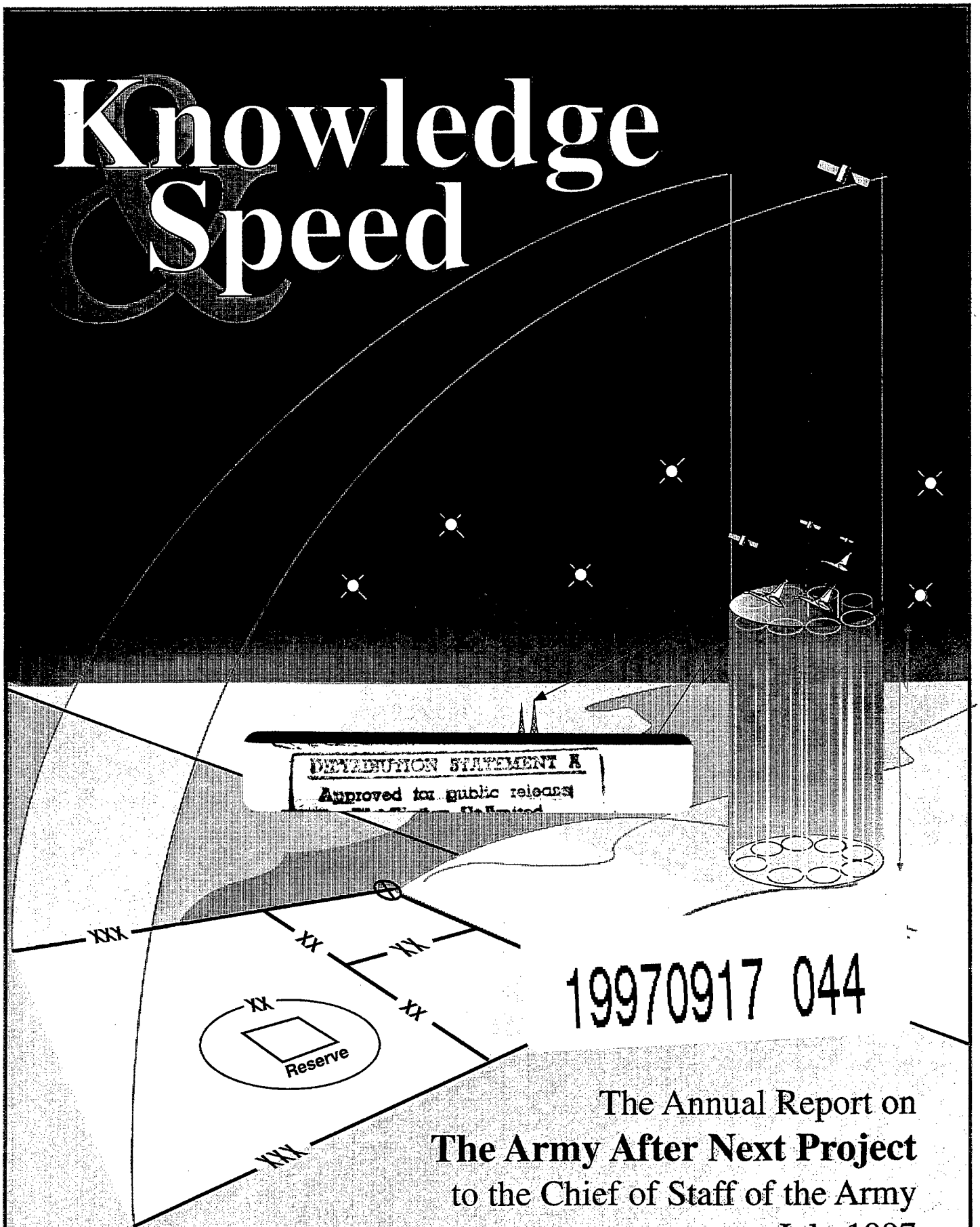
Knowledge & Speed



The Annual Report on

The Army After Next Project

to the Chief of Staff of the Army

July 1997

UNITED STATES ARMY

THE CHIEF OF STAFF

August 1, 1997

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: The Annual Report on The Army After Next (AAN) Project, July 1997

1. In February 1996, the Army established the AAN Project to assist our leadership in developing a vision of future Army requirements. The focus of the project is on issues of interest to the Army looking out thirty years. Positioning ourselves conceptually in 2025 (as we know it today) and then looking back enables us to chart a more clear and steady course to 2025 and beyond. The project has completed its first full year of study. The success of this effort is the result of the hard work done by a great many people.

2. Enclosed is the 1997 Report for the AAN Project. The research for the AAN Project has been focused in four areas: probable geopolitical realities, evolving military art and science, human and organizational behavior issues, and technology. Each of these areas is addressed in the report.

3. I encourage all to read it with great care and to join our constructive dialogue to better define and clarify the path that will best posture the Army to continue to play its critical role in defending and advancing the vital interests of this great nation.

4. My point of contact for AAN on the Army Staff is LTC John Medve, DAMO-SSP. He may be contacted at (703) 695-3256.

Encl

DENNIS J. REIMER
General, United States Army
Chief of Staff

SUBJECT: The Annual Report on The Army After Next Project, June 1997

DISTRIBUTION:

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U.S. ARMY RECRUITING COMMAND

The Annual Report on
The Army After Next Project
to the Chief of Staff of the Army

July 1997

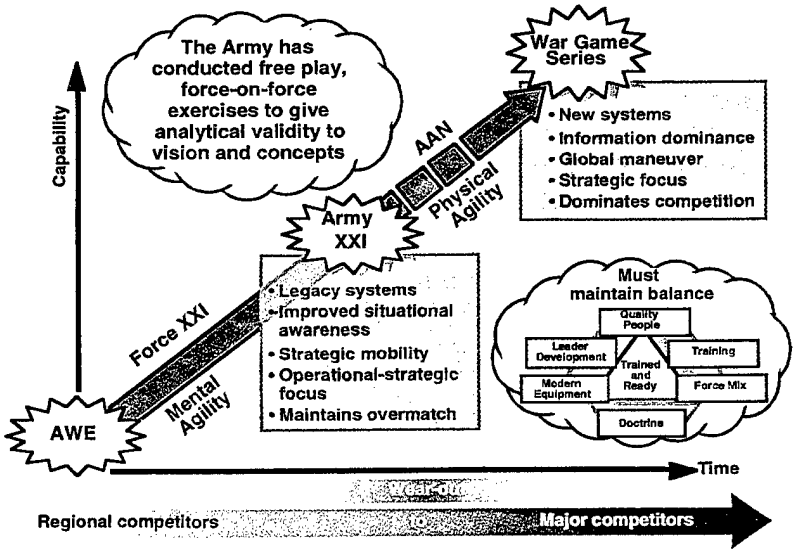
Contents

INTRODUCTION

The Chief of Staff of the Army and the Commander, Training and Doctrine Command established the Army After Next project in February 1996 to help the Army leadership craft a vision of future Army requirements. The project connects the process of change represented by Army XXI and guides future Army research and development programs. This is the TRADOC commander's second annual overview of the AAN program.

Visualizing the future requires a process that anticipates the nature of warfare in the next century and the evolution of US national security requirements. For that purpose, AAN conducts broad studies of future warfare to frame issues vital to the development of the US Army and to provide those issues to the senior Army leadership in a format suitable for integration into TRADOC combat developments programs. These studies focus on, but are not constrained to, the period 2010 and beyond. The choice of a 30-year point of focus is intended to place a distant intellectual beacon far enough in front of the pace of change so that ideas and a vision of the future will not be constricted by near-term budgetary and institutional influences. Such an approach is needed to break free of the action-reaction cycle of incremental change, which can only hold the future hostage to the past. To ensure a comprehensive and holistic perspective focused on 2025, the program is organized around four broad research areas: the geostrategic setting, the evolution of military art, human and organizational issues, and technology trends.

By 2010, the Army will exploit the Force XXI effort to achieve nothing less than a technological and cultural metamorphosis. By then, over a decade of experimentation and field exercises will create a knowledge-based force, Army XXI, balanced across our traditional imperatives and possessed with a clarity of observation, degree of decentralization, and pace of decision making unparalleled in the history of warfare. AAN simply seeks to provide the Army of 2020 with the physical speed and agility to complement the mental agility inherited from Force XXI.



The path to AAN begins with the advanced warfighting experiments and passes through Army XXI.

Following the conceptual direction set by Force XXI's advanced warfighting experiments, AAN's primary research mechanism is a series of free-play tactical, operational, and strategic war games and war-game excursions designed to explore the character of future warfare and to provide an in-depth joint and multidisciplinary examination of political, social, demographic, and technological trends likely to affect the future of war. Insights derived from games conducted to date comprise the heart of this report. Because they reflect only the first cycle of AAN studies, these insights should be considered suggestive rather than conclusive. Future AAN war games can be expected to refine them significantly.

THE PROCESS OF CHANGE

The history of warfare reveals a cyclical pattern of military change in which evolving technology alternately favors attack or defense. Before the Industrial Age, such cycles alternated slowly because innovation developed and spread slowly. After the Industrial Revolution, the cycles began to accelerate, though they were still somewhat retarded by political and institutional conservatism and the uneven development of military technologies. By the American Civil War, rifled muskets—the precision weapons of the day—had greatly extended the deadly zone troops had to cross to close with an enemy, a condition favoring the defense. Subsequent advances in artillery led European armies to believe that superior firepower would restore the power of the offensive and with it the possibility of quick, decisive victory. Events proved them wrong. While lethality skyrocketed, the pace of movement across the widening deadly zone remained that of a marching soldier. Technology thus served only to increase the slaughter and to mire armies on both sides in a conflict of attrition to which there seemed no alternative.

By 1918, the Germans had found a partial solution—a method of opportunistic infiltration allowing infantry to transit the deadly zone intact—but they lacked the technology to accelerate the advance enough to reach decisive objectives before the defender could recover. By the onset of World War II, the internal combustion engine, armor plating, and the wireless provided the means to accelerate maneuver. Mechanization allowed troops to cross the deadly zone protected and at high speed. Large units could dash great distances into the enemy's rear. Victory thus came from disintegrating the coherence of the defense and collapsing the psychological will of the defender. Through rapid maneuver supported by mobile firepower, the offensive once again came to dominate warfare.

In the postwar years, the United States and its NATO allies applied microchip technology to develop precise, long-range killing power in an effort to successfully defend against a Soviet-style *blitzkrieg*. The cycle of warfare had turned yet again in favor of the defense. By the mid-1980s, technology had extended the tactical deadly zone to what were once operational and possibly strategic distances. As this trend continues, long-range, precision firepower systems will maintain the defensive as the dominant form of warfare.

To restore the advantage to the offensive, we believe that the Army must devise the means to accelerate the speed of movement across the deadly zone by an order of magnitude or greater. The union of knowledge and speed will do more than increase linear velocity; it will also quicken a commander's ability to divine and exploit an enemy's

weaknesses and to offset the influence of chance and uncertainty. The American method of war-making in the future must rely on the offensive if this nation intends, as a matter of policy, to retain the ability to strike rapidly, decide quickly, and finish wars cleanly with minimal loss of life to all sides. Current AAN research is directed at this most vital and pressing challenge.

THE RATIONALE FOR CHANGE

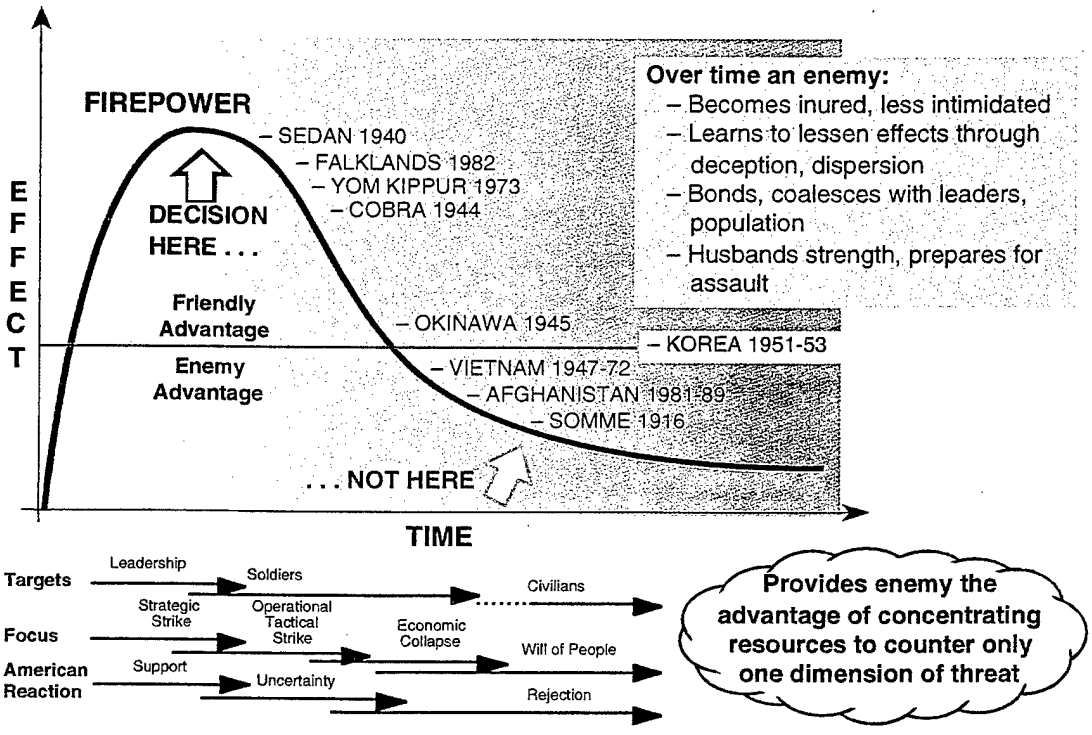
The historical record of military change is mixed. Some changes, like the Navy's development of carrier aviation in the mid-1930s, Germany's *blitzkrieg*, and the Army's development of airmobile operations in the 1960s, have succeeded. Others, like France's Maginot Line and the US Army's Pentomic reorganization of the 1950s, have not. Generally speaking, those that have failed reflected either too narrow a view of warfare or else a faddish preoccupation with untested theories. The AAN Project consequently embraces a broad view of warfare, particularly since the Army must win wars as well as battles. Accordingly, AAN studies consider warfare in all its dimensions, beginning with its most likely strategic conditions. Fundamental to this perspective is the belief that even the smallest element of the Army must reflect a common unifying thread, beginning with the vital interests of the United States and proceeding through national security policy, military strategy, long-term operational objectives, and, ultimately, the design and employment of every tactical unit.

Based on its broad study of future warfare, AAN research to date indicates that the Army should expect dramatic changes in the dynamics of battle in the period beyond 2010. The remainder of this report discusses those changes as we currently understand them. While many aspects of the future remain indistinct, others have already become discernible. The Army can and should begin now to prepare for the future, even if our desired end state remains only dimly perceived. We can adjust our glide path as our vision of the future gains clarity. Inaction is a decision we cannot afford. The Army must change soon for three reasons:

First, every revolution, whether political, economic, or military, unfolds in evolutionary steps. Generally, at least half a generation, about 15 years, is required for vision and ideas to mature into secure and irreversible change. It takes about that long to grow a battalion commander or platoon sergeant or to develop, test, and field major systems. It may take even longer to truly alter the institutional culture sufficiently to internalize revolutionary change. In addition, the Army today finds itself very much a fellow traveler in a grander societal revolution. Global institutions and cultures are busily shifting from the Industrial to the Information Age. The Army today has a foot firmly planted in both ages. Materiel and structures developed in the era of the recent past must now either be modified or replaced to prepare for conflict in the Information Age. Central to this decision is whether current and programmed systems will satisfy the requirements of a 2025 battlefield. Since current AAN research suggests that tomorrow's battlefield will differ from today's in revolutionary ways, the Army's leadership must soon determine how to apportion research and development resources among a host of competing technological alternatives. Also, it must determine how much of the Army to modernize along current lines before *leapfrogging* Army XXI systems with entirely new technologies and significantly different operational and organizational concepts.

Second, the United States currently enjoys unrivaled military supremacy, but this condition may well erode after the turn of the century. Many analysts see both China and a recovered Russia as having the economic potential to become major military competitors. Yet, any number of military challengers might arise. Such challengers need not seek to match the US in every military category. Instead, they merely need to acquire capabilities intended to counter critical American advantages—in sensor technology, for example—depriving US forces of the assurance of rapid battlefield dominance and raising the political costs of military intervention. That approach would especially appeal to armies building or rebuilding from a relatively small technology base, as the Germans did after World War I. Such armies would have few sunk costs. Indeed, current AAN research strongly suggests that any serious military threat between now and the 2025 period will very likely involve asymmetric forces designed specifically to threaten US superiority in areas requiring long development and deployment lead times.

Third, if not corrected soon, the current emphasis on a method of warfighting that emphasizes firepower at the expense of maneuver may well result in a protracted war characterized by stalemate, attrition, and unacceptable loss of life to both sides. Recent experience in war and insights from the AAN series of war games demonstrate that, even in the age of precision warfare, the principal benefit to be derived from firepower is the psychological paralysis of the enemy, not his physical destruction. Unfortunately, this benefit decreases over time as an enemy inures himself to the shock of firepower and learns to "maneuver under precision" through the use of deception, dispersion, and maneuver by infiltration.

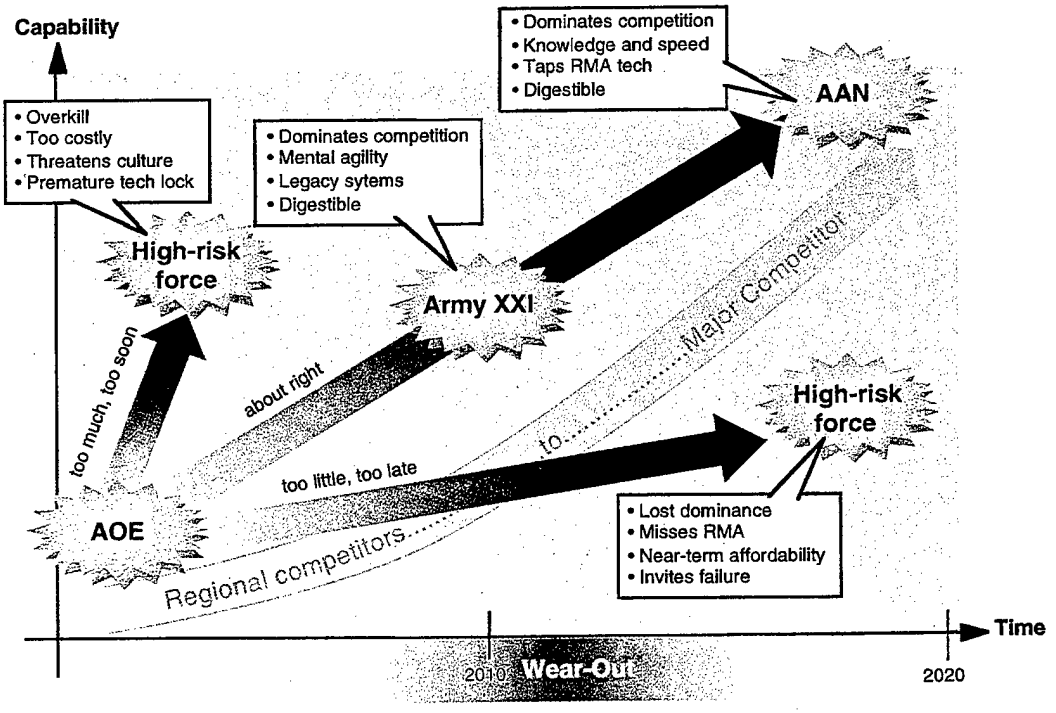


In war, the psychological dominates the physical. Since the psychological effects of firepower erode over time, decision should be sought quickly. To do otherwise invites unnecessary risk.

Quite likely by 2025, a competent enemy may also be able to counter American advantages in precision firepower with a variety of precision and counterprecision technologies of his own. If American military forces are to win quickly and decisively at low cost, they must have the means to conduct battle rapidly and to end it cleanly at the moment when the paralytic effect of firepower is greatest. As the figure above demonstrates, to delay beyond the high point of effect only prolongs the killing and stiffens the enemy's will to resist. Decisive victory ultimately must be achieved by forces on the ground. Psychological collapse—the breaking of an enemy's will to resist—results when an opponent finds himself challenged and blocked wherever he turns. Restoration of the balance between fire and maneuver will take time, at least a decade or more, and the process must begin soon.

THE PACE OF CHANGE

Adapting to change is difficult for any army. At best, changing a military organization too quickly may result in acquisition of immature or inappropriate capabilities. At worst, it can threaten the doctrinal and organizational cohesion on which any fighting force depends. But as armies throughout history have learned to their dismay, failure to adapt is equally deadly. Sunk costs or budgetary penury may preclude adoption of new technologies, while institutional conservatism may prevent their effective exploitation. In either case, failure to adapt ultimately results in squandered lives and military defeat. Our challenge today is to get the balance right. And with system wear-out only about12 years away, we have just enough time to do it. The diagram below makes this point.



The challenge is to change the force without putting it at risk. The rate of change must accommodate both affordability and acceptability.

The steep axis of change is undesirable because too great an angle encourages too rapid a lock on systems that might be quickly outdated. Another risk on this axis—perhaps even greater than premature materiel lock-in—is that of disrupting the organization without achieving a real increase in fighting capability, simply to be seen to outside audiences as "doing something." The Pentomic reorganization of the 1950s was perhaps the clearest recent example of such a misplaced impulse.

The shallow axis is equally undesirable because too slow a rate of change may miss the revolution altogether. For years after World War I the tank was widely seen as an infantry support weapon, though hindsight proved its value as a primary instrument of maneuver. When the dynamics of the battlefield change rapidly—and we believe such change is occurring now—so also must the rate of adaptation. Rapid military change is not unprecedented. But too often in the past, its driving impulse has been prior defeat. We believe effective adaptation is possible without that unpleasant incentive.

As a general observation, near-term change tends to focus on force structure and equipment. Planning for more distant futures tends to concern capabilities and possibilities—the *how* rather than the *who* or *what*. While pragmatic near-term planners try to improve existing systems, longer-term visionaries can deal in theory and emerging capabilities in a more abstract fashion. The challenge is linking the two without allowing the present to consume the future, or the vision to become intellectually sterile. While focusing on capabilities, AAN seeks at the same time to think through the organizational and human changes that will be required to exploit those capabilities.

THE PROCESS OF CHANGE: MID- AND LONG-RANGE

TRADOC's commander once commented that the AAN was about "ideas, not concepts." That is a succinct description of AAN's orientation. The AAN Project has become a laboratory—part technology-oriented, part military science—in which the Army works with other services and agencies of government, academic institutions, and civilian industry to build ideas about the future. AAN differs perhaps from the efforts of other futures groups in that its participants take extra care to subject ideas to both the considered experience of military history and the analytical rigor of state-of-the-art gaming.

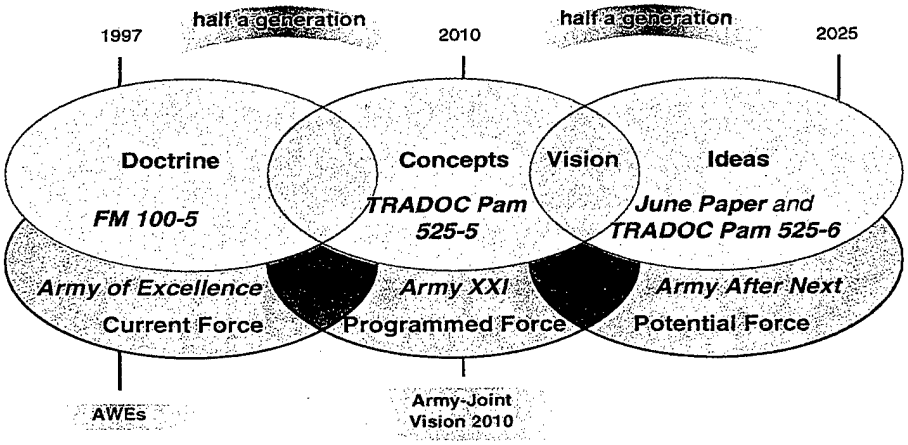
AAN is the flagship program among several studies whose purpose is to assist the Army's leaders to establish priorities and earmark resources to maintain force readiness today and in the future. The findings and analyses developed by the AAN Project and provided to the planners of the DCSOPS Office of Strategy, Plans, and Policy help set the more distant parameters that will guide Army long-range planning.

As a result of this year's study, a more complete understanding of the Army's long-range process of change is beginning to emerge. In general, the process divides into three *armies:* the current force, the programmed force, and the potential force.

The *current force* is today's Army in the field, ready to fight. TRADOC's obligation to this army is training and doctrine. Pursuant to that obligation, TRADOC soon will publish the newest edition of FM 100-5, *Operations*, the Army's keystone doctrinal manual, last revised in 1993.

The second force falls under TRADOC's combat developments responsibility. Roughly equivalent to the *programmed force,* it is the army in near-term development, which is undergoing upgrades to existing systems in order to take advantage of new technologies and opportunities immediately available for organizational improvement. This force falls within the influence of the Program Objective Memorandum, which tends to lock large programs within a 5-to-7-year period to compete within the budget process. The programmed force is aimed at the midterm future. In 1940, this would have been the Louisiana Maneuver force. Today, it is Army XXI. TRADOC's *battle labs* were established specifically to extend as far as possible the period of experimentation within the POM's influence. Programmed force development is guided by TRADOC Pamphlet 525-5 and addresses the familiar TRADOC requirements: doctrine, training, leaders, organizations, materiel, and soldiers.

The third or *potential force* is the one with which AAN is primarily concerned. Here the focus shifts from improvement of fielded capabilities to long-term research and development programs; and from current and programmed force structures to as-yet-unspecified capabilities associated with our emerging vision of future warfare. Implied is a similar shift from the sorts of Cold War challenges that shaped the creation of today's Army, to the more ambiguous and variegated global military challenges likely to confront America and her allies in the next century. Hence, while some of the associated technologies may be revolutionary, the potential force itself should be viewed essentially as the next logical step in a continuing adaptation of military capabilities to the changing dynamics of war and requirements of national security. Next summer TRADOC will publish a new pamphlet, 525-6, that will capture the emerging ideas of AAN in order to help the senior leadership craft its vision of future warfighting. The pamphlet will serve as the Army's *distant beacon* to guide the combat developments process for the mid- to long-term future.



A process exists to facilitate the orderly development of distant ideas into today's reality.

Because of this anticipatory function, AAN furnishes the primary link to other DOD agencies engaged in long-term development—for example, Defense Advanced Research Projects Agency projects and various Defense Science Board studies. As with AAN, such efforts typically aim well beyond DTLOMS and frequently push the outer bounds of

practicality. Moreover, because the potential force is not hostage to the POM, it represents the most promising opportunity for true integration with sister service concepts, such as the Air Force's ultra-high-altitude UAV and the Marine Corps' small-unit operations study.

