility for victory over the enemy rests squarely on the driver's shoulders.

The opposing drivers represent the enemy, a thinking opponent. Our driver's will is "directed at an animate object that reacts."[57] As our driver attempts to impose his will on the other drivers, they will do the same.

The track represents the cyclical process of combat. First, the driver assesses the uncertainties associated with the race environment and the other drivers. Next, he evaluates his desired position on the next lap -- his desired future. Then, turning to his gauges, mirrors, and crew he hunts for opportunity. Calling on his expertise and genius in the form of innovation, he identifies and exploits opportunity, imposing his will on the other drivers to achieve his desired position. His innovation may take the form of a particular driving tactic, speed and gear selection, or an adjustment to the new spoiler to improve traction. Regardless, the driver relies on a combination of technical expertise and genius to innovate his way to his desired position in the race.

Searching for opportunity and then being capable of exploiting it through all means available in order to control the future the driver reveals himself as an innovator. The process repeats itself lap after lap until the race is finally complete. To remain competitive the driver must be an innovator.

CHAPTER 5
CONCLUSION

The theoretical model suggests that the battle commander's ability to innovate in an effort to exploit the uncertainties in combat, reconciles technology with his genius. "The Battlefield 500" theoretical model attempts to provide insight into the regenerative process of combat in a way that reveals reconciliation as an integral part of the innovative process of the battle commander. The increase in the complexity of situations facing battle commanders warrants an evolution in Clausewitzian genius. This is far from suggesting that technical expertise will replace genius. The answer to the research question: How do you reconcile technological expertise with human genius? is that the battle commander must become an innovator. He must integrate expertise regarding technology with his genius for command. This combination transforms him into an innovator. As an innovator, the battle commander uses technology to recognize, seize, and exploit opportunities on the battlefield as a means for controlling his future. In doing so he imposes his will on the battlefield.

A point surfaced by the findings of this research is that close scrutiny of the innovative process of the battle commander may not only identifies sources of friction with his genius, but also may gain insight into potential solutions for its elimination. The innovations of Montgomery and Patton are good examples (a comparative analysis of the ABCS initiatives with respect to the directed telescope system is included as Appendix B). While ABCS situational awareness technologies put tremendous amounts of information at the fingertip of the battle commander, the directed telescope might suggest that the pointing of the telescope is more essential than procuring a wide angle lens. Here, the ability to deduce what is relevant is revealed as critical. This is not satisfactorily addressed by increases in quantity. The misdirected telescope employed by McNamara and company during Vietnam is a case in point.[58] This provides two lessons. First, in order to reconcile genius with technological expertise you need to ensure that both factors are at work in the system -- in this case genius. Secondly, careful analysis of how the innovation meets the commander's needs without clashing with his genius is the objective -- in this case pointing versus wide angle lens. While the pointing, or the directing of the telescope is an essential characteristic of the innovation, so too is the "swivel base." This allows for rapid shifting of the focused view. These insights are produced by observing sound experiments. This brings us to another relevant conclusion. Good experimental design is paramount to drawing valid conclusions regarding reconciliation of technological expertise with genius.

The Army's proactive approach to fielding technology for Force XXI can capitalize on the innovative abilities of the commander. However, poor experimental design can cripple the effort before it begins. Sound experimental design promotes meaningful conclusions. In the case of experiments involving technology, reliability of the technical system is essential. If a system is tested before it is capable of performing with its expected production reliability, or before users are adequately trained on its "technical" capability, then the commander innovates in a meaningless fashion. Any conclusion drawn concerning the acceptability or unacceptability of a technology from such an experiment is highly suspect. An interesting part of the theory suggested in this monograph is that the battle commander will innovate, and hence reconcile, with whatever is placed at his disposal in his quest to win. This means we only need ensure that what we put before him in the form of technology is truly representative of the technical "capability" we desire to test. Our theoretical model holds up here as well.

The race car driver thoroughly evaluates changes to his car on the test track prior to evaluating them under race conditions. There will be no question of his technical understanding of the modification, his training on how it functions, or the expected reliability if he is to use the new modification on race day. But note, he innovates on race day.

Another issue that emerges from this research concerns the training of future battle commanders. The army's aggressive attempts to leverage the power of technology at every opportunity, sometimes off-the-shelf, mandates we train our future battle commanders to be innovators. If the findings of this research are correct, then our military education system is once again the keystone to success. We must build an educational scheme that promotes technical expertise and military genius, then stimulates its combined use to produce innovators -- future battle commanders.