The wellspring of AAN is the Army leadership's vision of the role and function of land power in the 30-year future and beyond. AAN's four broad areas of study all seek to clarify developments in geopolitics, military art, human and organizational issues, and technology that are today only dimly perceived, and then integrate those insights with those of other services into a cohesive joint view of future warfare. At the same time, AAN is closely connected with *futures* programs in DOD and other government agencies, including partnerships with AAN *franchise* programs in the US Army Space and Strategic Defense Command (SSDC), US Army Special Operations Command, and TRADOC's Combined Arms Support Command.

In sum, AAN's objective is to provide the Army's leadership the raw materiel for a vision of war, and thus of land-power's role, in the 30-year future. To accomplish that objective, the AAN process must be continuous, year after year, so that the Army's vision is always extended and linked to developments in other services. Provided it remains solidly connected to technological and organizational development, such a process is the Army's best assurance of a smooth and effective glide path to the future.

A GEOSTRATEGIC VIEW OF 2025

The most difficult yet essential aspect of defining land-power capabilities 30 years in the future is forecasting the security requirements those capabilities must satisfy. Clearly, we cannot predict with precision the future geostrategic condition of a world that even today is changing at an unprecedented pace. We can however recognize those enduring national interests that any future land power force must be able to support.

AMERICAN NATIONAL INTERESTS THROUGH 2025

For the purpose of AAN studies, interests subdivide into *vital* and *important*. The boundary between these categories is neither rigid nor immutable, particularly since statesmen have a habit of transmuting important into vital interests when the former are challenged. But the categories at least help distinguish objectives for which the nation is willing to risk unlimited liability from others whose importance tends to be more circumstantial. Among vital interests, AAN recognizes—

- Deterrence and prevention of nuclear, biological, or chemical attack on the United States and its allies, and continuing reduction of the threat of such attack. Implied is the maintenance of effective control over formerly Soviet nuclear weapons and weapons-usable materiel.
- Prevention of the rise of a powerful, hostile hegemony in Asia or Europe. Implied are the continued safety, freedom, and prosperity of friendly nations in both regions, maintenance and improvement of effective alliances like NATO, and deterrence of hostile ambitions on the part of any potential aggressor.
- Continued unhindered access by the United States and our allies to global resources—especially energy resources—essential to our economic health.

In addition to these overriding interests, the United States will continue to pursue objectives that are less vital, but still important enough to justify the selective use of force. Examples might include preventing the emergence of a hostile regional hegemony in the Persian Gulf and maintaining the peace and security of the Korean peninsula, the Taiwan Straits, and the South China Sea. The US will also continue current efforts to suppress and combat international terrorism, drug trafficking, and transnational crime.

Given these interests, the United States can be expected to remain heavily involved in the world of 2025—a leader in both multinational and bilateral defense arrangements and an active promoter, as we are today, of democratic principles, free market economies, and human rights. Were the United States to renounce global leadership and turn inward as we did in the 1930s, the effect would be felt profoundly throughout the world, creating a power vacuum almost certain to produce uncertainty and unrest—historical precursors of global conflict.

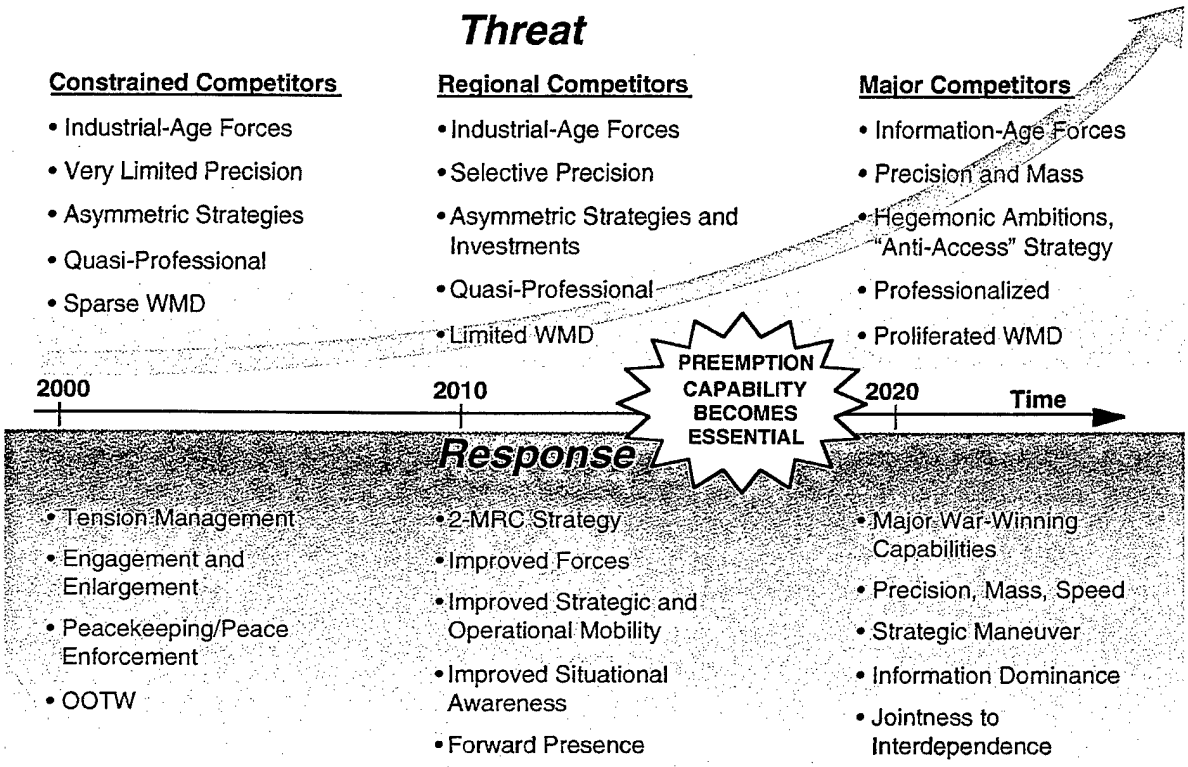
There is, however, no reason today to suppose that the United States will turn inward even if we could. On the contrary, every indication is that we will continue to maintain sufficient power to play a decisive international role. Thus AAN assumes a world in which the United States remains engaged, retaining the military power to support regional alliances and to deter or defeat major military competitors. In this year's studies and war games, our analytical focus was on hypothetical challenges to vital interests in 2021. This summer, the study effort will expand to include examination of potential conflicts involving *less-than-vital* interests. The following chart summarizes the expected features of the threat spectrum associated with pursuit of both vital and important national interests during the next 30 years.

RISE OF A MAJOR MILITARY COMPETITOR

From the beginning, the AAN Project has found problems with the term *peer competitor.* While a mirror-image peer may serve DOD and service programmatic objectives, AAN believes that the term *major military competitor* better characterizes the military challenge to the United States for the next 30 years.

Peer competitor implies the mirror-image, action-reaction stasis inherited from the Cold War. In fact, due to disparities in disposable wealth and the competence of the American technological base, current US military superiority will continue to discourage would-be aggressors from engaging in head-to-head competition. Today, already seven years into the new millennium, evidence indicates that many states concede US technical dominance and have sought alternative strategies to neutralize US strengths. These states do not seem particularly concerned with the acquisition of sophisticated, state-of-the art weaponry. They are inclined to purchase weapons that provide relatively cheap counters against our air and sea systems such as land and sea mines, distributed air defense, coastal seacraft, submarines, inexpensive cruise and ballistic missiles, and unsophisticated weapons of mass destruction. Such strategies offer a less sophisticated enemy the ability to dampen, delay, and disrupt the high-tech offensive power of an advanced military force without the inherent expense of purchasing battlefield symmetry. These states will likely offset technological inferiority with asymmetric approaches, which might well include the ability to field mass armies, to incite popular will, and to exploit the inherent strength of the strategic defensive.

Control or deterrence of military hostilities will undoubtedly remain an objective of future American national defense policy. Furthermore, AAN believes that there is a high probability that one or more major military competitors will arise by 2025. For purposes of this study, AAN defines major military competition as "first-tier state with a modernized military establishment and cultural and strategic predilections counter to the vital interests of the United States or its allies."



America's strategic challenge is to prepare for the rise of a major military competitor who is both competent and capable.

NATIONAL SECURITY STRATEGY IN 2025

Ideally, the pursuit of national interests is translated into action through a coherent national security strategy that balances requirements against capabilities. AAN assumes that US national security strategy through 2025 will continue to exhibit a fundamental continuity. While incorporating new capabilities and operational techniques, US military forces will continue to support allies, deter potential adversaries, and respond as required to unforeseen military and humanitarian contingencies. Forward-based forces will continue to play a vital role in supporting these objectives, not only in terms of their operational effectiveness, but even more importantly as the clearest demonstration possible of US national will and commitment to the defense of its allies and interests. Yet, as events in the recent past have shown, even the best positioned and most potent military force can fail to deter, particularly if an opponent misjudges American resolve because of his own ignorance or cultural bias. Therefore, actual or threatened military aggression will

usually require the deployment of major fighting forces from the United States directly into threatened regions to resolve the issue.

MILITARY ART AND SCIENCE IN 2025

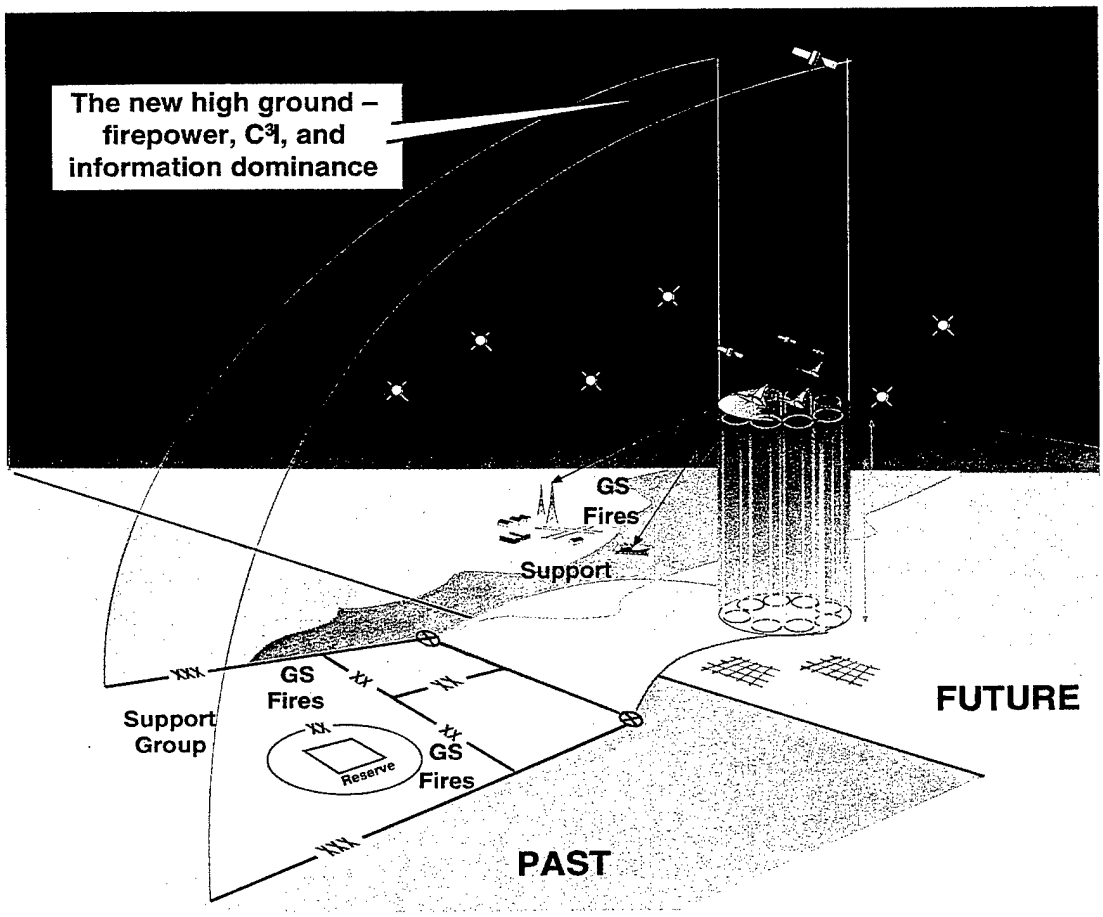
The proliferation of precision weaponry by 2025 will expand the battlespace enormously in terms of size and lethality—conditions that will favor the defense. Additionally, the ability to see the battlefield more clearly through information technology will heighten the defender's advantage by making attacking forces easier to detect and by allowing the defender to mass battlefield fires and other effects more accurately. This year's AAN war games indicate that, unless the speed of movement increases substantially, those improvements in detection and the precision-fire delivery will make offensive action infinitely more difficult.

Fortunately, knowledge—battlefield information—is a two-edged sword. Mating superior knowledge with speed of movement can provide the means to frustrate the defender's ability to acquire and mass fires and thus allow an attacker to cross the deadly zone intact to accomplish an operationally decisive maneuver. Since operational art, by definition, entails employing tactical successes to achieve strategic ends, increasing the speed of movement across all three levels of warfare must become the driving imperative of future military development.

THE FY 1997 WAR GAME SERIES

During FY 97, AAN conducted a series of futuristic war games to frame strategic and operational issues likely to influence war against a major competitor in 2020. The three TRADOC-organized war games consisted of operational-level, force-on-force games at the TRADOC Analysis Center at Fort Leavenworth (the Leavenworth Games), the Winter War Game at Carlisle Barracks (WWG 97), and a series of excursions derived from the WWG to provide a sensitivity check of the WWG major events. All games were open-ended, free-play exercises with an active and unfettered Red force. All services participated. The WWG included world-class representatives from the executive branch, industry, academia, the military, and other government agencies.

The games played a 2020 Blue force capable of order-of-magnitude increases in speed, which we propose can only be achieved by rotating the traditional two-dimensional orientation of land forces upward into the atmosphere and space. A more refined understanding of the character of this force emerged during the course of the war-game series. An independent contractor associated with the DOD Revolution in Military Affairs (RMA) study effort constructed a hypothetical Red force designed to present an asymmetric threat to US 2020 force structure.



Operational and tactical speed necessary to cross the deadly zone intact can only be achieved by orienting a two-dimensional land power force upward into the atmosphere and space.

THE LEAVENWORTH GAMES

The Leavenworth games explored force-on-force combat between notional forces at the tactical and operational levels. The principal objective was to develop a basis for determining conflict resolution in the WWG. Four subgames took place. The first pitted an Army XXI division against a Red 2020 force. The second and third placed a Blue 2020 force in opposition to the Red force in two different combinations of terrain. The last evaluated enhanced Marine Corps capabilities against the Red force. The games involved four variables: terrain, including urbanized areas; size and posture of the enemy force; support available but located outside the engagement area; and the level and quality of information dominance on both sides.

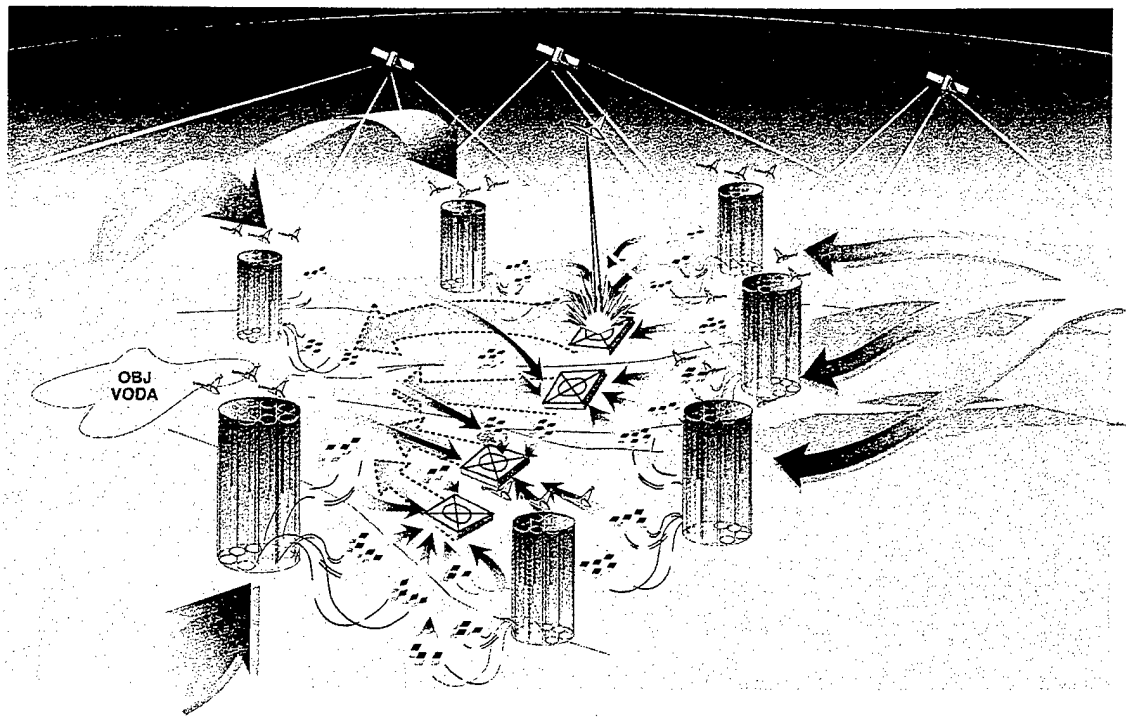
The principal finding of the Leavenworth games was that mobility, characterized predominantly by speed of maneuver, proved to be the most important factor contributing to battlefield success. Further, battlefield knowledge actually enabled speed, though the precise relationship to date remains difficult to determine. To help isolate the contribution of knowledge to combat outcomes, the AAN staff defined three tiers of relative battlefield

knowledge. A tier-one force possessed limited knowledge of the enemy plan and intent, but could achieve information dominance for specific periods of time; this force could exploit certain limited windows of opportunity. With tier-two capabilities, a force could understand significant aspects of the enemy's plan, could recognize his intentions at key decision points, and could react to take advantage of those decisions. With tier-three capabilities, the force could see the enemy as an organizational whole, including his pattern of operations, task organization, phasing and tempo; in short, Blue could understand Red's intent and could develop and execute a plan to counter that intent. The introduction of a force capable of tier–three knowledge superiority changed the time cycles and patterns of maneuver between opposing forces fundamentally and dramatically; Blue could enter the engagement more quickly, achieve decisions more rapidly, finish the fight faster, and reengage the enemy elsewhere. The Leavenworth games offered the following insights.

Maneuver

A significant finding of the AAN war games was that superior knowledge permits a commander to apply each discrete part of his force in a single simultaneous act of overwhelming fire and maneuver. Knowledge dominance on the battlefield will allow a dramatic increase in the speed of maneuver. A relationship exists between knowledge and precision that permits maneuver forces to employ an ambush dynamic against opponents on an almost routine basis. Precision in maneuver might take any number of forms. One example is highly refined targeting and maneuver directed against individual enemy elements by small units moving at great speed under leaders following mission orders. After several game turns, the Red commander knew that a Blue force with knowledge advantage and speed was unstoppable, and that his only options were to hold in place and concede or execute a series of disjointed, uncoordinated attacks and suffer defeat in detail. In either case, the practical result on the battlefield was always the same: immediate and dramatic disintegration.

Blue forces employed an air-ground tactical method of maneuver that combined lighter surface fighting vehicles with advanced airframes capable of transporting them at speeds as great as 200 kilometers per hour over distances in excess of 1500 kilometers. This method allowed, among other things, a more extensive use of the vertical dimension of the battlespace which, coupled with superior levels of information dominance, permitted greater speed and precision in maneuver. Terrain came to serve a protective and concealing function without restricting mobility; and the resultant ability to accelerate movement through the battle zone enhanced force survivability by frustrating the enemy's capability to detect, track, and engage Blue forces.



Air-ground maneuver uses the ground tactically without relying on it for mobility. In the Leavenworth games, an AAN battle force was able to catch and defeat two moving enemy divisions in a remarkably short time.

Asymmetric Responses

Red's learning curve rose sharply as the games progressed. Confronted by overwhelming combat power, he resorted to asymmetric responses in an effort to offset Blue's advantages. He recognized early on that Blue's superiority, particularly in firepower and information dominance, eroded over time. Any action that heightened ambiguity or complexity, and thus increased the time Blue needed to gain control of the situation, benefited Red. Therefore, Red moved rapidly to complex terrain—urban, suburban, and, in some cases, forests and mountains. He used his limited information warfare capabilities to slow Blue maneuver through electronic warfare and deception. Although Red lost, his asymmetric responses partially succeeded: he managed to degrade Blue's precision, to slow his operational tempo, and to significantly increase the damage to the Blue force. The lesson is obvious. For the 2020 Blue forces, time is the worst of enemies.

THE WINTER WAR GAME

The strategic, or winter, war game forms the capstone event in the annual AAN cycle. This year's WWG focused on the whole realm of political, strategic, and operational levels of a *most vital* war in 2020 to identify issues related to the changing character of warfare in about 2025. (The complete game analysis is appended.)

The Blue force employed in the WWG represented a multifunctional *total* army concept. It consisted of Special Operations Forces providing an essential *global scout*

function, forward-deployed Army XXI forces performing deterrence and condition-setting roles, a global strike force composed of AAN battle forces, and a force of decision consisting of CONUS-based Army XXI units operating as a consolidating force that insured the ability to fight sustained combat should the campaign last longer than expected or take an unexpected turn. In effect, the WWG Blue force represented an army in transition, from the Army XXI legacy force to the notional 2020 AAN battle force of the Leavenworth games.

A portion of the legacy force was deployed in Europe, but scattered in partnership-for-peace packets—so dispersed as to offer the capacity for only limited resistance when Red began threatening aggression. Modernized 2020 forces were concentrated in CONUS, with the exception of a 2020 force deployed in Korea as part of the Army's 2020 modernization plan. Special Operations Forces were present in Europe prior to hostilities. They established close and trusting relationships with nontreaty states in the region and this provided the *glue* that held together a quickly assembled coalition of warfighting partners. They also provided the first reliable theater-level eyes-on-target and helped prepare for the arrival of Blue forces. In deployment into battle, the Blue 2020 forces reached conflict termination before the legacy systems could close on the theater. The WWG offered significant insights on the influence that speed and knowledge will have on a future battlefield.

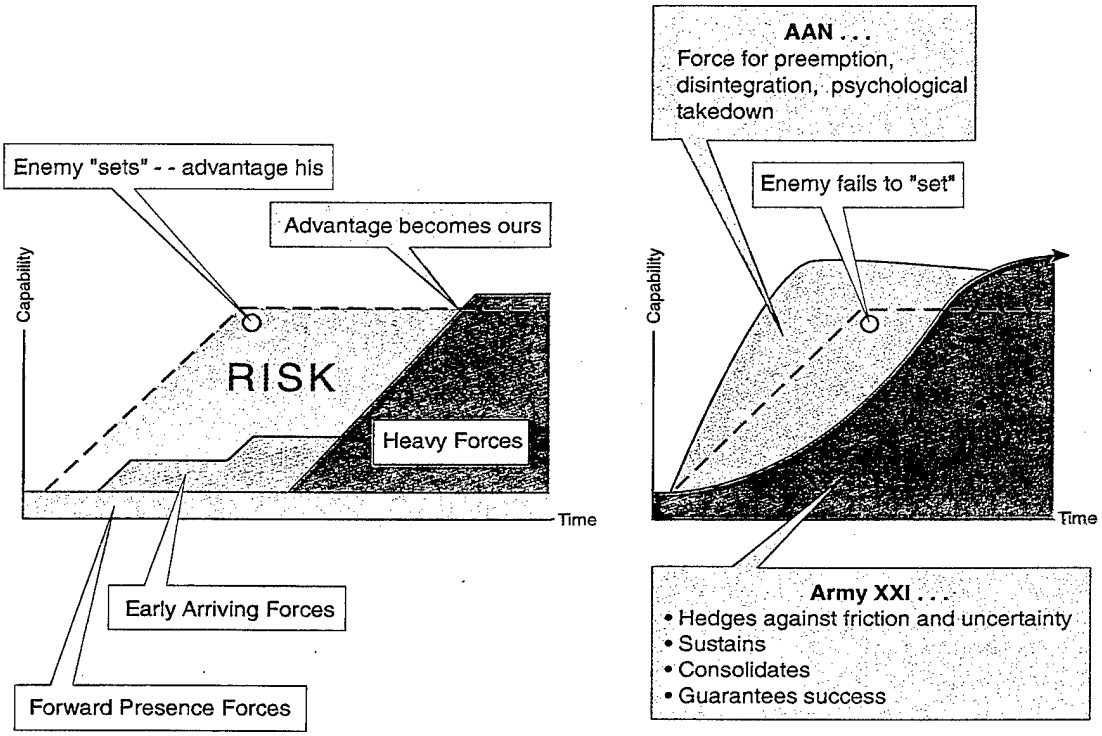
Speed

Speed emerged once again as a dominant factor at the strategic-political, strategic-military, and operational levels of war. Technology's impact on the speed of political decision making during crisis complicates the National Command Authorities' problems of deterrence and response and the always-difficult problems of forming coalitions of willing allies and reluctant friends. Paradoxically, the very capabilities that allow future forces to increase speed and tempo may contribute to hesitation on the part of political leaders.

Strategic speed—very rapid deployment directly into a theater of operations—as played in the WWG allowed political leaders and military commanders to accelerate movement to a theater of war before the enemy can set or make a preemptive move. In a subsequent war game excursion, an earlier Blue deployment effectively deterred Red's aggression. Concerns emerged during the game over an obvious disparity between the strategic speed of an AAN force—arriving from CONUS ready to fight within 48 hours—and the follow-on CONUS-based Army XXI force. To allow the ability both to preempt an enemy from setting his force in a theater and to continue unrelenting sustained pressure over time, the projection schemes of both forces should be seamless and firmly joined. It became clear during the game that by 2020 a mature Army XXI force must be much more projectable than heavy forces are today, inferring perhaps the requirement to move globally from a staging point to a distant battlefield in no less than two weeks. Also the war game reinforced the observation that most of the information technologies inherent in AAN should be present in an Army XXI force to ensure that both can act in harmony on the battlefield and collectively exploit the advantages of a knowledge-based force.

The challenge of connecting the deployment of forces with dramatically different strategic speeds was exacerbated by the requirement that arose during the game to approach the theater by infiltration rather than by staging. During the Leavenworth games, it became apparent that even when opposed by an enemy possessing primitive weapons of mass destruction, the risk of mass casualties prohibited the use of major ports and airfields. The enemy quickly realized that his greatest opportunity for success when facing a force of such enormous capability was to defeat him before arrival in theater. Therefore, early-arriving AAN forces were obliged to set down at scattered locations deep inside the theater of war just beyond the reach of the enemy's operational forces.

Operationally, the WWG suggests that sequenced operations, as understood today, should occur in a more seamless and simultaneous manner at theater level, melding the application of firepower and maneuver into a single culminating act and thereby reducing the duration of campaigns from months to days or hours.



Future power projection will allow AAN forces to start decisive action before the enemy sets. Decision will be assured through the seamless integration of Army XXI forces.

The geostrategic position of the United States has committed the Army in this century to rely on strategic maneuver to win wars on the ground. The major difference between General Marshall's concepts of power projection in 1942 and the Army's of 2025 is the speed with which forces can be deployed and employed in a single, unrelenting, sustained act of global maneuver. Early discussions of

global force projection indicate that the worldwide structure that will enable Army forces of 2025 to conduct high-tempo strategic maneuver must be in place prior to deployment. The early placement of logistics, communications, and intelligence may play a more significant role in the pace and effectiveness of strategic maneuver than the deployment of the fighting force itself.

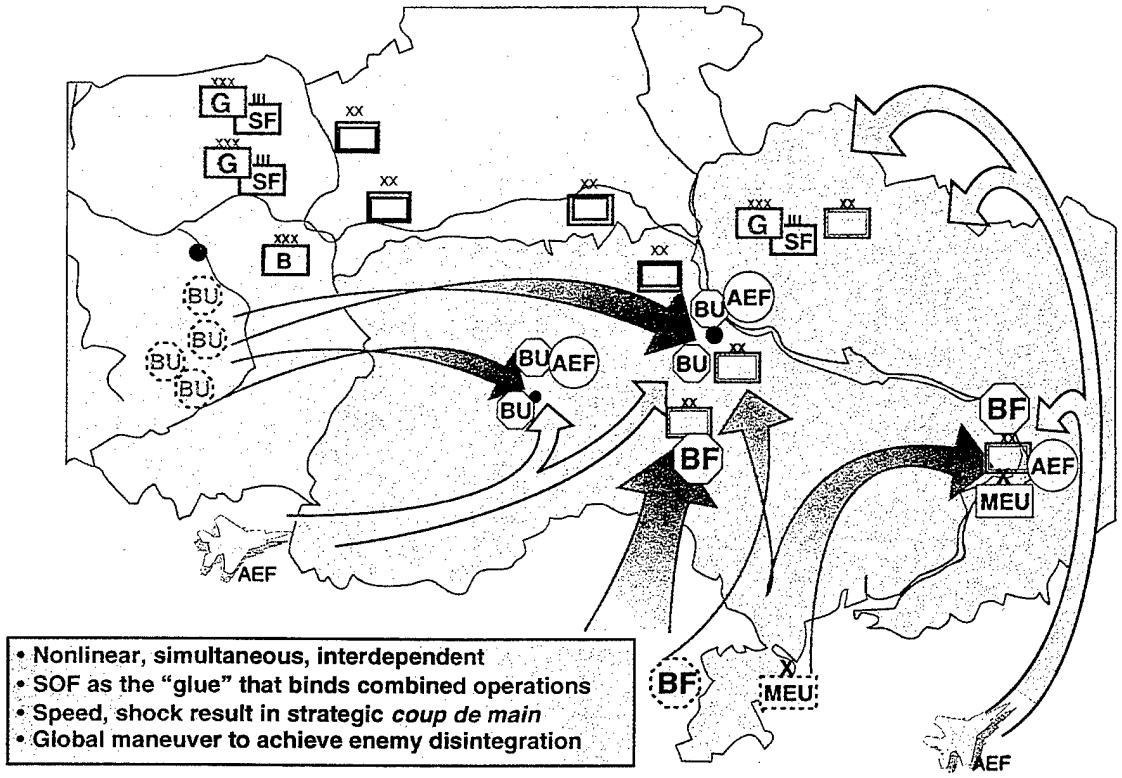
Logistics in the WWG, the Leavenworth games, and the war-game excursions were played primarily as a function of deployment. AAN's hypotheses, which require further testing in FY 98, posit that to achieve the speed necessary to cross the deadly zone intact, operational-level forces require a radically streamlined logistical tail. Second, strategic-level deployment requires new technologies and methods of projection that get a fighting force from its CONUS base into combat in a few days. Current deployment systems, based on an outmoded Cold War view of strategic maneuver, will only present the enemy with targets in a precision-rich theater of war.

Knowledge Sensitivity

In the WWG, Red reacted to Blue's deployment by immediately attacking the systems that Blue relied on for knowledge dominance, especially space-based systems. Red's all-out attack in space caused policy and warfighting dilemmas for Blue. The erosion of Blue's ability to use space-based assets would have, over time, significantly reduced Blue's knowledge advantage. As it happened, Blue's war with Red ended before attrition of space assets could influence events on the battlefield. Forces already in contact mitigated the loss of satellites to some extent by using organic means, such as high-altitude UAVs, to maintain tactical knowledge dominance. Strategically and at the theater level, however, the loss of specific systems would have had a cumulatively harmful, though not disastrous, effect. Blue's Pacific campaign against Pink, just getting underway when the game ended, was partially blinded by Red's actions. The effect on global logistics would have been felt immediately. A subsequent war-game excursion that varied the nature of Red's attack on space-based assets did not materially affect the outcome of the game. Nonetheless, in both war games Red commanders understood how vital information dominance was to Blue force effectiveness. Both aggressively sought to collapse Blue's protective shield of knowledge. The insights from the games suggest a serious need to protect information flow through robust, resilient, and redundant infrastructures that can be reinforced with a *bodyguard* of deception and disinformation and easily regenerated if damaged.

EMERGING CHARACTERISTICS OF THE FORCE

Thus far, AAN study results indicate that success on the 2025 battlefield will require force characteristics that emphasize a robust surface-to-space continuum, split-based operations, interdependence, hybrid forces, and mature leaders leading cohesive units.

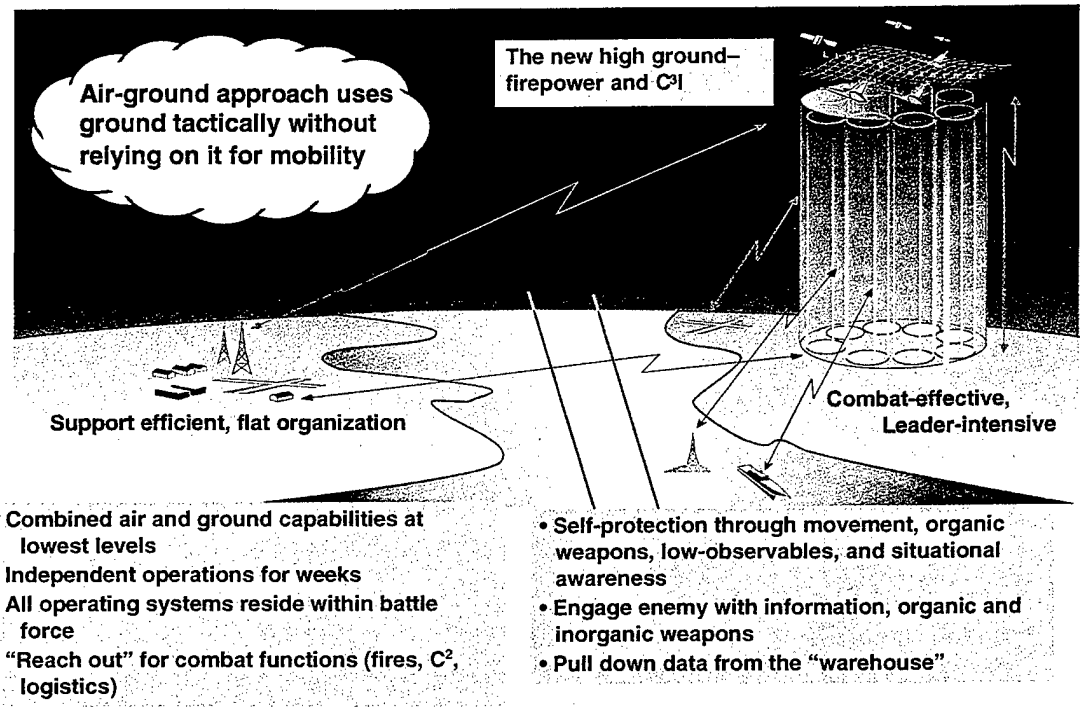


By Winter War Game D+6, the joint application of AAN-era forces quickly disintegrated the opposition and delivered a strategically decisive victory.

Surface-to-Space Continuum: The New High Ground

In order to achieve the degree of knowledge dominance and operational speed postulated in this paper, by 2025 the Army must have shifted upward from its traditional two-dimensional spatial orientation of land forces into the vertical or third dimension. In particular, the deep-strike operational maneuver function must be able to occupy the third dimension from just above the surface through the exosphere into space. Future land combat units will exploit terrain by maneuvering for tactical advantage within the folds and undulations of the earth's surface without suffering the restrictions imposed on mobility by contact with the ground.

The vertical component should also include tactical UAVs, exospheric long-endurance UAVs, and space vehicles in various orbital configurations extending to geosynchronous orbits. This constellation of aerial vehicles should allow traditionally land-bound functions—intelligence, all forms of communications, and fire support delivered from unmanned platforms orbiting continuously above close combat forces—to move upward. Many of the elements in the continuum will come from other services and from the civilian telecommunications industry.



AAN operations will be characterized by the domination of the surface-to-space continuum with vastly improved capabilities in mobility, lethality, surveillance, communication, and sustainment.

Split-Based Operations

A robust surface-to-space continuum—consisting of a constellation of UAVs and space-based telecommunications satellites—will also permit an order-of-magnitude reduction in the size of the tactical force arrayed in close contact with the enemy. *Reach-out* communications, intelligence, and fire support, combined with *just-in-time* and *just-what's-needed* logistics, will eliminate all baggage not directly related to closing with or gaining positional advantage over the enemy. To achieve a relative degree of protection and security, support units will operate from separate locations, possibly hundreds of kilometers from the theater, beyond the effective range of weapons of mass destruction.

Interdependence

Time is the enemy of a force that depends on knowledge and speed for effectiveness. The effect of time on the conduct of battle is corrosive and gradual rather than dramatic. As we learned in the Leavenworth games and subsequent analyses, the shock effect upon which much of the effectiveness of US combat power depends dissipates as the enemy becomes inured to the psychological impact of precision fire and learns to lessen its destructive effects through counteraction. Also, as the Red commander demonstrated, even a tier-three knowledge advantage inevitably erodes as the enemy learns our patterns of operations and begins to predict our actions.

Finally, the strategic game suggested that in a future era of informal and ad hoc military relationships, coalitions may become more difficult to create and harder to

maintain once combat begins. Lingering too long on the battlefield opens the opportunity for an enemy to split an opposing coalition. Saddam Hussein taught this lesson very well.

Therefore, in 2025 even more than today, US forces will not be able to afford linear, sequential campaigns that require discrete staging and phasing. To defeat this corrosive enemy of time, the operational level of war must be pushed toward the execution of near-simultaneous campaigns that, at the theater-operational level, will take on the characteristic of a *coup de main*. Operational acceleration of this magnitude can only be achieved by moving beyond joint toward interdependent operations. Interdependence suggests the need for a level of interoperability between land, sea, and aerospace mediums that will allow a near-simultaneous application of precision fires and maneuver applied in a broad pattern of effects that strike and check the enemy everywhere he can be seen and engaged. Sequenced campaigns, depicted today by delivery schedules and broad arrows on a map, will be replaced by an expansive takedown operation where the enemy's will to resist collapses when he finds himself smothered by fire and surrounded everywhere by maneuver forces occupying positions of advantage.

Interdependence also has programmatic implications. AAN believes force structures of the 2025 time period will also need to be interdependent, that is, whole functions may migrate from one service structure to another in favor of speed, agility, and economy. For example, space-based systems may well provide communications and other functions now associated with land systems. If this model holds up, quite possibly future land forces may require less expense to field and operate than previous Army forces.

Hybrid Forces

The US Army has always gone to war as a hybrid force. Traditionally, dissimilar forces—heavy and light, regular and reserve, legacy and modern—have fought side by side. The problem in the past has been to get the most out of such a disparate force. In the Winter War Game, the total land force that Blue employed consisted of a mix of Army XXI units and AAN battle forces. In the environment postulated for 2025, the capabilities of these forces complemented each other very well. AAN battle forces executed rapid, strategic maneuver, while Army XXI units functioned as a force of decision, providing the total force with heft, flexibility, and a hedge against uncertainty. The challenge in this scheme will be to ensure a proper fit between the early-deploying AAN force and the slower-deploying Army XXI forces. While the former must arrive quickly to collapse the enemy, the latter must possess enough strategic agility to follow immediately behind to guarantee unrelenting long-term pressure on the enemy and to limit risk to the early-arriving force.

The Human Dimension

Although discussed in greater detail further in this report, the human dimension bears mentioning here as well. AAN research indicates that battle leaders will have to function in very compressed planning and operating cycles and at very high tempos. Indications are that battlefields of 2020 will require cohesive units and leaders with higher levels of maturity. This research does not necessarily mean that the Army will require a higher leader-to-led ratio, only that it needs a more mature, better-experienced leader and soldier than is the norm today.

MODELING, SIMULATION, AND FUTURE GAMES

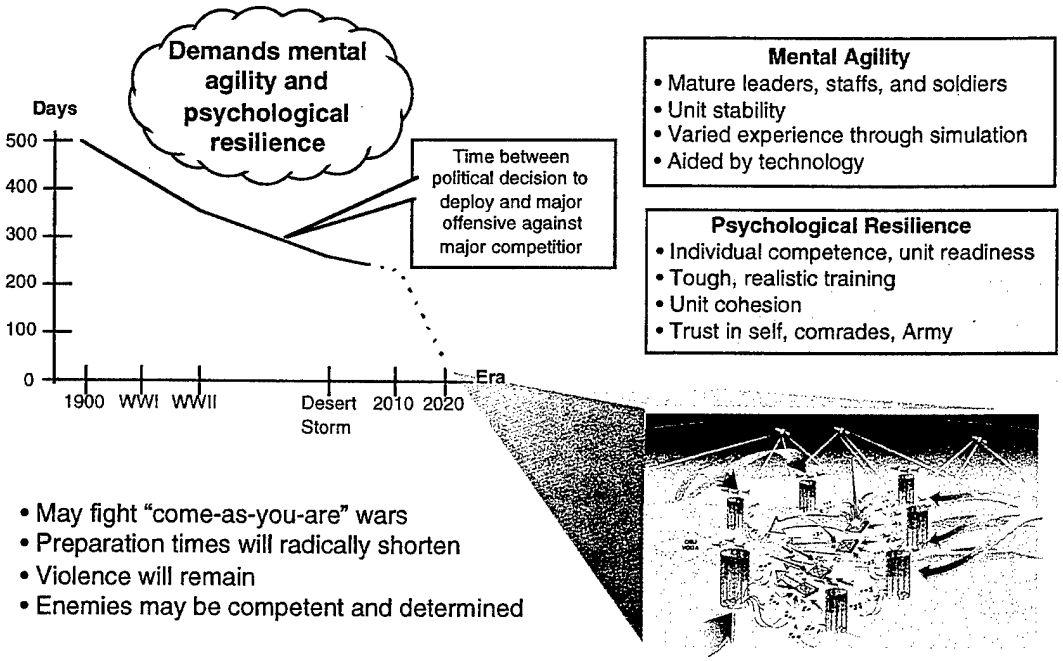
After a year of intense study, wargaming, and work with the other services and agencies of government, it is becoming apparent that present-day tools and perceptions only lead to more questions about the effects of technological change, the human and organizational dimension of future warfare, and the character of warfare itself.

Two-sided, open-ended war games continue to prove their worth as research tools for framing issues in the 25-year future. Free play is essential to understanding future warfare—even if Blue loses—because future success at the strategic and theater levels will increasingly depend on knowledge and other nonquantifiable advantages rather than on the more familiar attrition models that tend to favor bigger, more powerful forces. The key to gaming at strategic and theater levels is to make interaction between models and human experts as realistic as possible. WWG 1997 utilized an interactive global model with more advantages than drawbacks, but as games increase in complexity and focus, they will require more realistic models that effectively stretch a combat environment from surface to space. AAN will take this issue on as a major portion of its 1997 effort.

The Winter War Game this year postulated a war for vital interests. Consequently, game play centered at the most violent and intense end of the conventional scale of warfare. The AAN study group recognizes that to meet the needs of American defense policy in 2020, the Army must be extraordinarily *capable*, to be sure, but it must also be *adaptable* enough to be useful at the lower end of the conflict spectrum. Intuitively, an AAN force built around knowledge and speed would seem to possess characteristics essential to prevail in a conflict for "less-than-vital interests." Exceptional mobility across inhospitable terrain, speed of deployment, and the ability to observe with exceptional clarity and to maneuver and strike with great precision all give promise that the AAN battle force postulated here would be decisive in stability and security operations against a less sophisticated enemy. The Summer War Game (SWG 1997) has been designed to test this hypothesis under conditions differing markedly from AAN games to date. The Army Special Operations Command will play as equal partners in this important exercise, and AAN will provide an analysis of the game separately and in the June 1998 report.

SOLDIERS AND UNITS IN 2025

The war games demonstrated that Blue's tactical success depended to a great extent on his ability to execute decentralized operations. His strategic and tactical speed would have required an exceptional degree of mental agility and psychological resilience. We believe that the development of these qualities by 2025 will require nothing less than a cultural change within the Army that embraces a philosophy of decentralized action based upon a high degree of professional trust and confidence between leaders and led.



Speed and knowledge magnify importance of constant readiness. As deployment time shrinks, demand for mental agility and psychological resilience expands.

Situations changed quickly and sometimes dramatically in the war games, which suggests that commanders will have to make decisions at consistently faster rates. Real-time battlefield knowledge may require AAN leaders to rapidly digest and act upon an indeterminate and ever-changing amount of information. In addition, the heightened speed of AAN operations may generate higher levels of physical and emotional stress, thereby creating a greater risk of cognitive and psychological impairment. AAN battle units employed a larger number of *moving parts* functioning at higher rates of speed, which in the future may force leaders at all levels to cope with increasing levels of complexity. Even armed with the advantages of sophisticated information aids, AAN leaders may find their decision-making capacities quickly overwhelmed. To execute the precise and dispersed maneuver that characterized Blue operations in the tactical war games, crews and teams will very likely be obliged to fight in a degree of isolation far more psychologically demanding than in past wars. The war games suggested that Blue forces would also need a high level of mental agility and psychological resilience to operate effectively in discrete, self-reliant, well-informed, autonomous small units.

EXPERIENCED LEADERS

One way the Army can achieve and maintain the mental agility necessary for success on tomorrow's battlefield is by cultivating mature, highly experienced leaders. Such leaders provide at least four benefits: 1) mastery of increased skill sets; 2) greater experience in both command positions and staffs; 3) a firm foundation from which to exercise battlefield intuition; and 4) the ability to successfully withstand higher levels of stress due to psychological maturity and experience.

COHESIVE UNITS

Stable, cohesive units can provide the requisite foundation for developing mental agility and psychological resilience. Soldiers who train together for long periods tend to adopt a shared view of the battlefield, to include their environment and their unit's ability to respond to specific combat challenges. This shared view allows leaders, peers, and subordinates to act effectively, with little or no communication, even in rapidly changing situations. Likewise, cohesive units offer the Army a greater reservoir of psychological resilience—a safety net—that offsets, to a great degree, battlefield fear, fatigue, stress, and isolation. Such units remain mentally agile even under severe circumstances. They require less supervision, handle complex tasks effectively, and exhibit mutual trust, confidence, and loyalty.

SOLDIER TRAINING AND EDUCATION

Synthetic training environments, in the form of virtual, constructive, and live simulators, may allow highly effective training under conditions both safe and, in some cases, nearly indistinguishable from actual combat. In the future, newly formed units or staffs may build trust, confidence, and a state of constant readiness by working through a series of increasingly demanding exercises in a synthetic environment. Live training will remain necessary in the future to be sure. But, realistic simulators will allow live training to be reserved for *finishing exercises*. The Army should develop synthetic training to assist it in meeting the demands of the 2025 battlefield.

AAN soldiers and their units will require higher levels of mental agility and psychological resilience to successfully meet tomorrow's battlefield challenges. Experienced leaders and cohesive units should serve as the foundation for the Army's effort to develop and maintain these qualities. The goal of the AAN human and organizational effort should be to build units capable of operating within their optimal range while forcing the enemy to operate beyond his own.

TECHNOLOGY: THE PATH TO KNOWLEDGE AND SPEED

The Army of 2025 will probably differ from today's Army in two fundamental ways. It will achieve unprecedented strategic and operational agility by exploiting information technologies to create a knowledge-based Army. But to know and see with greater clarity is not enough. The Army must possess a complementary capacity to act on its superior knowledge by building into its structure the physical agility to move rapidly and adroitly across a larger and more lethal battlefield. An essential body of technologies is emerging that offers the potential to create a knowledge-based army capable of strategic and operational maneuver by 2025.

THE TECHNOLOGICAL CHALLENGE

The AAN study expresses tomorrow's technological challenges in terms of the need to achieve greater knowledge and speed.

Knowledge

Knowledge will proceed from a robust, redundant, and flexible network of communications and intelligence systems interwoven into a seamless surface-to-space continuum. This continuum will feature *nets* of surface sensors connected electronically to a series of interlinked UAV fields, ranging from low to very high altitudes, covered by an umbrella of space-based systems. This constellation of systems will provide an *unblinking eye* capable of constant surveillance over the battlespace and will connect the combat force with its distant support and sustainment base. It should serve as a living internet of connectivity immediately responsive to soldiers on the ground.

However, as the WWG demonstrated, an adversary may attack space systems immediately, and perhaps repeatedly, to deny knowledge dominance. Work should therefore continue in TRADOC and SSDC to identify specific land-power requirements in terms of space systems and to develop relationships that carry those needs into space technology initiatives in other services and agencies. WWG experience and follow-up research also indicate that low-, mid-, and high-altitude UAVs will become essential to maintaining knowledge dominance. Internetted UAVs serve to thicken the communications infrastructure in the event of a loss of space systems.

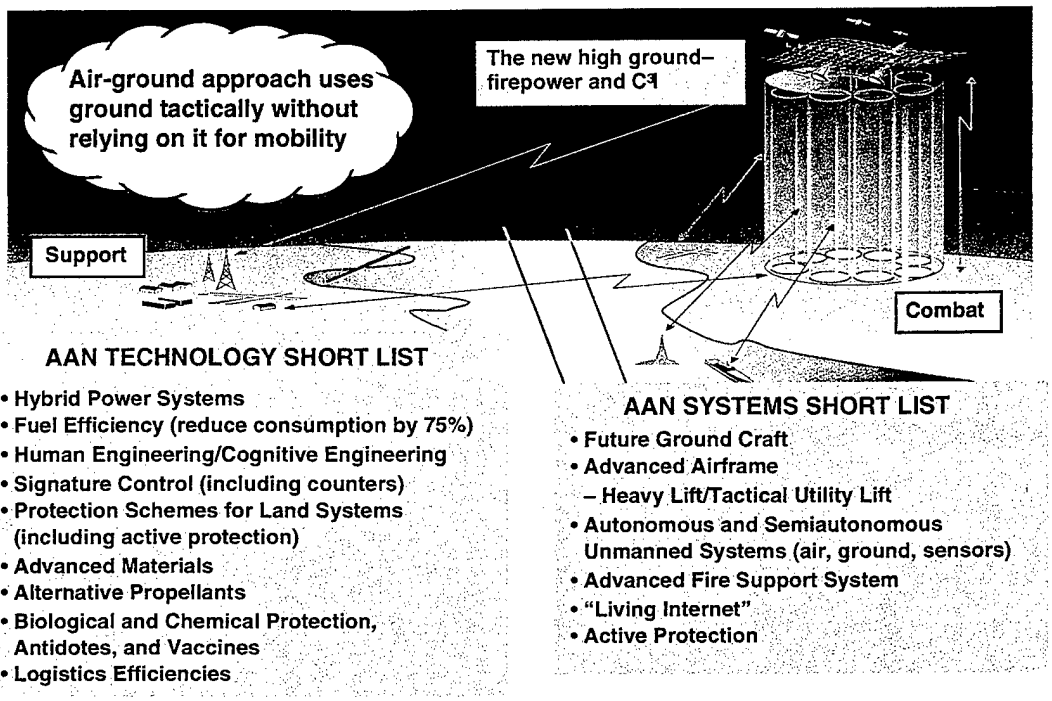
Mechanisms also must be established for both rapid replacement of degraded systems and seamless substitution of one information source for another. Finally, doctrine and training must accommodate the possibility of a degraded information environment; and soldiers, units, and leaders must be deliberately conditioned to sustain operational tempo notwithstanding system interruptions.

Speed

The AAN views speed in strategic, operational, and tactical dimensions. The Army must pursue ways to accelerate pace of movement so that, in the tactical dimensions, close combat forces can frustrate enemy acquisition, targeting, and precision weaponry and, in the operational and strategic dimensions, can rapidly counter, check, and ultimately collapse enemy maneuver forces.

Technologies related to self-deploying tactical forces, fast sealift, and airborne large-capacity lifting bodies currently support the acceleration of strategic projection. Although the Army does not develop new concepts or vehicles for air and sealift, these capabilities will become essential to the effective use of land power in 2025.

At the tactical and operational levels, three technologies offer possibilities for shrinking the logistical tail of fighting organizations. First, alternative power sources and fuel-efficient ultrareliable fighting vehicles will allow combat forces to operate longer and over greater distances than today. Second, cheap precision warheads, long-range fire support located outside the combat area, and alternative propellants will allow reductions in the weight and bulk of ammunition trains. Third, energy storage systems and hybrid power systems can reduce fuel and electrical power requirements and eliminate most of the weight and bulk of today's power generation and storage systems.



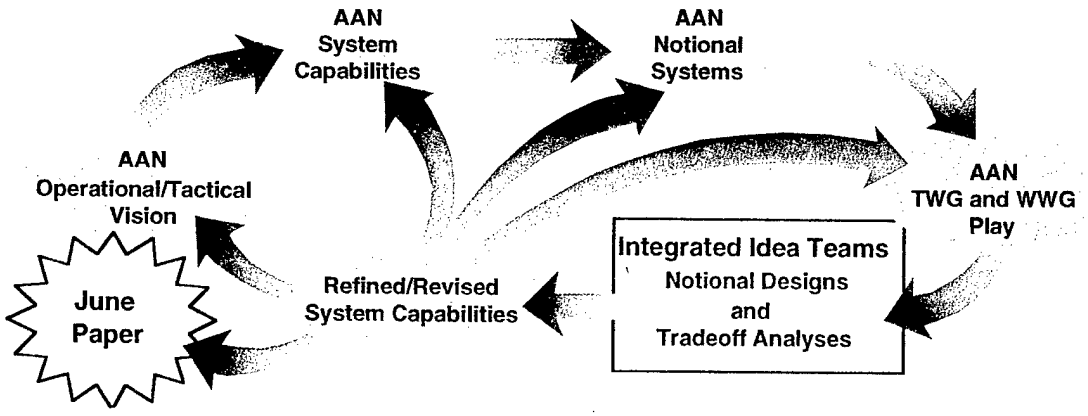
To set the stage for AAN, the Army should augment its existing research and development effort by further exploring these systems and technologies.