Finally, two words of caution evolve from the research. Whatever system one adopts for reconciliation, it must encompass the possibility for reconciliation of technological expertise with the commander's genius to result in rejection. There will surely be circumstances where the conflict rises well above a clash between technology and human genius and becomes a reconciliation between the logic of technology and the logic of war. Martin van Creveld might suggest this is an effort predestined for failure. Secondly, technology for technology's sake makes a mystery of the entire process. The connectivity between solution and requirement is lost. A comment made in the British Parliament many years ago by a young Winston Churchill is humorous but noteworthy. In 1910, as the British House of Commons erupted in rejoice over the announcement that the telegraph cable to South Africa was complete, Winston Churchill rose to his feet to say, "I too rejoice in the completion of this cable. Now what shall we say to the Africans?"[59]

FUTURE RESEARCH

An area for further research involves the effects that a paradigm shift might have on the innovative ability of the commander. Does a paradigm shift disturb the equilibrium of genius to such a degree that it disables innovative ability? Said another way, do significant changes to the "game" reduce the ability of the battle commander to adequately judge a technology's utility due to an already disturbed state of being?[60] Is a genius under one paradigm, necessarily a genius following a shift to another? Questions regarding the effects of a paradigm shift are beyond the scope of this effort, but are suggested as areas for future research.

Finally, issues previously raised concerning the education and training of future battle commanders merit in depth study. The findings of this monograph suggest that the education and training of battle commanders must cultivate individuals with a superior innovative capacity extending genius in the modern age by expertise. Methods for educating and training the battle commanders of Force XXI must be challenged.

APPENDIX A
ANALYTICAL FRAMEWORK

Development of a reduction framework is the first step in a synthesis that reassembles the analysis of this research into a coherent whole. The framework promotes understanding by revealing the rudimentary interactions at work when technology and genius meet. The framework is most readily visualized as a matrix of interactions.

Construction of the framework relates the Clausewitzian characteristics of genius and the set of Uhle-Wettler-like effects of technology on the battlefield in a matrix of interactions. The framework is shown at Figure 2.

A Reduction Framework

Characteristics of Genius

Effects of Technology	Determination	Presence of Mind	Coup d'oeil	Ambition	Strength of Will	Staunchness	Endurance
Fighters become rare							
Fighters become poorer in quality							
Increased dependency on resupply							
Specialized mobility							
Specialized firepower							
Difficulty with maintenance							
Armies become smaller							
Cdr becomes distanced from FLOT			✓			✓	
Info burden on Cdrs and Staffs	✓		✓				✓
Opns become hyper-synchronized							

Figure 2

As a whole, the formulation represents the interaction between a given technology and the battle commander's genius with regard to warfare. Each cell represents the potential for interaction between a single effect of the technology and an individual characteristic of genius. This refines the problem. We can now think in more specific terms with regard to the interactions induced by the introduction of technology with regards to effects on the battle commander.

Use of the framework entails two steps. First, given a specific technology, we determine the likely battlefield effects. The selection is made amongst the Uhle-Wettler-like list. This provides the first opportunity for reduction as, in all likelihood, not every effect is induced by the technology under consideration. The second step continues directly from these results.

Taken one at a time, each battlefield effect identified in the first step is reviewed in relation to every characteristics of genius. In the event the effect under consideration has potential for impeding on a characteristic of genius, that cell of the matrix is "marked." The process repeats until every interaction has been evaluated for potential conflict. The result is a matrix of marked and unmarked cells. Again, Figure 2 illustrates an example.

The set of marked cells articulates the clash of a specific technology with human genius. It does so in specific terms, providing reduction where possible. Every "unmarked" cell represents a reduction of the problem. It is now possible to focus on this more specific articulation of the problem in order to investigate the specific technology as it impedes on the battle commander's genius.

Lest more broad application be implied than is warranted, we pause to acknowledge the framework's limitations. Simply stated, the limitations on the framework correlate to the specific set of Clausewitzian characteristics of genius, and Uhle-Wettler-like effects of technology on the battlefield chosen for construction. In addition, the matrix framework is a conceptual reduction and refinement tool. It is therefore suggested and not asserted. While the framework proves useful in problem definition, there is a subsequent use for the tool.

Chasing Interactions

In addition to providing conceptual refinement and reduction, the framework can also reveal how a particular form of reconciliation may resolve one aspect of the problem while simultaneously inducing others. Although some combinations of cell interactions may be preferred over others, "chasing" interactions from one cell to another hardly constitutes significant progress. Progress is measured by the commander's ability to control uncertainty and the future.

APPENDIX B

ABCS AND THE DIRECTED TELESCOPE

The Army Battle Command System (ABCS) currently under development in the U.S. Army, is a venture into information-age technologies in support of the battle commanders of Force XXI. A relevant question for evaluation is, "How well do the ABCS initiatives use, and demonstrate an understanding of, the directed telescope phenomenon?" The directed telescopes employed by Montgomery and Patton were innovations that reconciled issues similar to those currently under consideration as part of the ABCS. A brief evaluation of the ABCS initiatives with respect to the directed telescope is presented here.

It is not sufficient, or even necessary, for the battle commander to know everything in battle -- just the right thing at the right time. The directed telescopes of Montgomery and Patton reveal the battle commander aggressively hunting opportunity through an information system. Through this innovation he seizes and exploits opportunities as they are uncovered. Through the ABCSs the U.S. Army will provide battle commanders throughout the force access to a relevant common picture of the battlefield. This effort revolves around digitization and situational awareness technologies. These technologies, in concert with conventional humint methods, are intended to aid the battle commander in his quest to use battle space information in an optimal fashion. This enables him to make more informed decisions consistently faster than the enemy. But there is a problem. This strategy could be looking through the wrong end of the telescope.