In addition, future ground craft, composed of advanced, lightweight materials, will enjoy greater firepower, mobility, and speed. Advanced airframes will possess increased capacities for heavy lift and tactical utility lift. These greater lift capacities will allow a marriage of ground and air systems that permits commanders to use the ground tactically for cover and concealment without suffering a degradation in mobility. Protection schemes for land power will include a host of new active protection and signature control systems. While the 2025 battle force will protect itself primarily through knowledge and speed, several emerging technologies promise to further enhance force protection. Advances in antidotes and vaccines will reduce vulnerability to chemical and biological weapons. Speed also includes rapid strategic deployment. All of the lightening technologies already mentioned have the potential to enhance deployability as well as battlefield mobility. In addition, future technology must concentrate on enhanced means of self-deployment, ultrafast sealift, and improved high-capacity airlift. Although the Army is not directly responsible for the last two, no service has a greater interest in them.

THE AAN SCIENCE AND TECHNOLOGY LINKAGES

Throughout the past year, AAN has established close relationships with the science and technology community, academia, and several DOD and non-DOD government scientific agencies, most importantly, the Assistant Secretary of the Army (RD&A), Army Materiel Command, DARPA, HQDA DCSOPS, and members of the TRADOC combat developments community. AAN operational requirements influence the research efforts of the science and technology community through these relationships. Just as importantly,

this collegial cooperation ensures that AAN remains apprised of further emerging technologies that might enhance its operational concepts and requirements.



AAN and the science and technology community have formed a partnership to foster early dialogue on the nature and feasibility of future warfighting capabilities. Integrated idea teams provide a mechanism to start translating their ideas into reality.

As the process matures, the AAN will become part of a growing number of science and technology decision-making teams. Through AAN, TRADOC has participated in the 6.1 basic research triennial review and has influenced the direction of defense strategic resource objectives and the creation of Army SROs. AAN has also provided a perspective on 6.2 science and technology objectives and advanced concepts technology demonstrations.

The Army must continue to develop partnerships within the science and technology community to create a focused set of technologies for future warfighting. Key among these is DARPA, which is already working with the Army to explore innovative concepts and technologies that apply to small-unit operations. As the pace of technological advance continues to accelerate, perspicacity in acquisition will become a strategic imperative for the Army.

THE ROAD AHEAD

Although the Army in the field is operating at a very high tempo, the next few years will find the Army in a position of unchallenged military superiority and with breathing space to consider the next challenge. This window of opportunity will not last long; perhaps by the end of the century the next major military competitor will begin to show itself. In the meantime, the Army can begin to reorder its house for the challenges ahead.

Since the opportunity is fleeting, changes of the magnitude tentatively envisioned in this report must begin soon. Issues of force structuring and budget management must be addressed within the tenure of this CSA if a new force is to begin fielding around 2010. The AAN process and its estimation of the future will continue to develop, but the AAN staff is satisfied that the major issues outlined above will remain valid. The challenge now is to begin to move from ideas and vision into action.

APPENDIX A

CYCLES OF WAR AND INFORMATION AGE WARFARE: THE ESSENCE OF THE ARMY AFTER NEXT PROJECT

The nature of warfare, like other forms of collective, complex human behavior, changes slowly. Cycles of change in warfare are particularly difficult to comprehend and even more difficult to anticipate because, unlike endeavors in finance, medicine or law, active experience in war is, thankfully, infrequent. Because warfare cannot be practiced often, soldiers are obliged to rely on the laboratory of past experiences to gain vicarious experience in war.

THE CYCLES AND PATTERNS ARE EVIDENT

Before the advent of the industrial age, study in the laboratory of past wars served soldiers well. Cycles of change were centuries long and factors that generated change such as demographics, politics, and relative power among contenders, while not necessarily predictable, were at least constant and familiar enough to give soldiers confidence that data derived from past campaigns would remain relevant and useful as signposts into the future. Since the beginning of the Industrial age, technological warfare—the applied science of killing—has eclipsed all other dynamics of change. For many, this magnitude and newness of science threatens the reliability of precedent as a useful mechanism for predicting the course of war.

To be sure, the frenetic pace of technological change in the modern world has served to compress the interval and stretch the amplitude of the cycles of change. Nonetheless, identifiable cycles remain. If our historical laboratory serves us, we should be able to search the recent past to identify new cycles driven principally by technology. Should we find a common pattern in technological cycles, and if we accept the premise that technology will continue to drive future change, then we should be able to use the recent past to fix the central axis aligning those cycles and project it into the future.

Technology began to dominate patterns of change with the rise of industrial production and the appearance of precision war-making machinery like rifled weapons in the mid-nineteenth century. The small bore repeating rifle, the machine gun and quick firing field artillery extended the deadly zone, or the distance that soldiers had to cross to turn a defender out of his position, from 150 meters in Napoleon's day to a thousand meters or more by the end of the American Civil War. As the deadly zone increased by nearly a factor of ten, the risks of crossing it were further multiplied by the lethality induced through the precision and volume from the massive proliferation of repeating arms. Thus, technology favored the defender. Images of the terrible slaughter of World War I remain as testimony to the cost in blood exacted by an operational method that relied principally on killing effect to achieve decisive results.

Before the slaughter ended, military professionals on both sides of no-man's-land sought to solve the tactical and operational dilemmas imposed by dominance of firepower on the battlefield. The tactical problem simply was to cross the killing zone

alive. The operational problem was to make a successful crossing militarily decisive. Once across, a force had to reach deep, concentrate and strike to dislocate and eventually disintegrate the order and cohesion of an opposing force. The conceptual solution, the innovation if you will, came first to the Germans in 1918 and it was deceptively simple: short, highly intense doses of firepower to prepare the assault; small units to exploit the shock effect of firepower in order to infiltrate and bypass centers of resistance; operational formations to move through exposed points of weakness to push deep into the enemy's rear. While the Germans had the method they lacked the means to translate theory into effective action. After the war, the development of the internal combustion engine provided the means. The graft of practical science to an innovation born in war turned the cycle of war a second time and restored dominance to the offensive. Motorized armored vehicles allowed soldiers to cross the deadly zone protected and at enormously greater speed. Large units could now dash great distances into the enemy's rear to strike at his brain and avoid his powerful extremities. The object of Blitzkrieg became the collapse of an enemy's will to resist. Victory was gained through psychological paralysis induced by movement rather than through butchery induced by massive application of firepower.

After the Second World War, the Western Powers faced another tactical and operational dilemma. The problem now was to halt a Soviet style blitzkrieg across the Northern German Plain. Tactical forces needed defensive killing power to absorb the initial Soviet armored shock and hold their defensive position. The operational problem was to strike deep with long range firepower in order to slow the rate of arrival from follow-on armored forces at the front line. Billions of dollars and the collective genius of a generation of brilliant minds succeeded in developing a remarkable set of technologies capable of stopping a mechanized offensive with precise, long-range killing power. Microchip technology provided the tools necessary to extend the killing zone and made targets easier to find, track and kill. Signs foretelling how the defensive's return to dominance might turn the cycles of war a third time began to appear as early as the closing days in Vietnam. A few laser guided bombs destroyed targets that had previously required hundreds of unguided dumb bombs. In World War II an average of eighteen rounds were needed to kill a tank at a range of 800 yards. During the 1973 Arab-Israeli War the average was two rounds at 1200 yards, and by Desert Storm one round at 2400 yards.

The ability to see and strike deep using ground and aerial platforms served to expand the battlefield by orders of magnitude. What was once a theater area for a field army now became the area of operations for a division or a corps. Just as an army moving at two miles per hour could not cross a killing zone dominated by long-range, rapid-firing, rifled weapons in 1914, the precision revolution made it prohibitively expensive for an army moving at seven times that speed to cross an infinitely more lethal space a hundred times as large. Thus, in a conflict involving two roughly equal, or symmetrical, forces evidence seems to show convincingly that the advantage goes to the defender.

Today, seven years after the prospect of a Soviet blitzkrieg has crumbled with the same finality as the fall of the Berlin Wall, we seem strangely content to remain frozen in the third cycle. As the post industrial age begins to give way to the information age we

still find comfort in a vision of future warfare that continues to emphasize the capacity to kill with greater and greater efficiency. Perhaps in our continued rush to embrace precision warfare we might find ourselves embracing a method of fighting that grows increasingly obsolete and more irrelevant with each passing day.

THERE IS NO SILVER BULLET

Arguments against a firepower centered approach to warfare have been with us since the earliest days of the industrial age. War is a deadly business. Yet the object of war is not to kill the enemy so much as it is to break his will to resist. No matter how efficient and precise a firepower system might be, victory is rarely defined by killing everyone on the other side. The extension of influence or control by force is much more powerful and palatable than genocide through firepower. Therefore, our object in applying firepower must be to exploit its substantial paralytic effects to gain advantage. Unfortunately recent experiments in the laboratory of real war substantiates the view that the paralytic effects of firepower erode quickly over time. Soldiers become inured to hardships and danger. Firepower that might break an enemy formation early in a conflict eventually becomes merely a nuisance once soldiers accustom themselves to firepower's pyrotechnic drama and devise effective means to deflect, deceive, dissipate, and protect themselves from firepower's killing effects.

To win quickly and decisively at low cost in the future we must have the means to conduct the battle quickly and to end it cleanly, preferably at the moment when the paralytic effect of firepower is greatest. To delay beyond that moment only increases the killing and makes the enemy more effective by stiffening his will to resist and by allowing him to reconstitute. Decision is best guaranteed through maneuver of forces on the ground. Psychological collapse, the breaking of an enemy's will to resist, comes when an opponent finds himself challenged and blocked wherever he turns. He admits defeat when further pursuit of his political objective is not worth the cost or when his centers of gravity are threatened, controlled or occupied and he has no remaining options for restoring them.

THE BALANCE BETWEEN LETHALITY AND MANEUVERABILITY

To avoid the horrors of protracted firepower-attrition warfare in the future we must be sure to maintain a necessary but delicate symbiosis between the ability to kill and the ability to maneuver. Easier said than done if one assumes that we still dwell in the third cycle of warfare, a period that favors the defender. As we gaze into the distant future and face the prospect of a competent enemy with both the will to fight and the means to develop or purchase his own systems of precision firepower, the prospects of winning a third cycle conflict become even more sobering. Possessed with the intrinsic power of the defensive and most likely defending on familiar terrain, such a foe would not necessarily have to defeat us tactically to win the conflict. He would most probably bow to our overwhelming superiority in the air and at sea and concede both. He would not have to seek victory so much as the avoidance of defeat. He would only need to preserve his

ground force in the face of superior firepower long enough to create stalemate and cause enough casualties for the Americans to tire of the contest first. Again, an enemy possessed with a will to fight at the beginning of a conflict is likely only to grow stronger over time without direct intercession and eventual domination on the ground.

THE OFFENSIVE MUST BE RESTORED

The restoration of the offensive as the dominant form of war will come with the appearance of a fourth cycle of warfare, a cycle defined more by the new revolution in information rather than the stale remnants of the machine age. Imagine a maneuver force possessing the ability to see with unprecedented clarity, to anticipate with unparalleled sureness, to accelerate the pace of movement with unequaled velocity and to maintain an unrelenting operational tempo. Such a force would be able to traverse the killing ground, however expansive and lethal, relatively untouched and decide the campaign with a violent and debilitating movement that ends quickly with minimum loss of life to all sides.

The fourth cycle of war will seek to exploit the information age in order to increase the velocity of maneuver. Speed must be the essential ingredient of a future land power force. Speed will be achieved by creating a force unburdened by the logistical yoke that has long been the principal impediment to agility and speed. The secret of the dominance of the offensive in the second cycle was not to be found in the tanks, personnel carriers, and self-propelled artillery of blitzkrieg armies. The secret lay, instead, in the ability of a portion of the maneuver force, in the case of the *Wehrmacht* just ten of a 117 divisions, to break free of the railhead long enough to reach deep into an enemy's rear with enough sustaining strength to collapse his psychological center of gravity and hold it down long enough for following forces to solidify the victory.

Today the railhead has been replaced by an equally cumbersome and constrictive logistical umbilical cord. Like the Germans in 1940 we must develop the means to break a portion of our force free to achieve the same objective. The information revolution promises to give us the means. Information technologies will allow us to deposit outside the close combat zone all but those forces necessary to move, observe and kill. Detailed knowledge of the enemy's strength will free us from our traditional fixation on stockpiling and *worst casing* so that we will be able to carry with us into the close combat zone only what we need when we need it. In effect, we will know enough to know what to leave behind.

The information revolution should allow us to track the individual elements of a force with exquisite clarity and detail. But knowledge of the enemy alone is not enough. We must possess the means to act on what we know and action is dependent, again, on speed. The combination of knowledge and speed of movement will allow a future battle force to anticipate enemy movement and turn costly force on force engagements of past wars into surer and less costly engagements by choice.

The combination of knowledge and speed will allow a battle force to maintain an unrelenting tempo. In the chess game of operational planning, superior battlefield awareness will enable us to stay four or five moves ahead of an opponent. Speed will allow battle forces to shift quickly about the battlefield to check, block, and, when conditions are optimal, strike in a ratio of friendly action to enemy reaction of, again, perhaps four or five to one. Thus the object of a maneuver force of this type will not be to kill so much as to paralyze, to exploit the ability to maintain a constant advantage of position in order to close an enemy's options, wear him down, and eventually collapse his will. Speed of maneuver offers the essential finishing function that balances our already prodigious ability to kill.

The imperative for speed in this new form of warfare begins at home ports, airfields and installations. A highly lethal force, shorn of its Cold War impedimenta, will be able to project itself from the homeland or from strategic points overseas in days rather than weeks or months and arrive in the operational theater ready to fight. The ability to get into a theater "firstest with the mostest" reduces risk to forces first to arrive and prevents the enemy from setting himself into an advantageous defensive position. Early arrival will change the elemental patterns of war at the theater level. Such a campaign will allow near simultaneous rather than sequential applications of both killing power and maneuver. Strategic speed will allow a theater war to take the form of a coup de main. The bloody, set piece, sequential campaigns of the industrial age will give way to sharp, intense acts of strategic preemption.

A land power force optimized to capture the benefits of the information age would take on physical characteristics distinctly different from industrial age armies. First, such a force would be able to divide itself into two functional groups: the first, essentially sustaining in character, might be removed from the combat zone entirely, relying on sure communications and rapid aerial logistics to deliver the goods and services of war to the combat zone in just the proper quantities just when needed. The combat force would become the second major group. It must be compact, possessing just the people and gear necessary to sense, track, move and kill. Many essential combat functions necessary in contemporary armies would displace from the ground upward into the exosphere and space. This *space-to-surface continuum* between close combat force and the information structures which sustain it from above would, in fact, form the central nexus of an information age maneuver force. In effect, space becomes the new high ground. When all the services occupy vertically oriented battlespace, the character of multiservice missions changes from the segregated land, sea, and air operations to a new approach which will be characterized by total interdependence throughout this surface to space continuum.

UNPRECEDENTED BATTLESPACE AWARENESS

The ability to see the battlefield and to know the enemy, combined with the speed to exploit these advantages, will fundamentally change the dynamics of fire and maneuver. A commander able to observe enemy movement with fine granularity would be able with confidence to divide his own forces into comparably fine increments and position

each precisely enough to control and dominate each discrete bit of enemy combat power. The ability to employ many small units at once would allow a commander to cover a large operational area with discrete combat elements. A sports analogy is particularly descriptive: a basketball team with superior speed, agility and understanding of the opposition would be more effective playing man-to-man rather than zone.

A commander with the dual advantage of speed and killing power will dominate the battlefield. Superior killing power allows incapacitation of an enemy force, a necessary capability, but by itself intrinsically indecisive. Superior mobility allows exploitation of the temporary advantage gained by the stunning effect of killing power. If these two essential elements of combat power are orchestrated with skill so that they are applied in harmony, an unfettered battle force would be able to strike multiple vital points simultaneously or in a sequence of our choosing. In a very short time, perhaps only hours, such a force would be able to inflict a rapid sequence of local tactical disasters. The cumulative effect of these closely spaced events would serve to dislocate and confuse an enemy to the point that his warfighting structures quickly disintegrate. This confusion, dislocation, and disintegration will combine to produce an unequivocal military decision with minimum cost to both sides.

EXPERIMENTATION AND INNOVATION

The image of a landpower force to accomplish such deeds is purely conceptual today. But certain realities have begun to appear dimly through the veil of the future. First, at a time when American arms will most likely be called on to win an offensive campaign cheaply, the third cycle seems to tell us that the advantage goes to the defender. The offensive cannot be restored by firepower alone because firepower cannot provide the essential decisive function necessary to end a campaign quickly on our terms at minimum cost. Second, even when preceded by overwhelming doses of precision firepower, a maneuvering force cannot hope to succeed against a determined, thinking enemy if its speed of movement cannot exceed the twenty kilometer per hour pace of a third cycle force. An information age army must move at ten times that velocity. Finally, as in past cycles, technology promises a way out of this dilemma. The information revolution will give land forces both the mental agility and matching physical speed to restore the essential balance between firepower and maneuver on a future battlefield.

Henry Ford never met Heinz Guderian, the German General commonly held most responsible for exploiting Ford's invention to gain victory on the battlefield. Likewise, history will eventually produce the warrior who will capitalize on the opportunities offered by Bill Gates and the revolution most often associated with his name. The name and nationality of the warrior who someday will proclaim himself the Guderian of the information age has yet to be recognized. But one fact is certain: the information revolution will continue to alter our world at an ever increasing pace whether we choose to engage ourselves in it or not. We cannot remain fixed on the third cycle of warfare for much longer. Already competing nations are striving to chip away at America's dominance in precision fires. Sooner or later someone will find a way to match or counter our firepower advantage. The result may well be equilibrium on the battlefield which might lead to

stalemate or eventual defeat. Imperatives for innovation and change are overdue. We need to begin now to forge a new marriage between battlefield knowledge and unprecedented landpower speed. We must do no less than draw the outline for a new army whose structure is predicated on the premise that the machine age is past and the age of information has just begun.

APPENDIX B

THE ARMY AFTER NEXT MISSION AND METHODS

INITIAL GUIDANCE

The Army Chief of Staff (CSA) established the Army After Next program in February 1996 to assist the Army's leadership with their effort to develop a long-term view of the Army's future. The program focus will be on issues of interest to the Army from about 2010 to 2025. The CSA's guidance centers on five requirements:

1. Connect Force XXI, the Army's process of change, to the long-term vision of the Army;
2. Connect the vision to the Army's research and development programs;
3. Leverage the work already accomplished in OSD's Revolution in Military Affairs (RMA) initiative;
4. Institutionalize the program to ensure continuity and quality of effort;
5. Involve the Army's senior leadership.

MISSION

The AAN mission is to—

> Conduct broad studies of warfare to about the year 2025 to frame issues vital to the development of the US Army after about 2010 and to provide those issues to the senior Army leadership in a format suitable for integration into TRADOC development programs.

The effective service life of the material purchases by the Army during the defense build-up of the 80's will begin to wear-out beginning about 2010. The prospect of a period of wear-out just a decade ahead will dictate that the Army leadership begin now to determine what significant changes in direction should be adopted by the Army prior to investing in replacement systems and organizations.

THE ARMY AFTER NEXT PROGRAM

AAN builds on the Force XXI process and initially follows the direction of its operational concepts. AAN seeks to take advantage of the creative research conducted under the OSD-sponsored Revolutions in Military Affairs (RMA) initiative and, for the Army, push the RMA inquiry out to at least 2020-2025. AAN is a comprehensive, holistic inquiry into the probable nature of future warfare. It is intended to be a continuing, institutionalized process for systematically looking 30-years into the future. The research focus of AAN is initially four areas:

- Probable geopolitical realities.
- Evolving military art and science.

- Human and organizational behavior issues.
- Technology.

The AAN program is an annual process anchored on two major, recurring events - a June Paper from Commanding General, United States Army Training and Doctrine Command (TRADOC) to the CSA, and a major Winter Wargame. Many other activities occur throughout the year to support these two events. The June Paper provides a comprehensive review of future warfighting. It identifies issues and serves as a vehicle for the CSA to direct further inquiry and development into areas posed as most promising by the previous year's efforts. The Winter Wargame brings together senior Defense policy makers to participate in a free play, force-on-force exercise to discuss critical strategic and operational issues concerned with future warfare.

The initial products of the AAN studies of warfare are issues that appear to be central to the nature of the Army of 2025. The disciplines involved in these studies include military art and science, the physical and social sciences, history, sociology, psychology, and organizational behavior; and include participation from current expert theoreticians, practitioners and futurists. The issues developed in these studies involve all aspects concerned with the employment of military forces for the world of 2025. When fully developed, the studies will lead to conclusions and recommendations about the following areas, as well as others that will become clearer as the AAN initiative progresses:

- A set of plausible futures that avoids errors inherent in predicting a precise future or in inadvertently ignoring an important possibility;
- Sets of hypotheses and relationships among issues that merit further scientific study and experimentation;
- Focused efforts to define possibilities and probabilities in all areas that contribute to developing and fielding US military forces of all services that can set the world standard in 2025; and
- Recommendations for action by the Army's leaders and major commands to start, modify, or terminate activities designed to define and to shape the Army of 2025, including the proportions of resources to be dedicated to current and potential future combat developments and overall modernization.

To be successful the art of 'future gazing" demands a unique set of skills and proclivities. A futurist must stay beyond the pull of the present and think in terms of major long-term shifts rather than small, incremental, linear steps derived directly from current events. Thus, the AAN's focus beyond the current resource budget and program years is an inherent characteristic. To maintain this needed future orientation, TRADOC will set the time horizon of AAN's activities ahead to remain focused about 30 years in the future. As AAN issues reach definition, TRADOC will organize and present them as options for decision by the Army's leaders and for execution by appropriate Army, joint, or other responsible agencies.

AAN PROJECT METHODOLOGY

The AAN project is a broad intellectual inquiry that adopts all methods appropriate to the profession of arms. It uses the scientific method to its fullest potential, while recognizing that many questions and issues important to warfare do not lend themselves to precise quantitative analysis. The AAN's methodologies include those that at present support DOD and Army research and development in the broadest sense, across all substantive areas of inquiry. The AAN project endeavors to apply the best available and relevant quantitative and qualitative, scientific and anthropological methods to better understand future warfare.

The AAN project is organized around an annual cycle of several major events. The cornerstone activity is the winter wargame that is designed to study the art of war beyond the year 2020. The culminating event occurs each June when the Annual Report is submitted to the Chief of Staff of the Army. This report presents a comprehensive summary of completed activities and outlines recommendations that deserve action during the next year. Additionally, several other key events are scheduled and conducted each year. These include tactical wargames in the fall and late summer wargames in September. Both of these wargame excursions are designed to develop analytical baselines for the winter wargame. Furthermore, several conferences and workshops are conducted each year in support of the project's four major research areas. Collectively, these activities provide the analytical rigor that identifies vital security issues and feasible planning concepts.

AAN 1996-1997 PROJECT ACTIVITIES

During the course of the last year, AAN has executed the following:

- The first annual AAN Winter Wargame at Carlisle Barracks 27 January - 6 February 1997 with follow-on excursions on 24-28 February 1997. This strategic wargame focused on the qualitative dimensions of the future geopolitical environment, politico-military decision making, the nature of warfare, and the broad characteristics of friendly and adversary military forces. It involved over 400 participants in a complex, scenario-driven, computer-supported exercise characterized by unscripted free play and inter-agency and all-service participation. Results from the wargame are covered in Appendix C.
- A series of all-service tactical wargames in October through December 1996 that focused on the development of qualitative and quantitative aspects of force-on-force and noncombat types of military action keyed to plausible 2025 capabilities for US and adversary forces. Wargame products were used primarily to feed the adjudication process for the Winter Wargame. These wargames took on the challenge of trying to move beyond the limitations of the Lanchestrian attrition-based models of the Cold War and developed innovative techniques for gaming previously non-quantifiable influences of information on future operations.
- Hosted 16 conferences and workshops of experts across all disciplines to generate ideas about the world of 2025 and to support development of discrete AAN

activities and studies. Participation ranged from 12 to over 150 personnel at each event. Of particular note was an inaugural gathering of human and organizational behavior experts on 13-14 January 1997 and an assembly of over 150 leading industry technologists on 11-13 March 1997 to help identify promising technologies whose development would significantly effect future warfighting capabilities.

- Active efforts to reconnoiter and develop networks into all relevant disciplinary fields to compile the best available expert views of the status of those fields and their relevance to AAN purposes, with particular emphasis upon psychology, organizational behavior, technology, and the art and science of war. This effort has been particularly rewarding and has led to the establishment of specific alliances with selected communities who have agreed to engage in studies, largely at their expense, to further develop issues of importance to AAN; and
- Studies and experiments applying the best available qualitative and quantitative methods to develop AAN issues. One experiment currently underway through the support of SSDC in Huntsville, Alabama, is attempting to harness the capability of Cray computers to create an interactive environment to accurately portray the activities of various warfighting systems and organizations anywhere within the surface to space continuum and which, if successful, may allow for effective simulation of alternative approaches to future warfighting.

AAN 1996-1997 TECHNOLOGY INITIATIVES LINKING TO THE SCIENCE AND TECHNOLOGY COMMUNITY

The AAN project approached the issue of identifying critical future technologies through multiple mutually supporting efforts over the past year. They included—

- Biotechnology Workshop (May 96). Sponsored by the Army Research Laboratory, this was the first effort in support of AAN to assemble experts from this field and focus them on how they might influence warfighting in 2025.
- AAN Winter Wargame (Jan-Feb 97). The WWG assembled over 60 technologists from industry and research centers to participate on special technology teams that both supported the game and worked to surface promising technologies to empower operational capability requirements as they emerged during the game play.
- AAN Technology Workshop (Mar 97). Building on the outputs of the Winter Wargame, AAN assembled over 150 leading researchers and members of industry at a technology workshop to examine key topics in human and organizational behavior, logistics efficiency, strategic maneuver/mobility, force protection, platform protection, biosciences, and battle command control.
- Robotics Workshop (Mar 97). An ARL-sponsored workshop in support of AAN to study robotic applications in mid-to-high intensity and MOUT operations during the 2020 time frame.
- Identifying and integrating on-going research initiatives, both inside and outside the Army, that were potentially supportive of emerging AAN operational requirements. Significant progress was made in establishing a network with

cutting-edge research centers and individuals to better inform AAN on the "art of the possible" across the many disciplines effecting future operational capabilities. Among these efforts were:

- CG and DCG TRADOC and Dir, DARPA initiated an AAN Initiatives Panel to assist the AAN Project in concept development and exploration of technological possibilities. The panel proposed a focus on early deploying forces and described strategic mobility, fire support, individual soldier systems, land systems, and information systems technologies being used in our AAN descriptions. The panel has promoted a greater mutual understanding between DARPA and in the AAN Project and how the two organizations can help each other.
- Established an Internet link to facilitate an active and routine exchange of ideas between concepts and technology. The Army Technology and Concept Network (ARTAC Net) is the web site being established by ARL in concert with TRADOC DCSDOC. The site is due for full scale operations by June this year.
- Creation of the Integrated Idea Team or IIT concept. Similar to the Integrated Concept Team used in the Army and in the commercial world, the IIT gathers a multi-disciplinary group of experts to investigate primarily technological possibilities in support of emerging Army After Next characteristics and descriptions. The first IIT on Tactical and Operational Mobility convened in May. It will evaluate the developing tactical and operational ideas, and the technologies, and systems described in the AAN Tactical Games.
- Established important links to the S&T community and the S&T process. We have formed partnerships and associations in the Army, in the commercial world, in DOD, in the other services. Our association with the Army Science and Technology Working Group (ASTWG), the Triennial Strategic Research Objective Review, the Board on Army Science and Technology (BAST), the Army Science Board, the Defense Science Board, DARPA, as well as other major conferences and workshops has rendered a broad initial perspective on S&T and the possibilities for AAN.

The AAN project established a preliminary process and identified the areas in which basic and applied research (e.g., 6.1, 6.2) can best be directed to support AAN objectives. This process brings together all major Army science and technology participants to identify needs for refined or new strategic research objectives (SROs) to drive basic research, and refined or new science and technology objectives (STOs) to drive applied research. Participants in this process are now assessing the outcomes of 1996-1997 AAN work, including in particular the technology workshops and wargames. The results of this assessment will influence the forthcoming revisions of the Army's programs, including near term budget adjustments to dedicate a portion of the basic research budget to AAN-related work.

The Army last promulgated a modernization plan for fiscal year 1996. This plan, normally updated annually, is the definitive catalog of Army leaders' decisions, plans, and programs for modernizing the force in the near term and mid term, the years covered by the current budget and proposed five-year Defense Department program. It is the document that will explain the path that the next wave of force improvements,

currently Force XXI. Pending completion of the ongoing Quadrennial Defense Review (QDR) process, the Army's leaders decided to forego promulgation of a modernization plan for fiscal year 1997. Once decisions by executive and legislative branches on the QDR are in place, the Army will again have the opportunity to build a definitive modernization plan.

In terms of AAN future needs, the Army Modernization Plan will provide a near term baseline. The plan will define the scope of Force XXI improvements, and indicate the scope of AAN action for the future beyond Force XXI. Therefore, Army decisions on directions for, and investments in, AAN activities will serve as a tentative limit of advance for Force XXI. Viewed from the current ("legacy") force and Force XXI perspectives, the Army modernization plan offers a level off certainty for current force development and readiness efforts, avoiding wasteful expenditure of energy and resources on areas that fall within the AAN purview.

An extension of the Army Modernization Plan, the Army Science and Technology Master Plan (ASTMP) catalogs Army leaders' decisions on the entire Army research and development effort. For the near term and mid term, it translates the program direction set out in the Army Modernization Plan. For the long term, it explains the science and technology direction needed to bring to fruition the Army leaders' vision and plans for the long range future. As the AAN project leads to Army decisions on the future, their long range science and technology implications will be reflected in ASTMP, including adjustments to SROs, STOs, and related funding.

The ASTMP currently takes its lead solely from the Army Modernization, as there is no future oriented element in the Army's planning process. Initiatives underway will reestablish a longer range Army planning process. In the past, this process (e.g., the Army Long Range Planning Guidance) incorporated the future vision developed by TRADOC and endorsed by the Army's leaders (AirLand Battle 2000, AirLand Battle-Future, Army 21), which assisted in shaping long range research in science and technology as well as concept development. As the Army refines its long range processes, AAN will be a significant source of insights and direction for future science and technology research and development

AAN RESEARCH ALLIANCES

To ensure full engagement of all organizations with potential contributions to the AAN project, TRADOC has entered into a series of functional alliances that cover the range of national security matters from the present through 2025. These alliances include civilian academic and industrial experts as well as a wide array of governmental entities. Alliance member representatives habitually attend TRADOC workshops, conferences, and wargames; and participate in AAN studies and analyses. Similarly, TRADOC provides representatives to take active roles in future-oriented national security projects hosted by alliance members. The resulting sharing of information and collaboration on innovative work focused on the future has already increased the value of insights

relevant to the AAN project and to the projects of alliance members. The gains for ensuring adequate future forces without unwanted duplication or uncovered gaps should be evident as the AAN project unfolds in the months and years ahead.

During the past few months, we have organized three AAN "franchises" with other Headquarters or TRADOC staff agencies. The Franchise idea gives us the ability to impose our standards on specific study areas while still leaving the initiative and detailed work to other headquarters. The guidelines to operate an AAN franchise are to—

- Conduct research cooperatively with TRADOC, DCSDOC.
- Focus upon war in the thirty-year future and concentrate on "how" wars are likely to be fought without getting entangled within the "who" or "what" issues.
- Develop a research connection between previous and future wargame issues.
- Include joint and interagency studies within the planned activity. Maintain and encourage service-to-service relationships.

Currently, three franchise studies are underway. Each effort includes both joint and interagency participation. The first is an SSDC/DCSDOC "gamelet" at Huntsville in June to follow up on policies and doctrines relative to the Space protection issue. The Assistant Secretary of Defense for Space, the Air Force and the DoD Space Architect's office are cooperating with this project. The second study is a JFKCENSPWAR/DCSDOC "gamelet" designed to explore unconventional warfare in the 2021 time frame aimed at a robust Orange force for the upcoming Summer Wargame. The third franchise project is an Information Operations "gamelet" that is also designed to support the Summer Wargame. TRADOC,DCSINT is coordinating this study with assistance from the MI School and other agencies such as DADCSINT, CIA and LEWA.

Since its inception, the AAN project has been also closely linked to the long-range studies of warfare under the rubric of the "Revolution in Military Affairs" (RMA) undertaken by the Office of the Secretary of Defense's Director of Net Assessment (OSD(NA)). AAN and RMA efforts are mutually reinforcing, providing significant input for AAN activities, particularly wargames. Moreover, in the past year a number of other studies, essays, and commentaries on future conflict and combat have advanced propositions of importance to the AAN's mission. Other important alliances include:

SPACE

AAN activities have generated an increasing appreciation of potential contributions of operations in and from near-space and deep-space. As a consequence, TRADOC forged an alliance that included the premier space organizations in US national security affairs, including the Air Force, the National Reconnaissance Office (NRO), the US and service space commands, and the Army's Space and Strategic Defense Command.

ANALYSIS

To expand the ability to apply the most powerful and relevant analytic techniques to AAN areas of inquiry, TRADOC established analytic relations under the leadership of the Future Battle Directorate and the TRADOC Analysis Center (TRAC) with the Army's

Concepts Analysis Agency (CAA), the Army Research Institute for the Behavioral and Social Sciences (ARI), the Army Research Office (ARO), the Army Research Laboratory (ARL), the Walter Reed Army Institute of Research (WRAIR), the Defense Advanced Research Projects Agency (DARPA), the Office of the Secretary of Defense' Directorate of Net Assessment (OSD(NA)), the RAND Corporation (Arroyo Center and Project Air Force), Science Applications International Corporation (SAIC), the Logistics Management Institute (LMI), the Institute for Defense Analysis (IDA), Booz-Allen and Hamilton, and Coleman Research.

INTERSERVICE

All-service participation is a hallmark of the AAN. AAN activities routinely include participation from all relevant US military services as well as selected allied and friendly country military organizations, with early participants including Britain, Canada, and Australia at the 1997 AAN Winter Wargame. Moreover, TRADOC's AAN representatives participated in a number of future-oriented workshops, conferences, and wargames sponsored by other services over the past year. AAN has been briefed to each service chief and networks have been established with the future warfighting cells within each service. Of particular note was the joint authorship of a comprehensive article addressing the direction of future landpower published by AAN and the Marine Corps Combat Developments Center. Interservice participation in AAN is the most comprehensive, intense, and detailed ever in the Army's developmental activities.

INTELLIGENCE

The entire US intelligence community has important projections and forecasts that bear on the AAN. While most intelligence products are projected for the near term, an alliance of intelligence agencies assisted TRADOC make its projections of the world environment and potential US adversaries and competitors to 2025. These include the Defense Intelligence Agency (DIA), the National Ground Intelligence Center (NGIC), the Federal Bureau of Investigation (FBI), guided by intellectual constructs and specific intelligence forecasts and products produced by TRADOC's Deputy Chief of Staff for Intelligence (DCSINT), and the Army's Deputy Chief of Staff for Intelligence (DCSINT). The resulting projections and forecasts are the most comprehensive and useful produced since the demise of the Cold War and its premier Army intelligence forecasting tool, the Soviet Battlefield Development Plan (SBDP).

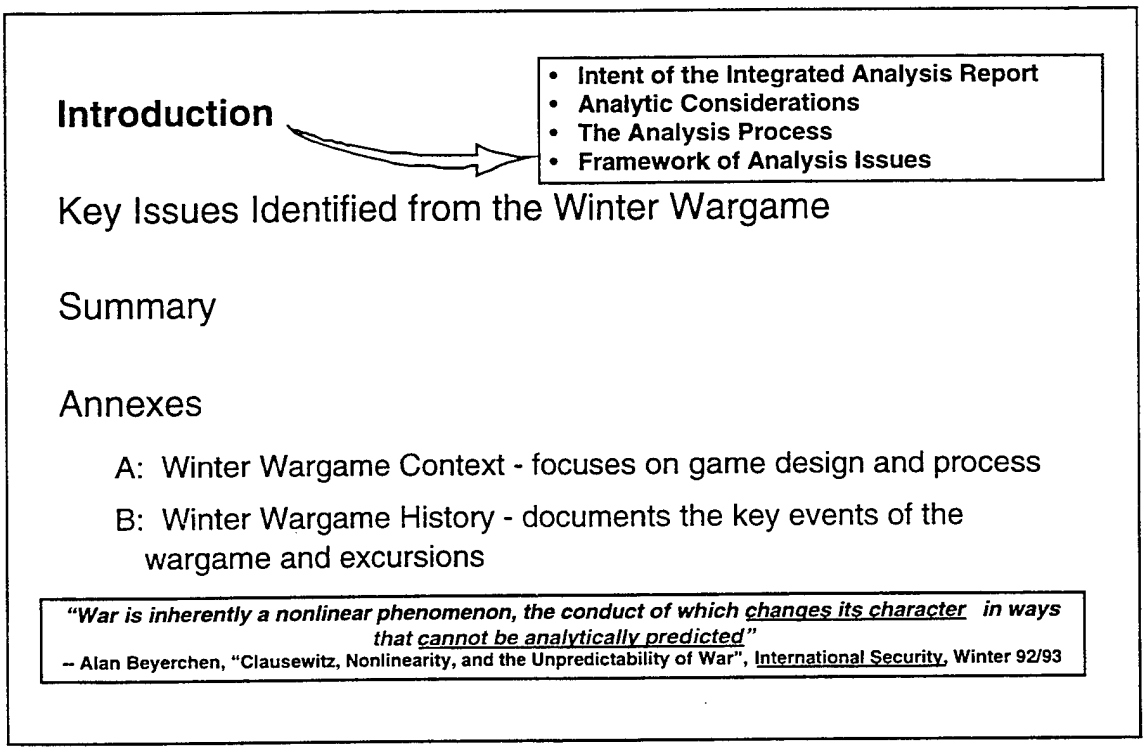
The AAN projects on the road ahead will expand this concept of alliances. As issues mature, alliances will include agencies responsible not only for theoretical developments and laboratory experimentation, but also the transition from demonstrated concepts to practical production and fielding of actual combat and supporting capabilities. Alliance maintenance will be a principal area of AAN activity, ensuring the most efficient and effective use of intellectual and analytic capital for meeting the AAN mission.

AAN AND ARMY LONG-RANGE PLANNING

AAN is the flagship project among several studies which have as their core purpose "to inform the long range planning process and assist the Army's leaders to establish priorities and earmark resources to maintain force readiness today and in the future." There is a need for a viable process that routinely produces planning guidance that can serve to set the course for shaping the Army of the future. This guidance must assist leaders as they endeavor to ensure that the Army continues to be capable of fulfilling its fundamental mission. Actions taken today will have profound effect on the trained and ready force of the future. It is imperative, therefore, to establish the basis not only of long-term planning, but of the design and implementation of current programs that carry the seeds of the future. AAN and DAMO-SSP have together recognized the obvious value of using findings and analysis developed within AAN to help set the more-distant parameters that guide Army Long Range Planning and are actively developing procedures for melding these two activities together. Both recognize the need to "outline a continuous process of change that will transform today's Army into the AAN battle force of 2025" and "provide a clear focus and sense of priority to necessary research and development activities" for the Chief of Staff of the Army as he makes planning decisions. The intent is to establish a close collaboration between TRADOC and the ARSTAF in the development of the parameters that set the limits of possible alternative futures addressed by the Army Long-Range Planning process.

APPENDIX C

INTEGRATED ANALYSIS REPORT



This report provides the key issues derived from the 1997 AAN WWG conducted at the Center for Strategic Leadership at Carlisle Barracks. The report is regarded as the authoritative source of the key WWG 97 issues and has been approved by the WWG sponsor, the TRADOC Deputy Chief of Staff for Doctrine (DCSDOC). While there is value in immediate impressions, individual perspectives, and media reports of the WWG, the fact remains that no one person experienced the entirety of the WWG. This report attempts to look across multiple sources, filtering out biases and errors that often accompany early reports of an event, to present one overarching, comprehensive suite of important issues identified during the game.

Four other characteristics of the report are highlighted on the cover. Only the key issues, identified after sifting through a library of information, are included, though many more issues developed during the game. The issues are still viewed as emerging, since they are only based on the initial game; other events and follow-on games may reveal evidence that leads to a shift in the focus of an issue. The issues span the strategic and operational levels of war. Finally, all issues are traceable to the WWG 97 or follow-on excursions. There is no shortage of ideas on the nature and character of future warfare in current literature; however, an attempt to capture all those thoughts is clearly not the intent of this effort. The ideas in this report all have origins in the WWG, a process specifically created to generate such issues.

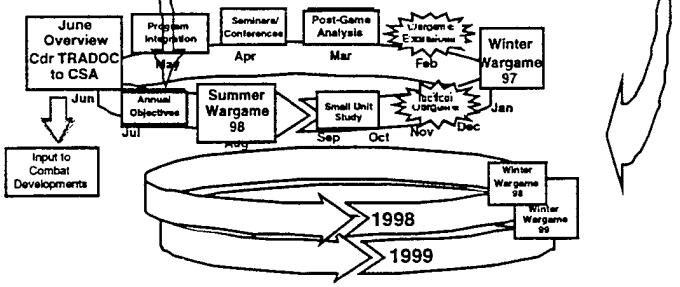
The structure of the report is shown here. The introductory section provides the analytic context for the effort. Key WWG issues across nine categories are presented, followed by a summary of the analysis. The two annexes enable this report to serve as a stand-alone document, providing sufficient contextual and historical information to allow an understanding of the sources of the key issues and the particular geostrategic setting that provides the foundation for those issues. The first annex provides the game design, the proposed Blue force structure, and the road to war. The second annex presents a history of the WWG and the follow-on excursions, through an annotated time line and accompanying discussion. A glossary of terms is also provided.

In our attempt to create a vision of warfare in 2020 through the WWG, Alan Beyerchan's quote suggests one theme that is prevalent throughout the analysis, and another theme that figures prominently in the analysis methodology itself. First, the possible changes in warfare raised by the WWG are more related to the character, rather than the nature of warfare. Second, the analysis methodology did not attempt to predict and then measure the possible changes; instead, the approach relied on the WWG to provide a rich environment from which patterns of change might emerge.

Intent of the Integrated Analysis Report

Present a set of issues that:

- *Serve as input to the June CSA Report*
- *Provide a baseline for analysis in future games*
- *Influence the analysis effort for upcoming AAN cycles*



The Army After Next Cycle

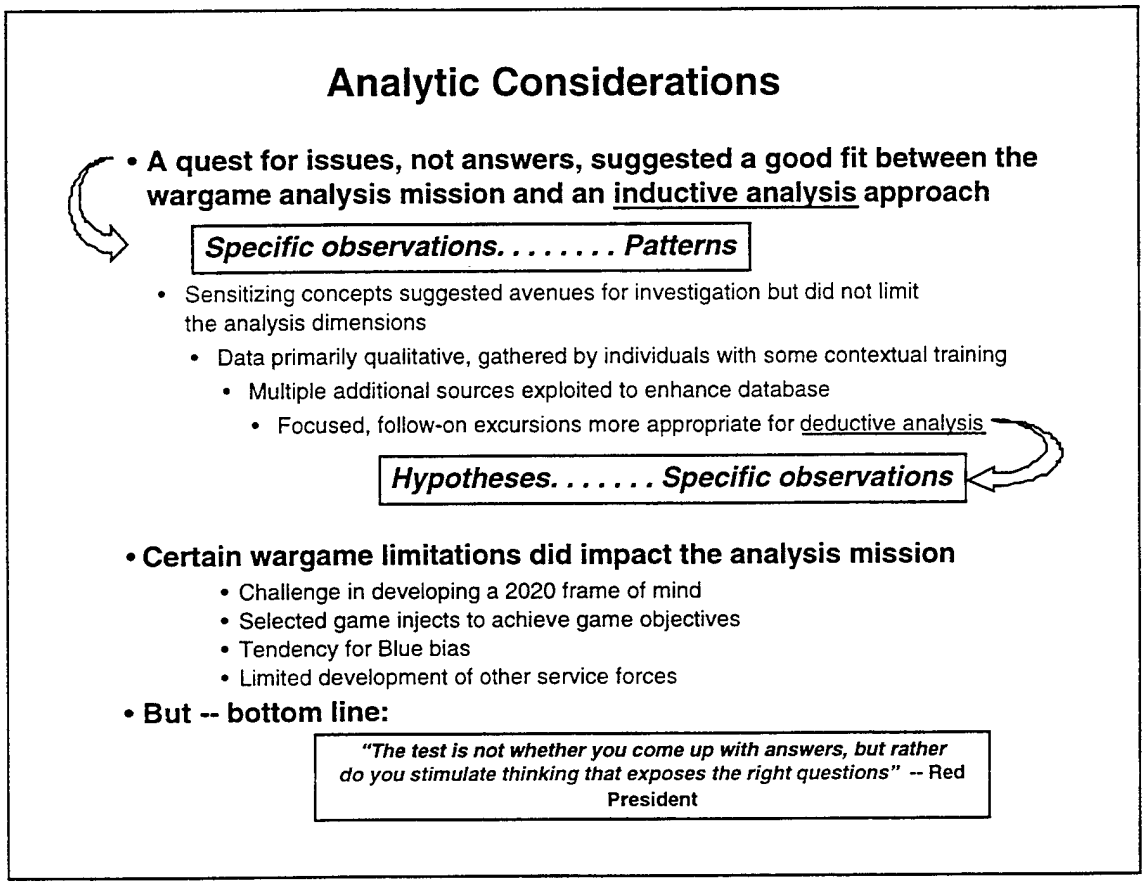
The Integrated Analysis Report is best explained in the context of the overall AAN program and process. The AAN program, sponsored by the TRADOC DCSDOC, includes an annual cycle of events aimed at identifying and framing issues associated with war in the future, to aid in development of a vision for the future Army. The key event in the cycle is the WWG, a policy/strategy level political-military wargame set initially in the year 2020 (advancing one year with each annual cycle) to raise such issues through player discussions and employment of notional future forces. The culminating product in the cycle is an annual report to the Chief of Staff, Army (CSA), on the critical issues and insights generated throughout the cycle, not just from the WWG, but from seminars and conferences, the supporting Tactical Wargames, and independent analytic efforts.

As stated initially, the Integrated Analysis Report serves as the authoritative source of key issues from the WWG, providing a stand-alone report of the critical outcomes of the event. In fulfilling this primary purpose, the report also affects the AAN cycle in three distinct areas. First, it serves as the primary input from the WWG to the June CSA Report. Second, it establishes a record of the initial WWG and provides a baseline for comparison with follow-on games. Finally, the issues raised in this report are intended to influence the full suite of analysis efforts conducted under the AAN umbrella through integration in the annual program objectives. This effort is aimed at sharpening the focus of analysis support to the AAN process.

The report integrates the efforts of two analysis agencies, the TRADOC Analysis Center (TRAC) and the RAND Corporation, and also integrates issues at the operational and strategic levels of war. TRAC's initial focus was on operational issues while RAND

looked initially at the strategic level. As the WWG demonstrated, the distinction between operational and strategic levels in future warfare may become blurred, and this effect, coupled with the free-play nature of the game, resulted in significant cross-over by the two agencies beyond their initial focus. RAND provided their input in the form of a Project Memorandum, while TRAC, as the integrating agency, incorporated that input as well as ideas from numerous other sources to develop this Integrated Analysis Report. Finally, the report integrates considerations of both a political and a military nature from the WWG.

It is most important to recognize that this report is not intended to centralize thought or limit debate, but rather to stimulate open discussion and exploration of issues concerning future warfare. It is also important to understand that these issues are based on a single plausible geostrategic setting. Given any other plausible environment, a different set of issues, perhaps with some overlap, would likely emerge. In keeping with the intent of the AAN program and the WWG, this report is about issues, ideas, and avenues for investigation. It will not present conclusions, answers, or proven results.



This 'issues' orientation led to the use of an inductive analysis approach, attempting to identify emerging patterns or categories out of many specific observations. These patterns were not predetermined; however, RAND developed an early set of strategic objectives and issues that served as 'sensitizing concepts' for the observers, suggesting some possible characteristics of future warfare that might surface during the game. Regardless, there were no boundaries placed on the analytic team with respect to the issues that might arise from the game, nor the relative importance of various emerging technologies or functional areas, such as space or information operations (IO). This approach was a sound complement to the design of the WWG; the free-play feature of the design was the real strength of the WWG as a forum for generating issues, and avoiding lock-step, predictive analytic results.

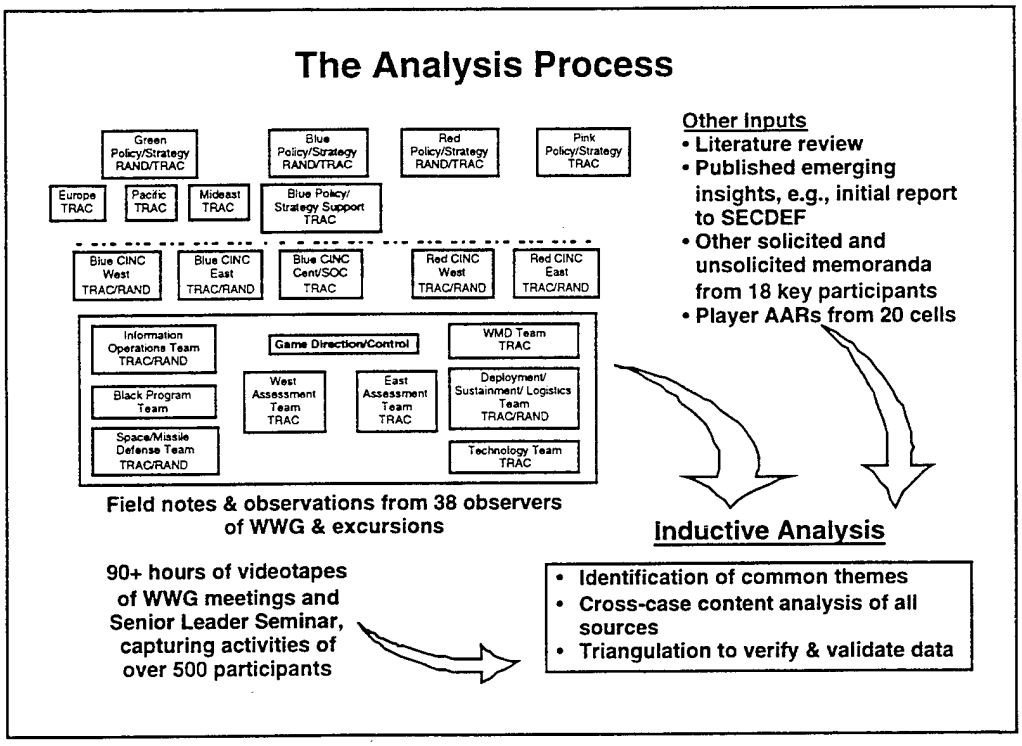
Observations of the WWG events, primarily qualitative in nature, were made and recorded by members of the TRAC/RAND analysis team. Both groups of data collectors and analysts received training on the WWG context, techniques of data collection and qualitative analysis procedures. A core group of the team had extensive experience with the development and tactical gaming of the notional 2020 forces, and the development of the road to war and assessment procedures for the WWG. Although relying on the observer team as a primary data source, the analysis integration team leveraged multiple sources of information to supplement the database and complete the analysis.

The experience of the WWG surfaced some specific issues regarding space operations and the sensitivity of timing of deployment decisions. These issues led to exploration of some hypotheses in follow-on theater-level excursions where the approach shifted from inductive to deductive analysis. These excursions and the associated observations are considered an integral part of the WWG.

There were several limitations that did affect the analytic process and product. Foremost was the challenge of developing a 2020 frame of mind in all the participants, to achieve realism in play and understanding in analysis. The analysis team attempted to meet this challenge during observer training events, but a similar effort was not feasible for all the other invited participants. Moreover, it remains uncertain how to instill individuals with a 'futures' mind set or how to measure when that is accomplished.

Other limitations are described here. First, there were several key injects to game play that were made to achieve game objectives. Players seeking diplomatic solutions to crises were reluctant to use military force; however, to explore both the political and military considerations of warfare in 2020, actions were taken to initiate hostilities in the West theater, and later in the East. Second, there was an observed and admitted bias towards Blue in the assessment of results, based on greater familiarity with Blue, among other factors. Finally, although a concerted effort was made to develop other services' 2020 forces for the WWG, there was a limited degree of development of those forces, relative to the Army's 2020 notional Battle Force.

In the end, however, the overriding objective, as phrased by the Red President, was "exposing the right questions" concerning future war. WWG participants widely acknowledged that this objective was accomplished.