While ABCS situational awareness technologies put tremendous amounts of information at the fingertip of the battle commander, the evidence provided here suggests that in fact this effort resembles looking through the wrong end of the telescope. The innovations of battle commanders Montgomery and Patton show that the key is an ability to deduce what information is relevant, then obtain it, and exploit it to your advantage. This is not satisfactorily addressed by tremendous increases in quantity of available information. The "misdirected" telescope employed by McNamara and company during Vietnam is a case in point.[61] Careful analysis of how the innovation meets the commander's needs without clashing with his genius is the objective. The innovations of Montgomery and Patton suggest that technologies that radically increase the amount of information without providing commensurate focus for the effort might disable the battle commander's ability to identify and seize opportunity, inevitably creating friction between technology and human genius. Collecting, disseminating, and displaying information about the commander's battlespace is a technical issue. Technical expertise on the part of the battle commander enables him to innovate using ABCS information systems in such a way as identify and exploit opportunity with his genius. Through a combination of technical expertise and genius the battle commander can provide "direction" to ABCS through innovation. In the absence of this combination of elements in the battle commander, the conflict between technology and genius will persist. Innovation leads to reconciling technology with genius and hence technology becomes a tool for manipulating the future.

The “swivel base” of the directed telescope is adequately replicated in the ABCS as the battle commander can rapidly shift his focus for information on a vastly distributed battlefield. Redirecting the telescope is possible without creating disruptions to the force. An essential characteristic of the directed telescope mentioned previously was the ability to move “trusted agents” from place to place without causing major disruptions to subordinate commands. This is facilitated in the ABCS through a reliance on a “broadcast” environment. All source information is made available to the commander and his staff to pull down what they suites their particular needs. Under this scheme, the commander can redirect his search for opportunity quickly and with minimal disruptions or taskings.

The “broadcast” methodology for communicating a common picture of the battlefield addresses the issues of immediacy through speed of communications and horizontal dissemination. The ‘J’ service of the PHANTOM, provided monitoring of friendly radio nets for reports to higher. The result was rapid communication of information to higher headquarters with simultaneous horizontal dissemination. The “broadcast” technique for information dissemination attempts to achieve this same effect. Once again, however, volume brings with it the potential for problems.

The ABCS architecture stresses accuracy by eliminating unnecessary handling of force level information which can produce bias. Like the PHANTOM’s operating procedure that minimized interpretation, facts about unit locations, terrain, ammunition and fuel status, and other information are introduced to the ABCS with minimal interpretation.

Locations determined by the Extended Position Location Reporting System (EPLRS) are an example.

Many of the ABCS objectives seek resolution of issues identified by reconciliation taking place some 50 years ago. In a thorough study of the directed telescope phenomenon, Colonel Gary B. Griffin wrote "While this tool may appear to be an anachronism, modern commanders and military theorists can ill afford to ignore the time-honored directed telescope concept in developing command systems."[62] The combination of technical expertise and genius transforms the battle commander into an innovator capable of reconciling technological capability and human genius through innovation.

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[21] Schneider, James J. "The Theory of the Empty Battlefield." JRUSI, September 1987, 37-44. Also see Chris Bellamy presentation of diagrams depicting the increase in the size of battlefields from 1805-1945 in The Evolution of Modern Land Warfare: Theory and Practice.

[22] U.S. Army, Advanced Warfighting Experiment "Operation Desert Hammer VI" Final Report. (DRAFT), D-39.

[23] Ibid., D-39.

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[26] At the time of submission of this monograph, the status of this report was still "not cleared for publication." Observations have been cited from the AWE Operation Desert Hammer VI Final Report. Grossman, Jonathon. "Observations on Command and Control in Recent NTC Rotations." (Santa Monica: RAND, June 1994.)

[27] U.S. Army, Advanced Warfighting Experiment "Operation Desert Hammer VI" Final Report. (DRAFT), L-3.

[28] Ibid., L-4.

[29] A question arose in the AWE report regarding the Future Battle Command systems' ability to assist faster decision cylces and reaction times. The leader decision cycle model used was the "Boyd cycle" or "Observe, Orient, Decide, Act loop." The findings from the ODH-IV digitized NTC rotation suggest that the decision cycle has great potential for ehancement (ie. shortening) as a result of digitization technology. Due to numerous technical immaturities in the digital systems fielded during the focused rotation statistical analysis did not prove this out. Moreover,

commanders and staffs performed both manual and digitally supported planning. However, a common perception developed amongst the Observer Controllers and participants suggesting that in the absence of these factors the decision cycle, in particular the synchronization of the 'act' phase, would have been significantly enhanced. It is also noteworthy that the Boyd Cycle has been largely discredited in literature. Ibid., L-3.

[30] Rosen discriminates innovation into the catagories of peacetime, wartime, and technological. The first two have a social and organizational focus. His discussion of technological innovation stresses the need for strategies for managing uncertainty. Rosen,Stephen P, Winning the Next War. (Ithaca, NY: Cornell University Press, 1991), 45, 52.

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