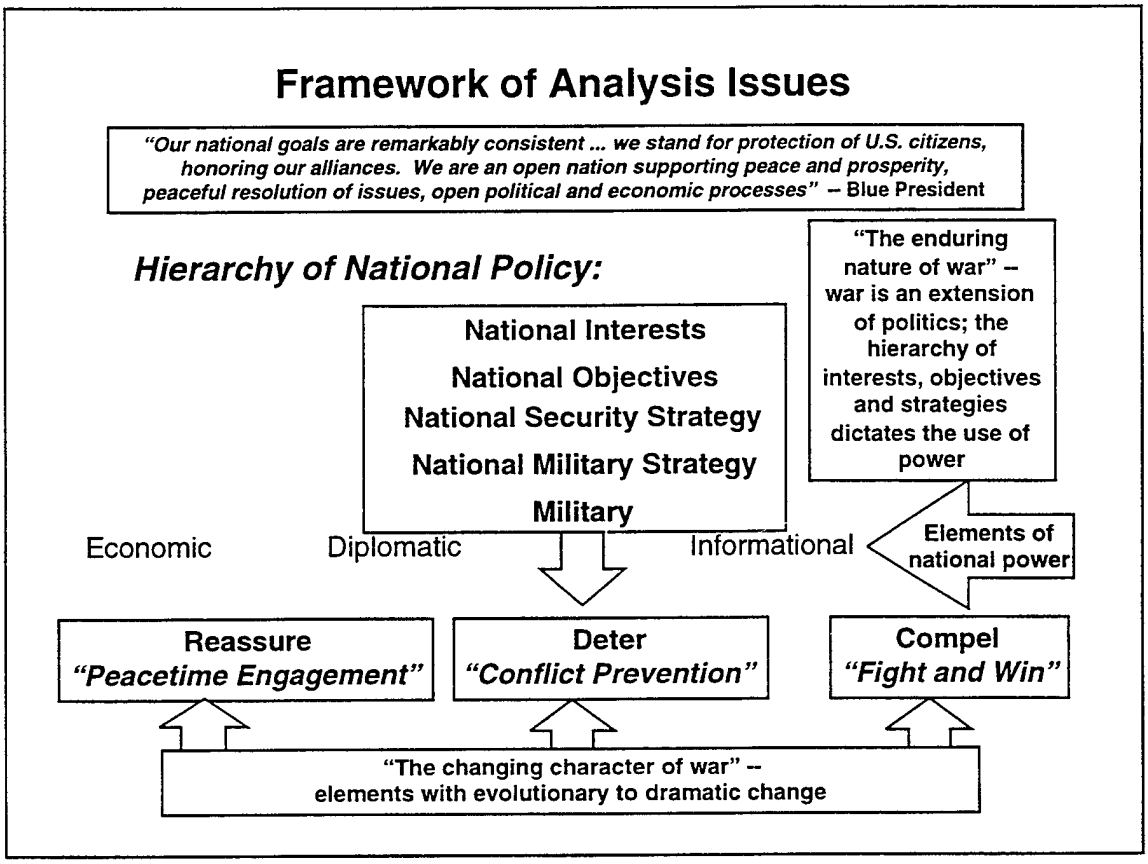
To capture the discussion and issues generated at the WWG, TRAC and RAND observers were located in the player cells as shown. RAND held the primary role at the political/strategic level, with TRAC leading the efforts at the operational level and below, including the assessment teams and the supporting special teams. These observers generated a database of field notes, observations, and outcomes spanning the experiences of the WWG, albeit each observer had a very focused perspective. As an interim step, RAND project leaders synthesized the inputs from their observers; the data base of TRAC observations was used directly by the TRAC analysis integration team as a data source.

Additional sources supplemented the database, including current and historical literature and writings on global futures and war in the future. We used these sources to determine patterns of consistency between the insights from the game and the thoughts of independent thinkers; those areas of congruence are highlighted throughout the report. Other sources included summaries of initial insights by various agencies; notes and memos produced by individual players; and records of after-action reviews (AARs) in the player cells. Participants who took the time to document their impressions after the game included the Blue President; the Red President; Blue players in the roles of National Security Council (NSC) Advisor, Chairman of the Joint Chiefs of Staff (CJCS), Economic/Industrial Policy Advisor, Commander-in-Chief (CINC) East, and Deputy CINC (DCINC) West; and key members of the assessment teams and special cells. In fact, the comments of the Blue President were directed to the Secretary of Defense (SECDEF) who was also provided an initial, raw set of emerging insights from the game.

The WWG Excursions, conducted a few weeks after the principal game, generated an additional set of observations, although the effort was conducted on a smaller scale and

addressed selected issues regarding space capabilities and deployment raised during the WWG. This report merges information from the excursions with WWG observations.

Using an inductive analysis approach, the analysis integration team identified emerging patterns, or common themes, from this vast array of data. These emerging patterns were evident across multiple sources, not isolated in the views of a lone participant. As a validating step, many hours of videotapes of WWG events, including the Senior Leader Seminar, were reviewed to resolve inconsistencies, verify events, clarify observations, and underpin the analytic process. The resulting product is a sound, balanced view of the important issues of the WWG.

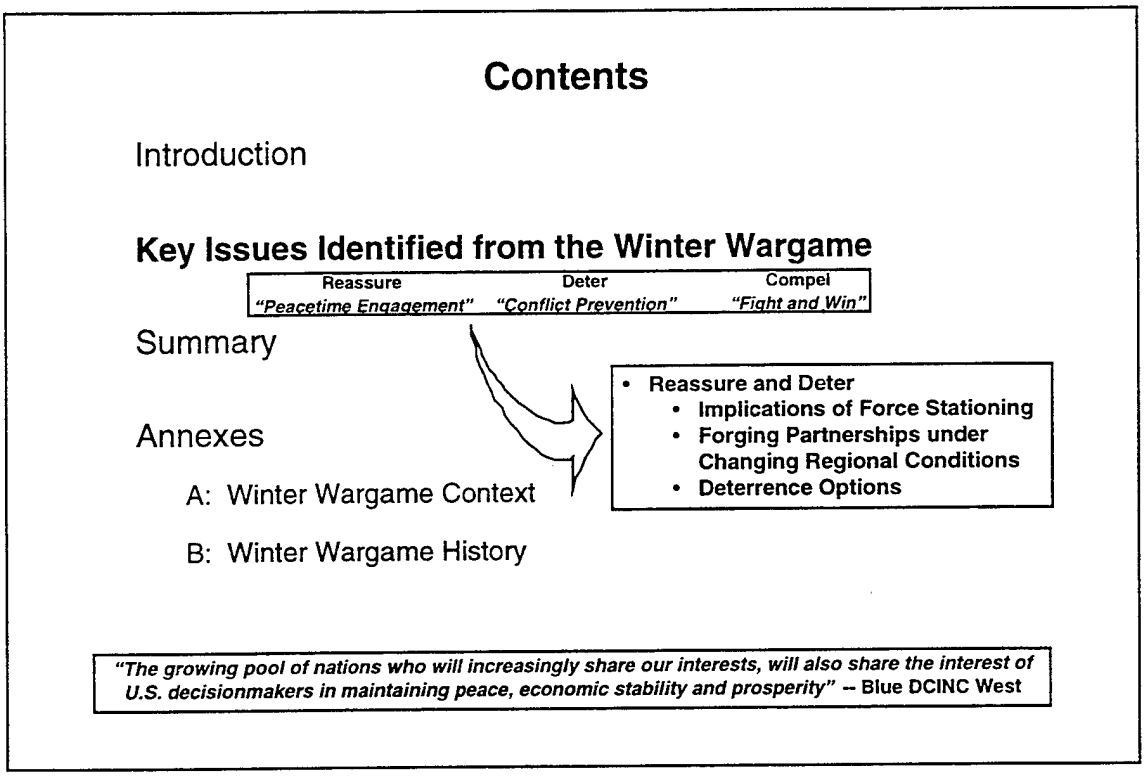


Our analysis suggests that the nature of war— as an extension or subset of politics, as a clash of human wills, with elements of uncertainty and rational calculation—is enduring. The hierarchy of national policy, from national interests and objectives, through national security strategy, to national military strategy and the elements of national power, remained a stable framework for discussions during the WWG. It is within the character of war— the use of military means as an element of national power to reassure our partners, deter our adversaries, and compel our enemies—that the WWG provided evidence of potential changes in 2020, ranging from evolutionary adjustments to dramatic shifts. The focus of the analysis report is on these elements of change. While not explored in the WWG, other elements of national power—economic, diplomatic, and informational—may undergo similar transformations that could have ripple effects on the use of military power.

Within the more constant policy framework and the nature of war, the WWG clearly demonstrated that US interests will drive the decision to go to war in 2020, much as they have historically. "What are our equities?" the Blue President repeatedly asked, when weighing the input to decide to execute proposed deterrent options or to go to war. Our national interests were debated at great length, as the National Command Authorities (NCA) struggled with the situations in the WWG and whether those situations threatened national interests. The Blue President indicated that our national goals were remarkably consistent; the two he highlights in his statement, protection of US citizens,

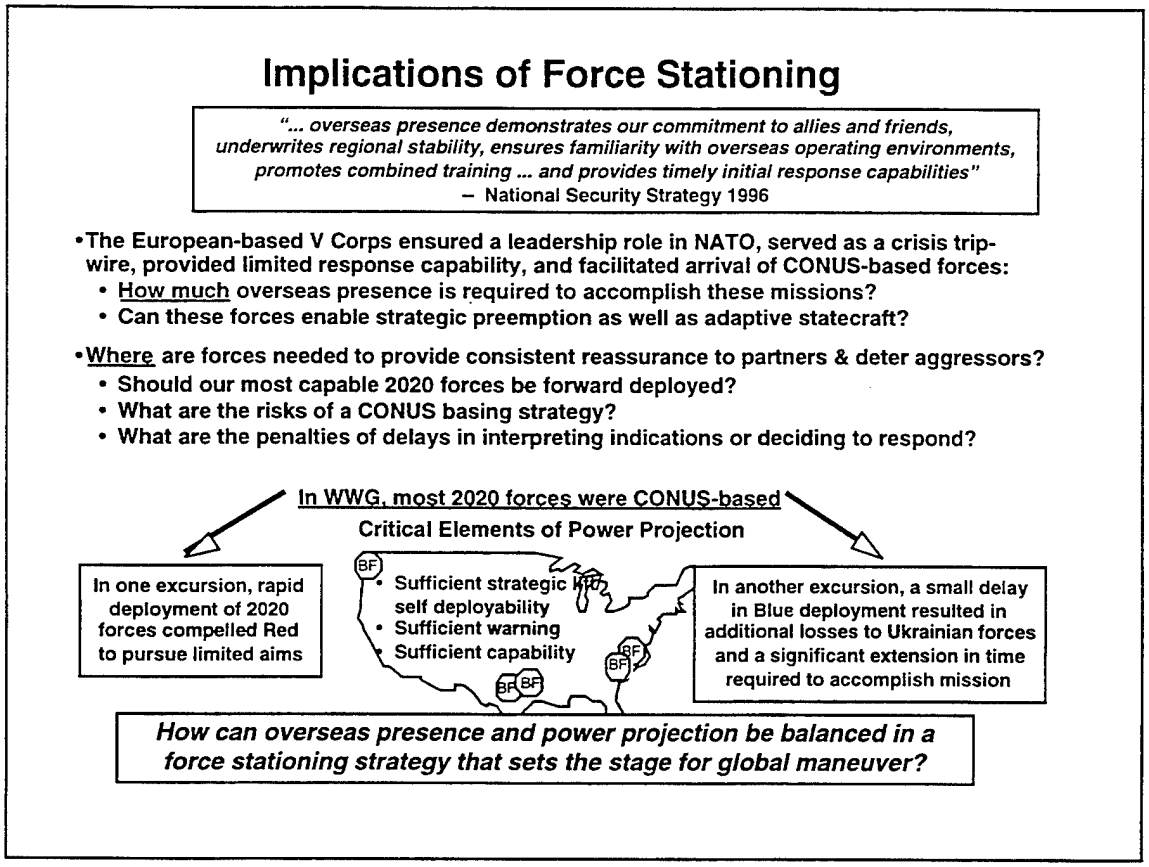
both at home and abroad, and honoring our alliance commitments, were among the more compelling interests which drove the NCA to the use of military power in the WWG. The evacuation of noncombatants from Kiev was clearly conducted to protect US citizens. Indications of potential Red aggression against Poland, postulated as one of several countries accepted in a North Atlantic Treaty Organization (NATO) expansion in 2002, resulted in swift deterrent actions by the US and other NATO partners. The defense of Ukraine was based on the Nuclear Non-Proliferation Treaty and the reaffirming 1992 Lisbon Protocol. But in any interest area, the implication was that there is a threshold of aggression or unacceptable activity which must be reached for us to act. Where our interests are expanding, due to increasing global connectivity, these thresholds may not be clearly understood until the full impacts of aggressive actions are recognized.

The remainder of the report addresses the changes suggested by the WWG in the character of war: in the strategies and methods that reassure and deter, and in the means and requirements to compel an enemy to alter his behavior or cease aggressive actions.



Those issues related to actions to reassure or deter will be discussed first. Within these categories, we will first look specifically at force stationing and forging partnerships, as influenced by the global nature of conflict in the WWG. Both of these areas include elements of reassurance and deterrence. We will finish this section with a more focused look at options for deterrence that appear to be rapidly expanding given the 2020 force capabilities postulated for the WWG. Relative to these areas, the Blue DCINC West expressed one possible positive forecast for the future, in terms of a larger set of nations with interests common to those of the US. However, the very fact that we will be involved in broader areas with a larger set of international, multinational, and corporate agencies almost certainly assures that we will have a less-than-adequate understanding of our cultural and societal differences that can lead to misunderstandings, disagreements, and breakdown of common interests.

The slide protocol used throughout the discussion of the issues generally begins with a quote or statement relevant to the topic (throughout the supporting script, quotes from game participants will be distinguished by quotation marks and italics, while corroborating statements from literature sources will be set in quotation marks and footnoted). The slides continue with a set of important issues derived from the analysis; certain supporting historical evidence from the WWG; and a key issue for the topic. These key issues capture what we believe are the essential considerations for understanding warfare in 2020, and perhaps present the greatest intellectual challenge to expand beyond a 1997 mind set. These issues form a proposed set of study questions for further analysis under the AAN process.



Because future national interests will be so varied, our military capabilities must be particularly robust, the basing of forces must be geographically diverse, but we must achieve a balance between basing at home and abroad. The current National Security Strategy of Engagement and Enlargement lists a range of expectations of forward-stationed forces that in the future may include "intimate and continuous contact between armies,"[1] with even more emphasis on the role of reassurance. With this shift, power projection forces must be rapidly deployable, transitioning from the continental US (CONUS) to combat almost immediately, and capable of strategic preemption.

In the WWG, the V Corps forward-based forces gave legitimacy to the US leadership role in NATO when Poland was facing potential hostilities, and provided an initial response capability. This is an enduring factor in US force stationing strategy: forward presence enhances credibility "by making the US commitment tangible and meaningful. Further, such forces give the assurance of their virtual automatic involvement in the event of aggression."[2] This automatic involvement during the WWG also highlighted the role of special operations forces (SOF) as global scouts, providing initial awareness of developing crisis situations and serving as an important source of information after space systems were destroyed. Another important mission of forward-based forces is

[1] TRADOC DCSDOC briefing slides for Army Board of Directors, April 1997.

[2] William N. Ciccolo, "Geography and Strategy," *Military Strategy*, August 1973.

enabling the arrival of CONUS-based forces. The Battle Force, with a self-deployment capability, may not be constrained by lengthy movements through port facilities and major airfields, but forward-stationed forces could establish reception, staging, onward movement and integration (RSO&I) stations to facilitate the Battle Force transition to combat and maintain the powerful momentum of their deployment. But one clear issue is the determination of just how much overseas presence is enough. Political and fiscal constraints will certainly mean that in some theaters, forward forces cannot provide a viable strategic preemption capability; however, forward-based forces can be thoughtfully designed to provide the NCA and CINCs "flexible instruments of policy engagement, not simply a sheaf of thunderbolts ... adaptable instruments of statecraft"[3] that are useful across a wide spectrum.

An important counterpart to the question of how much overseas presence is the issue of where forward presence is required. In the WWG, most 2020 forces were CONUS-based. During the deterrent phase, CINCs had the opportunity to reallocate forces but declined, indicating they were comfortable with force positioning. Outside of CONUS, Army forces were stationed in Korea, Germany, Czech Republic, Hawaii, Israel, and Ukraine, and a Marine Expeditionary Force (MEF) unit was stationed in Japan. Our long-standing relationship in NATO will probably assure a continued presence in Europe; however, the turbulence and growth of the Asia-Pacific region, coupled with our growing interests in the area, will require reevaluation. The WWG demonstrated one incident of the instability of the region. The current administration agrees that our interests are strong in the region and the potential for instability is high: "We share the view of almost every nation in Asia that a strong American security presence remains the bedrock for regional stability."[4]

But the total basing strategy must be founded on a global view of our interests, our alliances, our capabilities, and our vision. There is an obvious risk to a CONUS basing strategy; regardless of whether warning is timely, the capabilities of the total force, even with a rapidly deployable component, can be quickly lost to failure to commit them in a timely manner. The graphic illustrates the penalty of such delays, but also indicates the power of timely decisions or, potentially, of forward presence. As with most elements in the changing character of war, the issue is one of balancing "the complementary concepts of overseas presence and power projection."[5] Forces will be required at home and abroad, and our interests span the globe. Our force stationing strategy must lay the foundation for global maneuver.

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[3] General Charles C. Krulak, "An Enduring Instrument: The Force in Readiness in National Defense," *Strategic Review*, Spring 1997.

[4] Peter Lewis Young, "View from the Other Side," *Armed Forces Journal*, April 1997, quoting President William Clinton's address to the Australian Parliament on 20 November 1996.

[5] General Charles C. Krulak, "An Enduring Instrument: The Force in Readiness in National Defense," *Strategic Review*, Spring 1997.

Forging Partnerships under Changing Regional Conditions

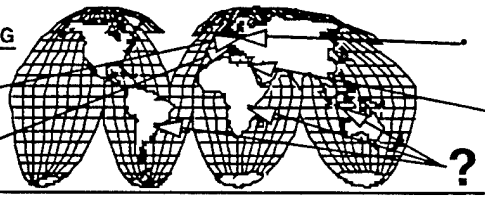
"We used alliances all over the place, wherever we could. There will be more alliances in the future and their value will increase" – Blue CINC West

"U.S. view is not always the NATO view; European view may be very different ... a lot of team building must go on" – ABCA Panel Member

- Blue faced a "coalition of the reluctant" as it prepared for operations in Ukraine:
  - When might alliances get in the way?
  - How do we foster "coalitions of the willing"?
  - How do we develop long term relationships that build trust, connectivity, and "coalitions of the ready, willing and able"?
- How resilient will our partnerships be in the face of actions (e.g., Red space attack) with global consequences? What reassurance measures demonstrate commitment to partners?
- WWG suggested that our partnership strategy in the East is not as mature as in the West; what alliances, treaties, or host nation agreements will be needed? What is our global partnership strategy?

Examples of Partnerships in the WWG

- Exercises in Poland
- Use of NATO air bases and ports



- SOF advisors in Ukraine
- TMD in Israel

What new challenges will be posed by increased global economic, military, & social interconnectivity in establishing and maintaining alliances, partnerships & global collective security arrangements?

Throughout the WWG, key players recognized the critical role of alliances and partnerships. Some, like the Blue CINC West, argued that alliances will be vital in the future and that we will share interests with an expanding set of nations. Indeed, a strategy of reassure-deter-compel rests on our ability to successfully nurture close relationships with potential allies and partners. However, it became obvious that development and execution of a global partnership strategy may be quite a challenge in a future world that could be "messy, evolving and not susceptible to simple formulation or manipulation."[6]

Supra-alliances such as NATO, regional alliances among NATO and non-NATO countries, and ad hoc alliances all played significant roles in the WWG but as the second quote suggests, these agreements were not always viewed the same by the respective partners. In Ukraine, combined Blue and Ukrainian ground forces were supported by Blue and NATO air, operating from Green bases and facilities. This combined effort, however, was achieved only after some lengthy debate among various Green countries about the nature of Red's aggression, the vital interests at stake, Green's role in a proposed noncombatant evacuation operation (NEO), and the NATO Article V implications of an attack in space. This 'coalition of the reluctant' initially constrained

[6] Joseph S. Nye, Jr. *What New World Order?* Foreign Affairs, Spring 1992.

Blue's freedom of action to some degree, and had to be converted through team building to a 'coalition of the willing' to ensure success.

This need for team building implies that the development and maintenance of effective partnerships will be a demanding, time-consuming process that is "unlikely to be achieved simply on the basis of the first show of hands when volunteers are requested."[7] But nations in the future may be prone to enter short-term, limited purpose alliances that do not have the resilience of long-term alliances like NATO. These future partnerships may be unpredictable in the face of multipolarity, may dissolve in recognition of a diminished threat, or may evaporate in the face of actions that impact global economic, financial, or informational networks. The "art of peace"[8] will require the same level of effort, commitment and vision as the art of war.

Blue's familiarity with nations of the West was obvious throughout the WWG. The Blue CINC West was quick to brief an exercise schedule with many of the European nations; the role of V Corps in the defense structure of NATO; and the missile defense assets deployed throughout the theater. A similar condition was not as obvious in the East theater. In fact, the Blue SECDEF remarked that "we have to grow and foster military alliances in the East, like NATO in the West, a lot better than we are doing it if we are going to be able to have a presence and influence situations that may develop there." Accomplishing this may be quite difficult if current forecasts hold. Some analysts suggest an emerging, "complex five-sided balance of power"[9] in the Pacific Rim region, a balance that may be very sensitive to issues concerning resources, economic power, religion, environment, ethnic cultures and military capability.

In the WWG road to war, there was evidence of the array of alliances in which Blue has entered, alliances intended to protect Blue's interests around the world. These include collective security organizations such as the United Nations (UN); several formal multilateral and bilateral arrangements; and perhaps outdated alliances like the Southeast Asia Treaty Organization. Which of these partnerships need to be restructured, strengthened, concluded, or revised? How should they be assessed in light of diverging competencies and interests? What others need to be developed? How does a nation assume the mantle of global leadership without becoming mired in every regional crisis, that will eventually sap its power? As WWG players looked forward to 2020, many envisioned a world marked by increased economic, military, and social interconnectivity and dependencies. Will those nations "grow and prosper together—or stagnate and scapegoat apart?"[10]

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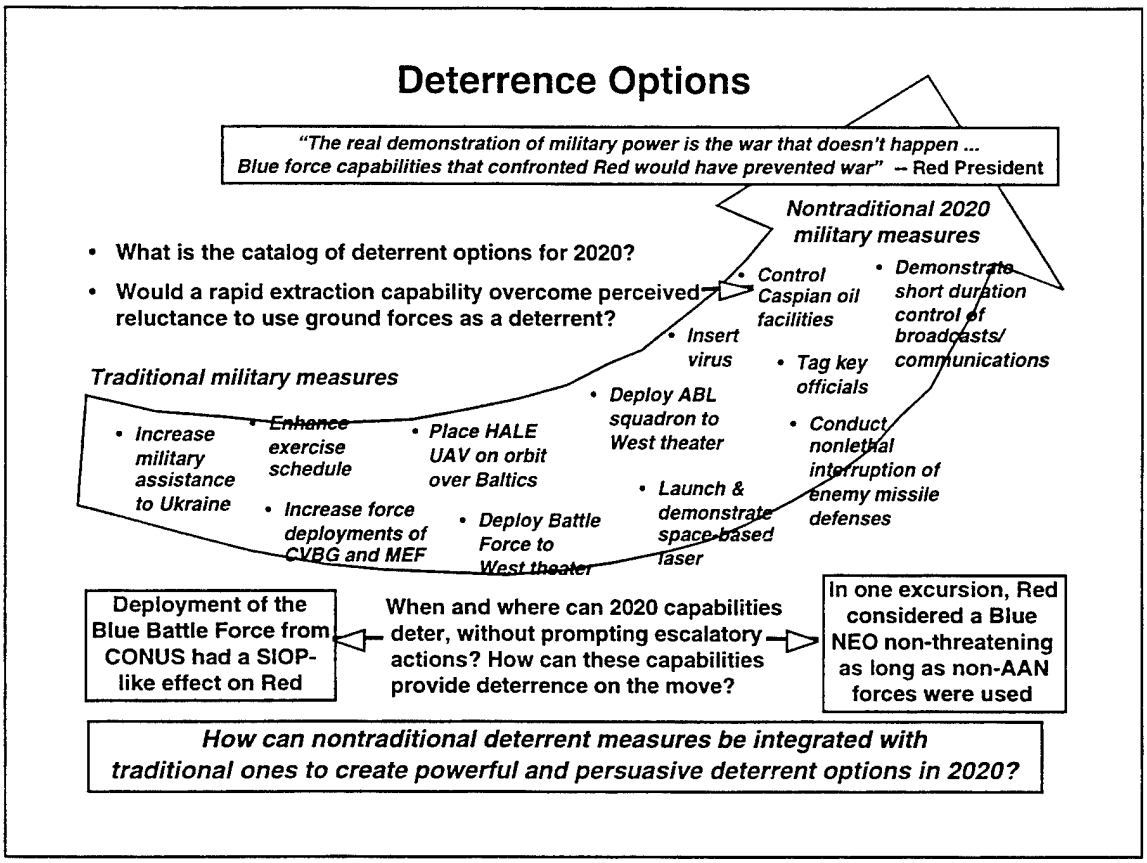
[7] Lawrence Freedman, "The Future of Military Strategy," *Brassey's Defence Yearbook*, 1996.

[8] William J. Perry, *Defense in an Age of Hope*, Foreign Affairs, November/December 1996.

[9] J. Mohan Malik, "The Sources and Nature of Future Conflicts in the Asia-Pacific Region," *Comparative Strategy*, Volume 16, 1997.

[10] John Hillen, "Superpowers Don't Do Windows," *Orbis*, Spring 1997.



Joint Chiefs of Staff (JCS) Publication 1-02 characterizes deterrence as a "state of mind brought about by the existence of a credible threat of unacceptable counteraction." Crafting an effective deterrent strategy, whether using military means or other diplomatic, economic, or information methods, requires an understanding of the effect of those options on the decision maker's state of mind—implying a sophisticated level of understanding of the decision maker, including his propensity for rational thought. It is clear from the Red President's statement that proposed 2020 Blue force capabilities, coupled with the demonstrated stationing strategy, effectively achieved the appropriate level of influence. Ironically, these powerful, dynamic future forces illustrate the "paradox of deterrence: military forces are most useful when they are not used at all."[11]

A preliminary step to exploring how 2020 options can achieve this level of influence involves understanding the catalog of available options. The Blue President repeatedly sought a "stratified list" of deterrent measures. The slide illustrates some of the options discussed at the WWG, including several measures beyond traditional military alternatives. The Blue CJCS recommended a potent suite of options with the intent to convince Red not to pursue aggressive actions beyond his borders. Despite this intent, the deterrence measures actually employed by the CINCs were evolutionary at best, built around those options found at the traditional end of the spectrum. An NCA-

[11] Edward N. Luttwak, "A Post-Heroic Military Policy," *Foreign Affairs*, July/August 1996.

approved IO campaign plan included some of the less traditional options, but the Blue Director of Central Intelligence (DCI) indicated that these measures were generally ineffective because they were initiated too late.

An issue of interest in the WWG was the use of ground forces as instruments of deterrence. A contemporary view, that may be founded in our growing reluctance to accept casualties, suggests that "ground forces are not available as instruments of US foreign policy, except under very unusual conditions."[12] During the WWG, the reluctance to use ground forces as deterrent measures assumed a slightly different twist. The Blue CJCS offered the use of a Battle Force to seize and control key Caspian Sea oil facilities, demonstrating Blue capabilities and resolve to Red leaders. Although this was considered an 'easy match' for Blue, the President did not execute the option because he was concerned with extracting the force later. At the Senior Leader Seminar, he indicated that a rapid ground force extraction capability might overcome prevailing concerns of protracted ground force operations.

The challenge in building persuasive flexible deterrent options is to understand the delicate balance between deterrence and provocation. Current deterrence theory suggests that movement of mobile forces into a theater at the first sign of a crisis can have a greater influence on opposing decision makers than forces that "have become 'part of the landscape'."[13] This notion of deterrence on the move may be particularly effective if an aggressor believes he cannot 'set' before the deterrent force arrives. This idea was echoed in an excursion where Red recognized the early deployment of a Battle Force into theater and, in response, clearly limited his operational objectives in Ukraine. Conversely, after Red invaded Ukraine in the WWG, the same deployment of a CONUS-based Battle Force prompted Red to escalate the war into the medium of space, eventually employing nuclear weapons and extending the battlefield by attacking targets in Blue's homeland.

Creation of powerful and persuasive deterrent packages requires a clear understanding of all available options, and a sound understanding of basic principles of deterrence. Ultimately, the package must influence the opponent's state of mind: issuing the "right threat to the right target, for the right reasons, in the right way."[14] As the Blue DCI indicated, seizure of the Caspian oil facilities, even using 2020 forces, might have little impact on Red decision makers whose country, throughout history, has survived much greater challenges. Finally, decision makers may not always make those rational choices implied by deterrence theory. The Red President required some prompting by Game Direction to overcome his rational assessment of Blue capabilities and to employ military force; but history suggests that misunderstandings, misperceptions and irrational behavior can counter the clear logic of deterrence, and we would be imprudent to assume that any deterrent suite will absolutely preclude hostilities.

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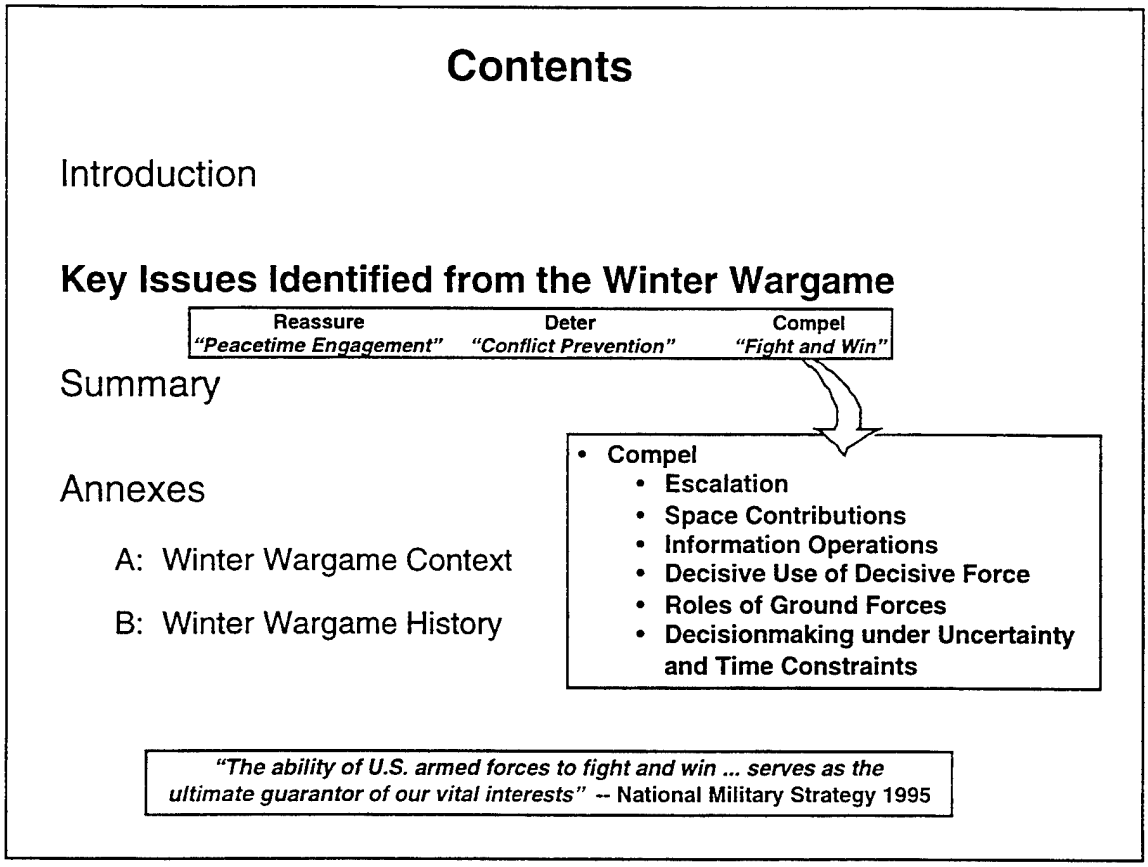
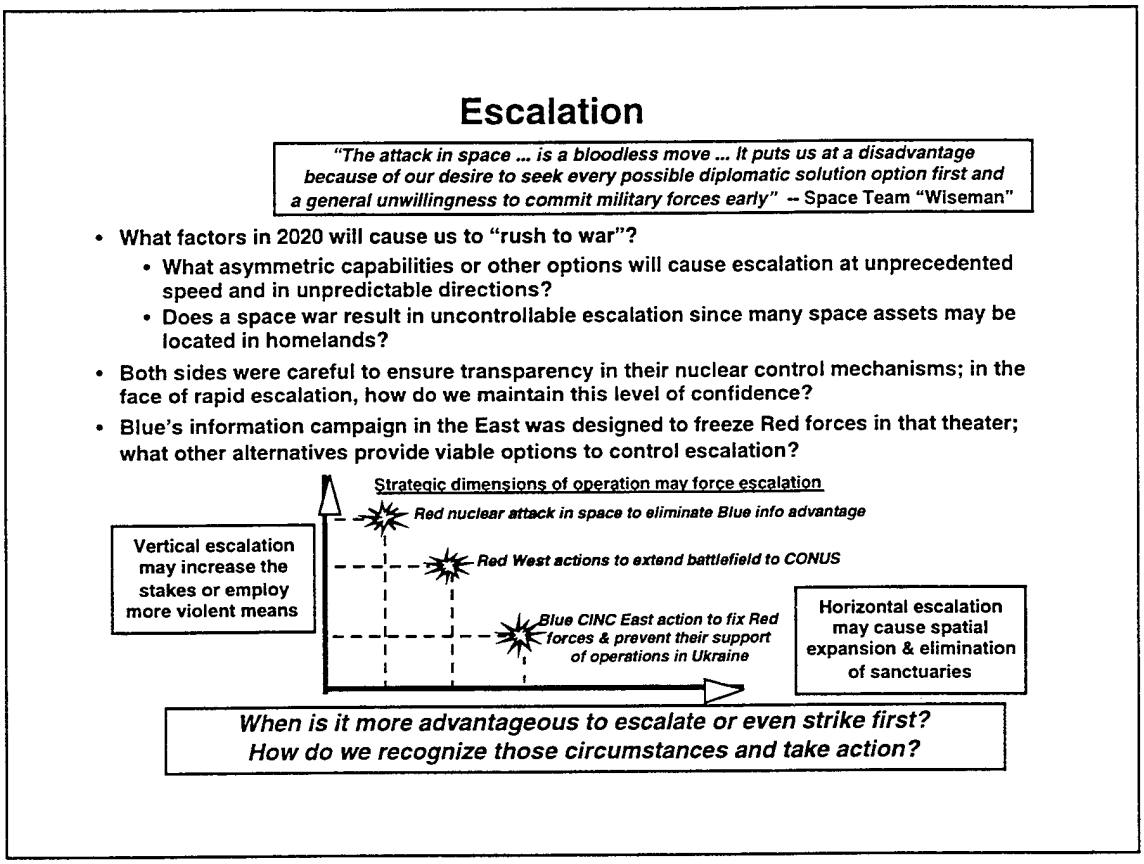
[12] Edward N. Luttwak, "A Post-Heroic Military Policy," *Foreign Affairs*, July/August 1996.

[13] Alan Zimm, "Deterrence: Basic Theory, Principles and Implications," *Strategic Review*, Spring 1997.

[14] Keith B. Payne, "Post-Cold War Deterrence and Missile Defense," *Orbis*, Spring 1995.



We now shift our attention to issues concerning warfighting in 2020—the compelling actions of military power, or as the National Military Strategy indicates, those actions that sustain our vital interests. Escalation is addressed first because it sits, perhaps, on the threshold between conflict prevention and open hostility. Next are two domains, space and IO, that are key to war in the information age. The decisive use of force and the particular roles seen for ground forces in the 2020 context will then be explored. Decision making will be discussed last, as it is influenced by all the preceding categories. This discussion will include both political and military perspectives.



The Red attack on Blue space systems, one of the first unambiguous, hostile acts of the WWG, effectively ended the debate on matters of deterrence and forced the Blue NCA to address matters of warfighting. Defining the appropriate response to this escalatory space attack became a complex challenge. While Blue's declaratory policy suggested that space attacks were equivalent to attacks on home territory, Blue's initial decision was not to strike targets in the Red homeland that specifically supported Red's space capability; this decision was based, perhaps, on the perceived escalatory nature of such actions. Eventually, Blue did initiate a series of attacks on Red, but clearly distinguished between various types of attacks. The insertion of computer viruses to disrupt control systems was considered least escalatory. Laser-capable unmanned aerial vehicles (UAVs) were then employed, and finally, more traditional strikes with explosives against Red ground-based space support systems were conducted. Blue seemed to feel compelled up this escalatory ladder in order to protect remaining critical space systems and to permit the reconstitution of those that were lost. Red, on the other hand, did not attempt to destroy any Blue ground-based space assets, but did eventually violate the rule of homeland sanctuary by using missiles, for example, to try to close some of the critical ports on the east coast.

As one senior leader observed, once we became involved there was a real "rush to war." The space attacks, with their linkage to ground-based systems located in supposedly secure sanctuaries, was just one dimension of that acceleration. The ability of

a handful of nuclear weapons to rapidly destroy an entire fleet of satellites, the potential capability of nonlethal devices to interfere with the deployment of the Battle Force as it moved out of its CONUS staging area, and the ability of future systems to sit in protected sanctuaries while still ranging enemy targets, all contributed to rapid escalation. There are significant implications. First, if alliances, coalitions and host nation support agreements are not in place, there may be little time to develop them. The NCA decision making process must obviously be responsive to this reduction in time. International agreements should be developed that address the status of space systems; are they considered the equivalent of a national flagship in international waters, where intentional interference is viewed as an infringement of sovereign rights? How can we be sure that we maintain the transparency necessary to retain confidence in nuclear control mechanisms? During the WWG, both sides were careful not to destroy those systems that provided visibility over each others' nuclear arsenal; how do ensure such restraint in future escalatory crises?

Escalation has been defined as "an increase in scope or violence of a conflict, deliberate or unpremeditated."[15] In discussions at the WWG, it became clear that escalation is further characterized by two dimensions: horizontal and vertical. As shown in the graphic, several of the actions observed during the game were, perhaps, more heavily weighted in one or the other dimension. Recognizing the nature of the escalatory action does not mitigate the threat of the action, but may suggest methods of control. Finally, the issue of 'controlling' escalation requires investigation. Control does not only imply containment but may, when appropriate, suggest the encouragement of escalation. The Blue CINC East actions, while potentially escalatory, were designed to strategically fix Red assets in that theater. Red's attack on Green airfields, while clearly escalatory, was designed to fracture the Blue-Green partnership. The key to escalation, either vertical or horizontal, is to be able to control it to meet our objectives.

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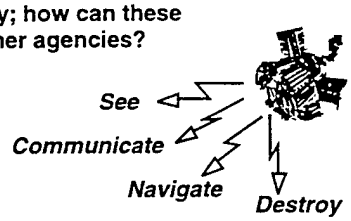
[15] *Department of Defense (DoD) Dictionary of Military and Associated Terms*, JCS Publication 1-02, 1 December 1989.

Space Contributions to Military Operations

Space operations are painfully misunderstood: "So what does this mean?" -- Blue President

- Will the next war start in space as it did in the WWG? Are attacks against Blue space assets equivalent to attacks on Blue territory?
- A lack of national policies and treaties regarding space complicated NCA decisionmaking; what mix of arms control measures, policies, passive defenses and offensive systems are needed to support our interests in space?
- In the WWG, space assets were vulnerable to attack and difficult to replace; how heavily should Blue rely on space as a host of military assets that serve as force multipliers?
- WWG space operations affected information capabilities; what is the relationship between space operations and IO? To what extent are they interdependent?
- The critical impact of the loss in space was not on the immediate tactical fight, but on the global and strategic perspective and logistical connectivity; how can these vulnerabilities be reduced? What will be the impact on other agencies?

Analysis supporting excursions showed that UAVs, SOF, and INS can provide robust mitigating capabilities for vulnerable space-based capabilities supporting sensing, communications, and navigation at the tactical level



How will the dimension of space be integrated into future warfare? How will space capabilities in 2020 complement land, air and sea forces?

The number of issues identified in this category reflects the limited understanding prevalent among WWG participants of space contributions to military operations. "So what does this mean?" was a refrain voiced not only by the Blue President but by many other players struggling to come to grips with the outcome of Red's attack in space. The need to reorient thinking about space became obvious; a player's notion that "we haven't lost our normal military capability, only space stuff," certainly suggested a failure to appreciate the operational impact of space assets, their influence on terrestrial campaign planning, and the need to analyze space operations within a meaningful strategic context.

In the WWG, Red attacked Blue space systems in an effort to eliminate the information advantage Blue enjoyed: "simply put, if the enemy cannot use space or must use it at a disadvantage, he can only gain by knocking space systems out."[16] This philosophy, aggressively adopted by Red, used indiscriminate area targeting, with no concern for the penalty of collateral damage, to rapidly reduce Blue's space capability. The attack may have stunned many participants, but there was a clear logic in Red's actions, suggesting an option for aggressors seeking a decisive opening knock-out punch of the next war: "the scorched earth policy of the 20th century will give way to the scorched space strategy of the 21st century."[17]

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[16] Jeffrey L. Caton, "Joint Warfare and Military Dependence on Space," *Joint Force Quarterly*, Winter 1995-1996.

Red's space activities were problematic for several reasons. Absence of appropriate doctrine and policy to provide the guidance and direction required at all levels of decision making tended to compound player ignorance concerning space capabilities and may have hampered integration of space capabilities into operational campaign plans. As a Space Wiseman remarked, "space warfare is not supported in current space policy." Players unanimously concluded that space doctrine and policy must be developed, must address those considerations necessary to support our interests in space, and must be flexible. Today's lack of understanding cannot serve as rationale for postponing this task: "space doctrine must be a living document, one that is critically analyzed and matures over time, for surely there will be future evolution in the arena of space warfare."[18]

Blue was also challenged by the need to protect or reconstitute space assets. Against an enemy with no concern for collateral damage, Blue had few viable force protection options. Space systems may be quite vulnerable if investments in radiation hardening continue to decline. The debris created by Red's attack could cause a virtual minefield in space, and the swift nature of the attack might preclude Blue efforts to maneuver particular systems rapidly enough to avoid the impact zone. Finally, while reconstitution may offer a potential solution, there were no strategic space reserves available for launch, and reconstitution would be too slow to influence theater operations. Redundancy appeared to be the most promising option. As the first excursion suggested, high-altitude long endurance (HALE) UAVs, serving as surrogate satellites and supported by a suite of complementary UAVs, provided the theater commander with communications and intelligence capabilities to execute the tactical fight. In addition, improved inertial navigation systems (INS) might offer some relief for the loss of global positioning systems (GPS). These systems could not, however, provide the global perspective provided by space-based systems, a critical element in the space-based strategic reconnaissance/counter-reconnaissance battle, nor could they replace the network that sustains envisioned logistical support systems.

One, perhaps extreme, view of the importance of space, a view shared by some players at the WWG, is that the "survivability of space systems will be the key to peace or war, victory or defeat, national extinction or survival."[19] While the WWG suggests that space control alone may not provide the key to victory or defeat in war, the intended use of that control, the potential for space to serve as a source of force enhancement or expand to provide force application, and the approaches to influence terrestrial force operations are all issues to be explored. Just as air and sea power can influence outcomes of war by their effect on land operations, how will space capabilities complement land, air and sea forces, and how will the dimension of space be integrated into future warfare?

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[17] J. Mohan Malik, "The Sources and Nature of Future Conflicts in the Asia-Pacific Region," *Comparative Strategy*, Volume 16, 1997.

[18] Steven J. Bruger, "Not Ready for the First Space War—What About the Second?" *Naval War College Review*, Winter 1995.

[19] Colin S. Gray, "Space Power Survivability," *Airpower Journal*, Winter 1993.

Information Operations

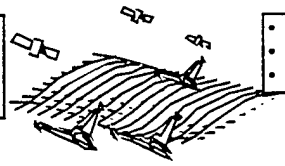
"We were constantly behind the curve ... we established in spades that the NCA needs to better understand how to use IO" -- Blue DCI

- How should the domain of information be organized to ensure a coherent strategy for IO and to support different command levels? What IO policies and ROE must be in place?
- Which pre-hostility IO activities might justify an enemy preemptive strike? Are offensive IO the last step taken to prevent war or the first shots in a war?
- A basic premise of AAN capabilities is an expectation of information dominance; how do we protect and reconstitute IO capabilities if adversaries can impose information denial?
- IO was a supporting function in the WWG:
  - How does knowledge become a capability that can deter war or shape the battlespace?
  - How can IO effects subsume the effects of more traditional forms of military power?

Examples of Effects of IO in WWG

Direct

- Loss of satellites
- Disruption of port management
- Bogus message to Red subs to force them to surface



Collateral

- Loss of strategic perspective
- Deploying force arrivals delayed
- Tracking of subs enabled

How do we integrate the spectrum of information capabilities into a cohesive IO campaign that creates the desired level of information dominance?

While WWG players seemed unanimous in their appreciation for the criticality of IO, there was a disturbing lack of understanding regarding the scope and effects of IO. As the Blue DCI suggested, the NCA struggled to come to grips with IO concepts; their frustration was representative of the confusion experienced at every level as players attempted to understand how to use "the latest technologies to do the oldest things."[20] This confusion was exacerbated by several notions. First, there is a lack of IO policy to guide actions and decisions. Second, there is a wide proliferation of thoughts, ideas, and concepts proposing varied, sometimes contradictory interpretations of IO. Finally, the role of IO, whether it will be dominant or supporting on the future battlefield, is a subject of vigorous debate.

The WWG vividly demonstrated the need to reorganize the domain of information, echoing contemporary views: current organizational structures may not be able to manage IO activities in the future. The Blue President was concerned that the Central Intelligence Agency (CIA) and DoD were developing overlapping, uncoordinated IO campaign plans, that no one was monitoring effects of NCA-sponsored IO within the government or the private sector, and that no one had considered 'war powers act' implications of CIA coordination with Special Operations Command (SOCOM) on

[20] *The Economist: A Survey of Defense Technology,* June 10, 1995.

covert IO activities. He requested government organizational alternatives for conducting IO to further national objectives.

The potential use of IO prior to hostilities launched a debate among WWG players. The notion of a preemptive strike by either side has interesting implications. For Blue, preemptive strike is not something with which we are comfortable. When IO is employed by Red or any other opponent, it may be difficult to recognize the nature of the activity, distinguish it from other seemingly random activities, determine the origin of an information attack, or convince decision makers that the action was taken with hostile intent.[21] Indications and warnings associated with IO must be developed and refined; new rules of engagement (ROE) may be required. An information campaign plan designed by Blue to deter Red's aggressive activities was never effectively executed; a member of the IO team indicated that strategic and operational level players never really understood the potential risks or impacts associated with IO.

Information dominance, a basic premise of future capabilities, implies a significant advantage in the knowledge an opponent possesses about his enemy. Today's term is situational awareness, the ability to see, with tremendous clarity, the current disposition of opposing forces. In 2020, however, information dominance should also include the notion of anticipatory planning, the ability to rapidly deduce feasible enemy options and the appropriate trigger conditions for each option. Information dominance should support the rapid elimination of infeasible options, allowing a commander to look beyond the current situation and more accurately visualize the future.

The WWG did expose the notion that certain advantages, such as an understanding of the terrain or popular political support, may convince an opponent that he does not need to achieve information dominance, simply information denial. Red was clearly in this position. Familiar with Ukraine, possessing the initiative and cognizant of diplomatic obstacles that might preclude a coherent Blue-Green response, Red decided to attack in space based on a belief that his forces would benefit if both sides were blinded. Red used 'high tech' capabilities to eliminate Blue space systems and IO capabilities. In the future, however, even low-technology options may deny Blue the information dominance it expects and requires.

Perhaps the most interesting debate revolved around the role of IO. Some suggest that IO may be so powerful, it will preclude conventional military operations. Others, in contrast, argue that "information superiority won't win wars by itself;"[22] IO will not fully eliminate the fog of war or the need for combat. Both camps, however, recognize that in order to be effective, IO must be delineated in a carefully developed, synchronized IO campaign plan. At the WWG, players seemed to only narrowly focus on IO technology, suggesting independent, almost random actions that might achieve both direct and collateral effects, but never proposing effective, coherent IO campaign plans, integrating deception, electronic warfare, psychological operations, and other dimensions of IO. Clearly, it is only through these plans that the full impact of IO will be realized.

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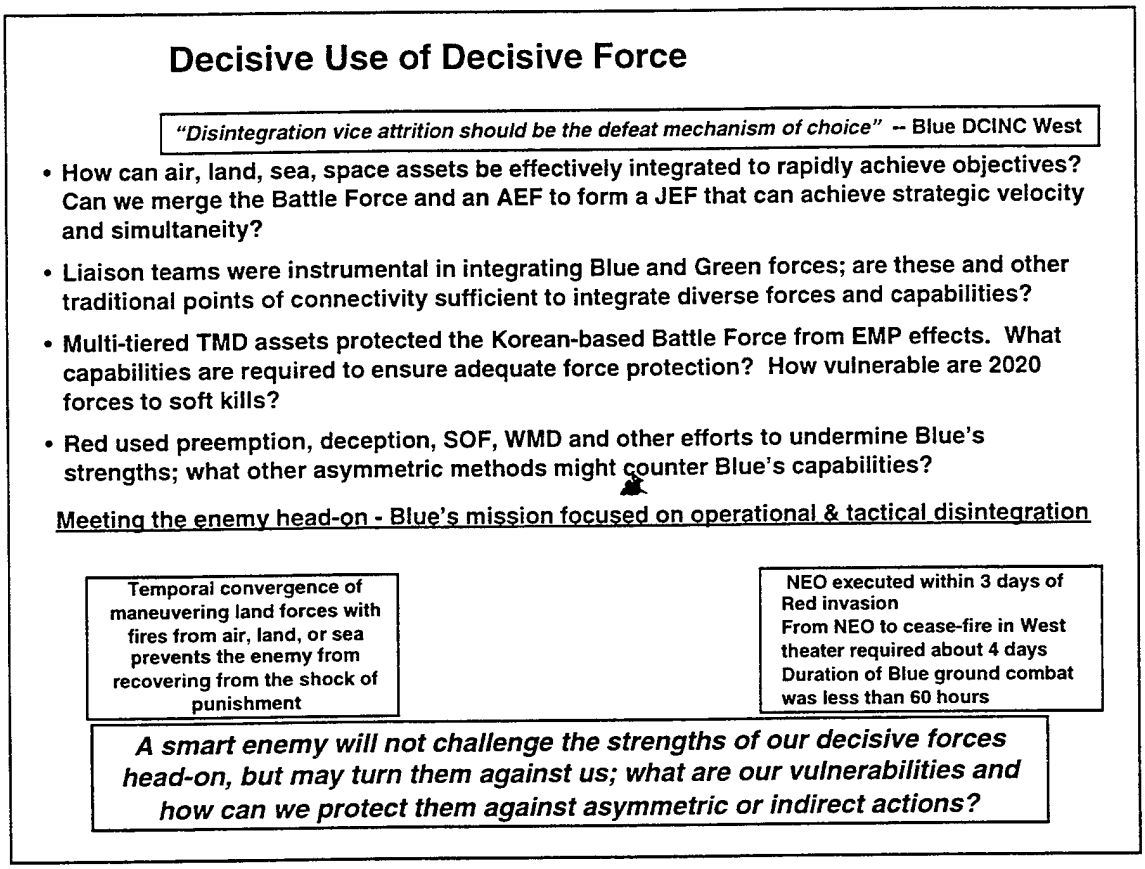
[21] George F. Kraus, "Information Warfare in 2015," *Proceedings*, August 1995.

[22] Lt. Gen. Paul K. Van Riper, "Viewpoint," *Aviation Week and Space Technology*, April 28, 1997.



Within a matter of four days, Blue CINC West was able to initiate and execute a campaign plan that allowed him to destroy the invading Red divisions and regain control of Ukraine while minimizing Blue casualties. The method he chose was based on the idea of disintegration: use an ambush-like, violent pulse of simultaneous multiple precision engagements to temporarily create incapacitating shock among enemy forces and then immediately exploit that shock with the precision maneuver of close combat forces. In fact, within a matter of 60 hours, maneuvering ground forces conducted force-oriented attacks at operational depths throughout Ukraine to exploit the fires from air, land and sea assets. Unlike the defeat mechanism of attrition, which uses physical punishment to eventually erode the enemy's ability to resist, disintegration is designed to be rapidly decisive; it implies the controlled but emphatic application of force, and relies upon certain supporting enablers to include information dominance and precision fires. While there may be circumstances in which attrition is the necessary approach, the desire for a rapid solution to the crisis made disintegration the clear defeat mechanism of choice for Blue CINC West.

In order to achieve disintegration, however, there is an expectation that various types of forces can be brought to bear in a nearly-simultaneous manner. During the WWG, the notion of a Joint Expeditionary Force (JEF) was developed, a concept that would allow the precision firepower of an Air Expeditionary Force (AEF) to be immediately exploited by the maneuver capability of a Blue Battle Force. Such a force could rapidly ambush

and defeat large, significant enemy formations, but it could also, for example, support the air campaign by rapidly seizing and efficiently destroying enemy air bases. This concept requires a ground component with the mobility necessary to achieve strategic velocity and simultaneity, and to quickly exploit, at the most appropriate time, the attrition effects of indirect fires. It suggests a sense of interdependence or, as one player suggested, a level of integration among the various services that "exceeds today's notion of jointness." It suggests a force that can establish points of connectivity and operate in a complementary fashion with allied forces so that diverse capabilities are efficiently integrated to maximize their effects. It will require a level of force protection that will permit the ground force to deploy, stage and be employed without being subjected to debilitating enemy actions, whether from missile attacks, biological terrorism or any other potential threat. It envisions the controlled application of a dominant force built on the premise that in order "to minimize casualties, it is necessary to maximize capabilities."[23]

It is just such a force that would be employed to achieve strategic preemption, but this idea of preemption clashes with our national character. Preemption, by definition, implies being first; preventing conflict by aggressively reacting to a situation, perhaps even in the absence of explicit indications and warnings. This type of 'first strike' is not our typical response to potential crises nor was it the observed response during the WWG. The Blue President refused to delegate the authority to initiate offensive operations in space even when his advisors judged that a Red space attack was impending. The request for authority to attack Red submarines positioned off Blue's coast in the event they demonstrated signs of preparation for hostile actions was also denied. Consequently, a decisive Blue force is one that must be able to provide a secure 'second strike' capability; that is, it must be able to rapidly respond, as opposed to truly preempt, and then in a very short window of opportunity, defeat an enemy force.

Throughout the WWG, the game of chess was frequently invoked as an analogy for future warfare. The chessmaster's ability to clearly understand the current situation and to predict the options available to his opponent, for example, suggested the potential role for IO, anticipatory planning and the challenge of future battle command. The game of chess can, however, be a dangerous analogy for future warfare. For warfare, unlike chess, is not a game in which the opponent is constrained by any particular rules. An 'uncooperative foe' will probably choose those options that "blunt the cutting edge of state-of-the-art, information-age forces."[24] Red certainly attempted that during the WWG, employing a variety of asymmetric and indirect responses to reduce our capabilities— actions 'outside the rules'—just as Garry Kasparov adjusted his dynamic, combative style of chess play after learning he "could not stand toe-to-toe"[25] with IBM's Deep Blue computer. There is clear danger in ignoring the historical evidence of the successful underdog or in assuming that our future enemies will accept our interpretation of warfare.

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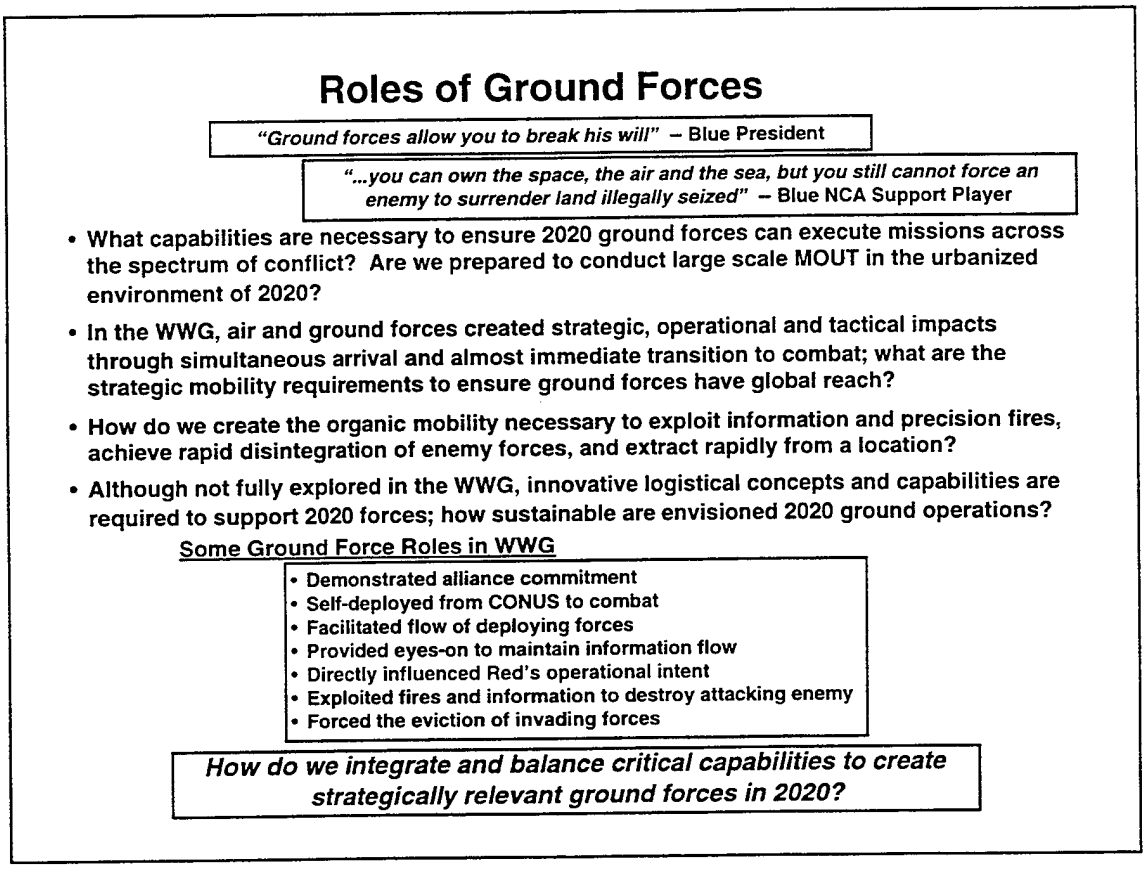
[23] Lawrence Freedman, "The Future of Military Strategy," *Brassey's Defence Yearbook*, 1996.

[24] Colin S. Gray, "The Changing Nature of Warfare," *Naval War College Review*, Spring 1996.

[25] Associated Press, "Tactics designed to Cross up Deep Blue," *Kansas City Star*, 9 May 1997.



At the WWG, there was clear appreciation of the requirement for ground forces. As the quotes suggest, players recognized that "wars are won when military forces occupy areas critical to an enemy's existence, dominating the enemy populace and their armed forces to a degree that assures their defeat."[26] There was extensive discussion throughout the WWG about the options available to end the crisis with Red, to include testing the limits of deterrence and implementing certain indirect approaches. However, key Blue decision makers ultimately recognized the determination and resilience of the enemy and the inevitable need for very direct and decisive contact with enemy forces. The employment of forces on the ground sent an unmistakable signal of commitment, determination, and resolve which could not be transmitted by any other means. As the graphic indicates, the deployed ground forces accomplished a myriad of missions, not the least of which was fixing enemy forces, and the destruction and eviction of invading Red forces. But ground forces were not always at the forefront of strategic options considered by decision makers, perhaps because of uncertainty regarding their relevance for some of those missions. How then, can we ensure the strategic relevance of ground forces in 2020?

First, ground forces must have the adaptability to execute a variety of missions, to include the dramatic, force-oriented operations displayed in Ukraine as well as the

[26] Frederick J. Kroesen, "No Silver Bullet Can Promise Success in War," *Army*, July 1996.

ability to root the enemy out of perceived safe havens that urban areas might temporarily provide. In the preparatory AAN Tactical Wargames as well as at the WWG, Red attempted to move as rapidly as possible to built-up areas with the intent of negating the precision capabilities of Blue air power and the mobility and speed of the Blue Battle Force.

Second, ground forces must be able to achieve strategic preemption, that is, they must be able to deploy rapidly enough to deter aggressive action or to terminate conflict on favorable terms, before it becomes a debilitating, protracted war of attrition. This capability depends on a level of strategic mobility that the Battle Force demonstrated during the WWG when it self-deployed from CONUS and transitioned to combat in two days. This operation did require a reallocation of lift assets from other Battle Forces and the dedicated support of several logistical organizations, but it provided the NCA and the CINC with a ground force that could be inserted before the invading Red divisions could go to ground.

Third, ground forces must have the tactical mobility that permits the force to conduct tactical exploitations at operational depths. The Blue Battle Force, built around the air mechanization concept, was able to ignore terrain constraints and exploit the shock and disorientation generated by fires from air, sea, and land forces. Enabled by information dominance, the force was able to move rapidly over 400 kilometers from deep hide positions to decisive points of attack, creating devastating ambush sites that disintegrated enemy formations.

Finally, ground forces must be cut free from the constraints of unwieldy logistical lines of communications (LOCs). Although this consideration was not examined in depth in the WWG, the need for innovative logistical operations that permit the ground commander to maintain the tempo and initiative demonstrated during the operations in Ukraine was recognized by most players.

But strategic relevance requires more than mere capability. It requires a balance among these dimensions: mission flexibility across the spectrum of conflict; strategic mobility and transitioning capability that permits strategic preemption; freedom of maneuver at operational depths, enabled by vastly enhanced tactical mobility; and agile logistical concepts. Forces that can rapidly deploy to theater and move quickly around the battlespace are not decisive if they are hampered by the need to wait for less agile logistical support systems. Forces that are structured to address a full spectrum of enemy options are not decisive if they cannot get to the theater in time to influence the outcome. Forces that can deploy rapidly are not decisive if they are stymied by man-made or terrain obstacles or cannot respond flexibly to changing diplomatic conditions. Strategically relevant ground forces must be able "to respond rapidly, offer a broad spectrum of operational capabilities, and yet remain flexible and adaptable in quickly changing diplomatic, military or domestic political settings."[27] Achieving this balance demands further investigation.

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[27] General Charles C. Krulak, "An Enduring Instrument: The Force in Readiness in National Defense," *Strategic Review*, Spring 1997.

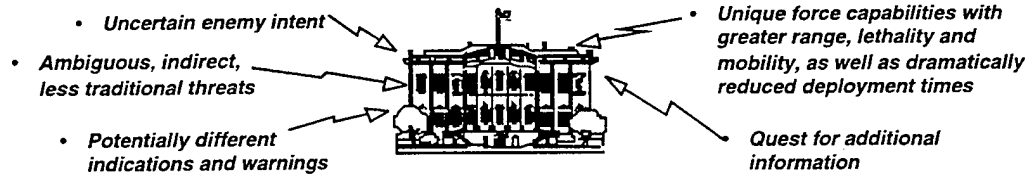
Decisionmaking under Uncertainty and Time Constraints

"War once begun will run rampant without time for political solutions to be worked out" -- Blue President

"The NCA must be trained to be able to conduct fast-paced decisionmaking in the highly compressed time frame that will be available" -- Blue SECDEF

- Will the pace of conflict outstrip political control or influence? How much are we willing to decentralize?
- Will decisionmakers require new knowledge? What new NSC expertise will be required?
- Strategic preemption requires rapid force projection:
  - Will decisions be made to ensure timely force arrival to prevent or rapidly terminate conflict?
  - What are appropriate RC roles given the demonstrated short duration of 2020 operations?

Decisionmaking Considerations Observed in the WWG



What information, policies, directives, and authorities are needed to facilitate decisionmaking in time-constrained scenarios?

The pace of operations in the WWG caught many players by surprise. Both the Blue President and SECDEF highlighted the impact of the pace of war in their remarks. Prior to a political decision to take military actions, even those focused on deterrence, an enemy can move rapidly to escalate hostilities, affect our capabilities in space, or initiate an IO campaign that will further complicate the political decision.

There are several factors that contribute to the marked increase in tempo. Global situational awareness, increased range and lethality of weapon systems, and enhanced force deployability and mobility all serve to diminish the time required to have a direct impact on an enemy force. Some of these enhancements are not limited to our own forces; increased weapons ranges and improvements in mobility were attributed to Red forces, and allowed the enemy to threaten major population centers in Ukraine in a matter of hours. The challenge for political leaders is to rapidly assimilate the relevant information and make an informed decision, recognizing the potential impacts of indecision: "the US can and undoubtedly will... fill its quiver with technologically superior arrows, but if it does not have the will to employ those arrows quickly and decisively it may find itself less effective in conflict than its opponents."[28]

[28] Richard Szafranski, "Peer Competitors, the RMA, and New Concepts," *Naval War College Review*, Spring 1996.

It must be recognized, however, that the very capabilities that increase tempo may contribute to indecision. Global situational awareness may lead decision makers to postpone an action, waiting for one last piece of information. Leaders might view rapid deployability capabilities as a rationale for decision delays. Other contributors to indecision may include a lack of knowledge regarding new force capabilities; the demonstrated lack of familiarity of space and IO capabilities at the WWG reinforces this concern. Delays may also stem from a need to understand enemy capabilities, from the lack of policies, or from the complexity of influencing factors, such as treaties or international law. NCA discussions of the implications of multiple treaties, the evolving complexity of the global economy, and the assessment of enemy capabilities reflect some of the areas where the NCA may require new knowledge. Leaders may also confuse global situational awareness with the ability to determine enemy intent, a task which will become even more difficult, given that potential aggressors may be less familiar to leaders, could take more ambiguous actions, will probably use indirect approaches, and may generate indications and warnings of a different nature than today. Will US forces "have sufficient power in place to counter a belligerent able to exploit the fourth dimension"[29] of time? Other approaches may also dilute our attention; Red effectively used a deception operation focused towards Poland to increase his success towards his true objective in Ukraine during one of the excursions. The WWG reflected a concern to achieve clear understanding of enemy intent: "Even in those circumstances where the political decision can be expected to be pretty automatic, there can still be delays resulting from uncertainties over intelligence, and a cautious desire to wait until ambiguities in the opponent's behavior have been clarified... Further time is inevitably lost in the process of consensus-building."[30]

General Hartzog, TRADOC Commander, indicated during the Senior Leader Seminar that "the administration and NCA level wanted alternatives left wide open to an extraordinary late point in the plan." The irony is that delays in decision making may clarify the picture but can limit alternatives as well. Signature concepts such as strategic preemption cannot be achieved without timely decision making. The challenge is determining the key enablers of information-age decision making.

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[29] Ajay Singh, "Time: The New Dimension in War," *Joint Forces Quarterly,* Winter 1995-1996.

[30] Lawrence Freedman, "The Future of Military Strategy," *Brassey's Defence Yearbook,* 1996.

Contents

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- **Contrasts in the Character of War**
- **Emerging Implications for Land Warfare**
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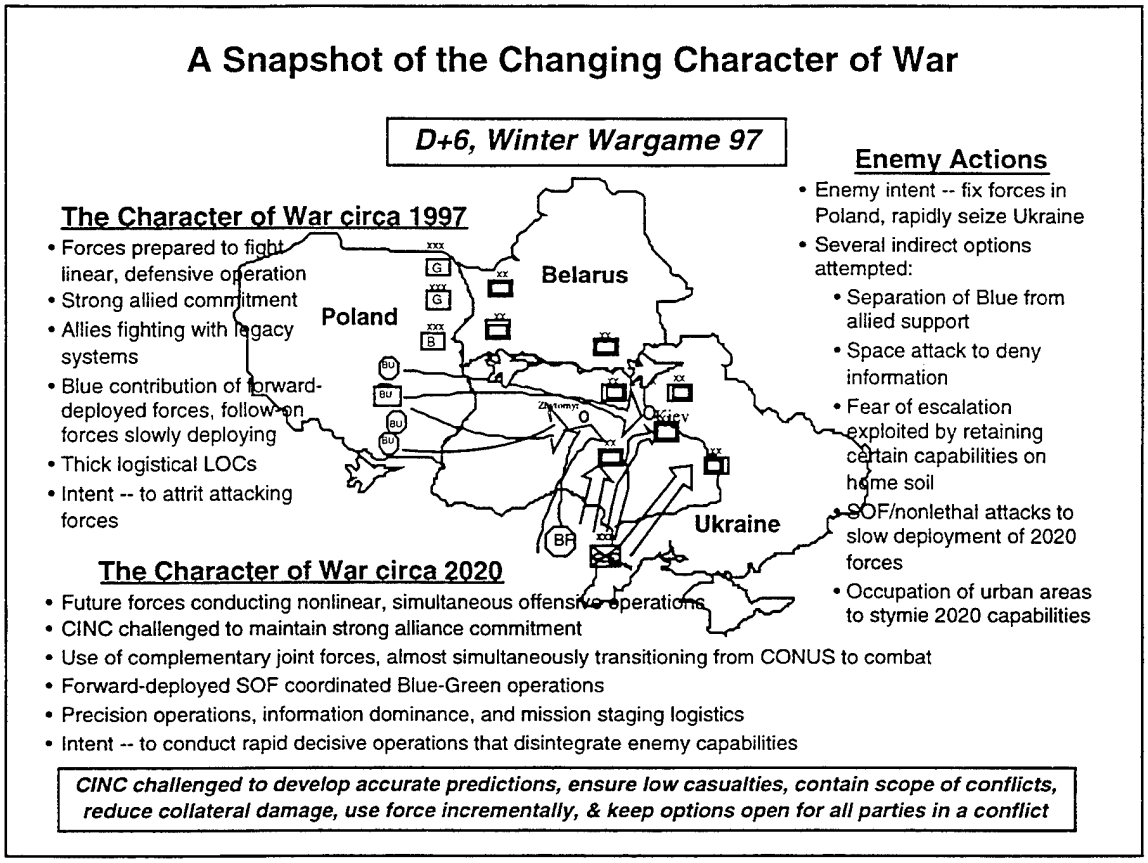
A: Winter Wargame Context

B: Winter Wargame History

"The nature of warfare does not change ... It is, and always has been, organized violence conducted for political ends ... If warfare, however, has a constant nature, it has a continually changing character, always producing new forms."
– Colin S. Gray, "The Changing Nature of Warfare?", Naval War College Review, Spring 1996

This final section highlights the changing character of war, through a series of summary views: a snapshot in time of operations in the West theater at the WWG; a side by side characterization of today and 2020, across the nine categories of change; emerging implications for land warfare, again within the issue categories; and finally, a recapitulation of the key issues raised in the previous section. Colin Gray's assertions regarding the nature and character of warfare underscore the theme of this analysis and the central evidence of the WWG in this closing section. This theme, prevalent throughout this report, was recently echoed by the Commander, US Marine Corps Combat Development Command: "The nature of war has not changed. It will not change. It is a bloody, dangerous business conducted on a chaotic, uncertain, ambiguous battlefield. It is a violent clash of wills. What is changing is the character and form of war."[31]1

[31] Lt. Gen. Paul K. VanRiper, "Viewpoint, "*Aviation Week and Space Technology*, April 28, 1997.



This snapshot of the situation in the West theater at D+6 of the WWG illuminates the changing character of war, yet serves as a clear reminder that legacies will continue to challenge interoperability from many directions.

In Poland, we saw an extension of today's warfighting characteristics: a linear defense, in conjunction with our less modernized but fully committed allies, honoring NATO responsibilities. Forward-deployed forces provided the initial defense capability, with follow-on forces on the move but hampered by deployability constraints. Forces were dependent on a cumbersome logistical lifeline as they prepared to attrit any attacking enemy units.

Operations in Ukraine, however, provided a glimpse into the future: a warfighting approach using the defeat mechanism of disintegration, unconstrained by linearity and sequence of operations. Unlike our strong historical commitment with NATO nations, though, the situation in Ukraine did not evoke the same allied response as the potential defense of Poland, and the CINC was challenged to put together an effective coalition. Our own very capable joint forces provided a potent response force, able to deploy from CONUS and rapidly transition to combat, aided by forward-deployed SOF units working with Ukrainian forces. Blue 2020 force capabilities were characterized by precision operations, in lethality, maneuver, information, and logistics, enabling the tactical and operational disintegration of Red capabilities.

Red utilized a range of asymmetric actions, from political through tactical level, to attempt to counter Blue capabilities. At the political level, Red worked diligently to portray Blue as the outside aggressor in Ukraine and to undermine the commitment of other Green nations to this effort. At the strategic level, Red conducted a preemptive strike in space, hoping to diminish or negate Blue's information advantage. Red also exploited Blue's reluctance to escalate hostilities by retaining key strategic assets within its borders, including space support and command and control facilities. Operationally focused attacks by SOF units, particularly nonlethal attacks on port facilities and other transportation nodes, were aimed at slowing the arrival of follow-on forces and neutralizing their ability to affect operational outcomes. Finally, in tactical operations, Red attempted to frustrate Blue's highly mobile forces by occupying urban and built-up areas.

Throughout operations, the Blue CINC West faced incredible challenges: to develop accurate predictions despite the loss of satellite support; to ensure low casualties, a limited scope of conflict, and minimum collateral damage on a battlefield that spanned the sub-surface to space continuum and included the most destructive and lethal weapons imaginable; to use force incrementally, yet finish decisively; and to leave acceptable options open for all parties in the conflict, a demanding task even without the influences of war.

The final slides extend this snapshot into a contrast across the issue dimensions, an assessment of the implications for land warfare, and a review of recommended issues for further analysis.

Contrasts in the Character of War

	Today	*2020*
Force stationing	Selective forward presence required, with most forces CONUS-based but slower to respond	Balanced global presence more readily achieved with well-positioned forward presence and rapidly deployable CONUS-based forces
Partnerships	Traditional alliances based on security issues	Global partnerships based on increased economic, social, and political interconnectivity
Deterrence	Military power provides force option of coercive diplomacy	Deterrence options may include IO, space, nonlethal, nontraditional alternatives
Escalation	Current capabilities tend to dampen escalation	Future capabilities and asymmetric responses may prompt escalation
Space	Literacy a problem, capabilities and vulnerabilities emerging and not well understood	Space may become an integral part of future warfare, complementing air, land, and sea forces
IO	Emerging vulnerabilities, operations integration largely misunderstood	Information dominance, generated by a cohesive, integrated IO campaign, enables 2020 forces
Decisive use of decisive force	Linear joint operations, terrestrially focused, logistically constrained, designed to attrit or control enemy forces	Nonlinear, simultaneous operations using complementary joint capabilities in sub-surface to space continuum with multi-tiered missile defense and focused logistics, designed to disintegrate enemy capabilities
Roles of ground forces	Reassure, deter, compel, but ground forces constrained by stationing, mobility and logistics	Self deployable, strategically mobile, logistically unconstrained ground forces relevant at strategic, operational, and tactical levels
Decisionmaking	Good understanding of impacts of constraints on operations and decisionmaking processes	Potential increase in operational tempo may time outpace political decisionmaking; proactive decisionmakers will influence outcomes

Stepping up from this WWG snapshot to a more aggregate view of war in 2020, we offer contrasts between the current and future character of war across the nine issue categories, from force stationing through decision making.

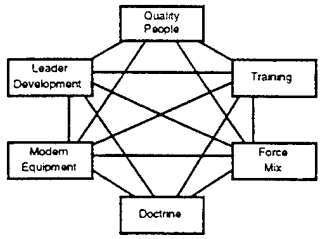
The fiscal and political constraints of forward presence may still apply in 2020, but a more effective and responsive global presence can be achieved with astutely-placed forward forces balanced with rapidly deployable forces from CONUS. The scope of activities in peacetime will reflect the increasing complexity of our partnerships and alliances. Those forward-based forces, perhaps smaller in number, will be involved in a wide range of activities to reassure partners, develop solid relationships, serve as global scouts, and as necessary, conduct missions in deterrence, transition to combat, and warfighting operations. Military deterrence options, anchored today in 'show-of-force' activities, could be expanded to include a wide variety of potentially effective actions using IO, space, and other nontraditional means.

With the onset of hostilities, escalation may be difficult to control; while current capabilities in the nuclear realm tend to dampen escalatory actions, the enhanced capabilities of conventional forces may prompt an enemy to look for any early means to negate those capabilities. Those escalatory actions could be directed against traditional force capabilities, or against new dimensions, such as space and IO capabilities. These two domains, poorly understood today, will become important enablers of decisive joint

operations. In today's world, joint force operations are still linear in nature, with significant logistical challenges and a focus on attrition or control. Force capabilities in 2020 will transform the character of the defeat mechanism from attrition to disintegration, using interdependent air, land, and sea forces. Ground forces will become more relevant in strategic operations as tethers that constrain them (heavy strategic transport, organic mobility tied to ground vehicles, and logistical support requirements) are loosened.

Intellectual agility in decision making across the missions of reassure, deter and compel will distinguish the most influential political and military leaders in 2020. The pace of conflict may not tolerate indecision.

Emerging Implications for Land Warfare



- *Forward-stationed* forces may have more varied responsibilities; forces must be capable of strategic preemption
- *Alliances and partnerships* can provide logistics support; IO linkages through points of connectivity; and a host of other complementary capabilities to create an effective combined force
- Ground forces may provide more effective *deterrent* options if capable of rapid extraction
- Redundant systems should be in place to provide focused view of theater; UAVs/SOF are especially appropriate to augment *space* capabilities; traditional focus on delivery of space products to warfighter may be broadened
- *IO*'s role in achieving information dominance must be explored in integrated, rather than piecemeal, approaches
- To exploit precision fires and information, *decisive ground forces* should have:
  - Capability for operational movement over strategic distances
  - Focused logistics (which require further examination)
  - Ability to anticipate and plan for asymmetric responses or indirect approaches
- Uncertainty and time constraints of operations have several *decisionmaking* implications:
  - Deployment triggers will hinge on timely decisions
  - Indications and warnings in 2020 may be new or different and must be quickly recognized and understood
  - Reserve Component's roles and missions should be revisited
  - Little time available to build alliances, develop host nation support in new regions
  - Military operations may be constrained by the tempo of diplomatic actions

As the CSA recently indicated, "...change is nothing new....I want to assure you that as we continue along the path of change the six imperatives will remain our strong link to the past." These six Army imperatives—doctrine, training, leader development, force mix, modern equipment, and quality people—should help guide our transition to the Army After Next. From the first annual WWG event emerged implications for land warfare that should be considered as we move forward in the combat, materiel, and training development domains. The linkages of two of these implications to the Army imperatives are illustrated below.

Requirements for decisive ground forces were clearly demonstrated in the WWG, and the implications for change reach broadly across the imperatives. Technological research must provide equipment and systems which enable strategic preemption, including options such as air mechanization to provide self deployability to theater as well as greatly enhanced tactical mobility within an area of operations. Doctrinal innovations in logistics, such as the notion of mission staging, will further serve to amplify the flexibility of ground forces. Because no force can accomplish all missions across the spectrum of conflict, a mix of force capabilities must be developed; while this general requirement is no different than today, the variety of possible partners, the diversity of capabilities, and the potentially greater magnitude of technological gaps will create a tremendous integration challenge. Preparing soldiers and units to execute warfighting operations that cause disintegration of enemy capabilities will place

stringent demands on the Army's training system; for example, what is the 2020 equivalent of the National Training Center that ensures our ground forces remain trained and ready? Among key features of future warfare is the notion that "conflicts will erupt at short notice. In the future there will be a low probability of a short warning major conflict, but a high probability of a short warning small conflict."[32] Training methods must support rapid reaction; accession standards must be designed to provide adaptable, innovative, quality people to operate in this environment. Finally, leaders must be able to assess potential enemy vulnerabilities and create options to achieve decisive effects while anticipating enemy actions or responses that may not fall within historically established rules of warfare.

One of the striking differences regarding future warfare is that it will be "about time, not ground."[33] The uncertainty and time constraints evidenced in the WWG suggested strongly that future leaders and quality Army people must all be more intellectually agile than ever before and correspondingly broad in their outlook to meet global challenges. Modern equipment and doctrine of the information age must provide for rapidly discernible indications and warnings. Because of the potential short duration of these 'short notice' conflicts, the future roles and mission of our reserve component need to be examined. There may be a dramatically different active/reserve force mix in the future Army. We will have little time to prepare regions for basing of operations; host nation support may be required in several regions of heightening interest around the world. Our doctrine must conform to this realization and our training must prepare us for this eventuality. Finally, diplomatic actions will continue to affect military operations in the future; this must be understood and anticipated by Army leaders who have been prepared throughout their careers by our training system to lead in a multipolar, global world.

Within any of the implications for land warfare, there is clearly no single driving imperative, nor is there necessarily a sequence to new developments. As indicated in our opening comments, war is a nonlinear phenomenon, and the relationships among the imperatives are also complex and nonlinear. We believe these implications and linkages are relevant for the geostrategic possibility represented by the WWG; however, we must recognize that there are yet other plausible futures on the spectrum which might lead to other implications or effects on the imperatives as the AAN process continues.

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[32] J. Mohan Malik," The Sources and Nature of Future Conflicts in the Asia-Pacific Region," *Comparative Strategy,* Volume 16, 1997.

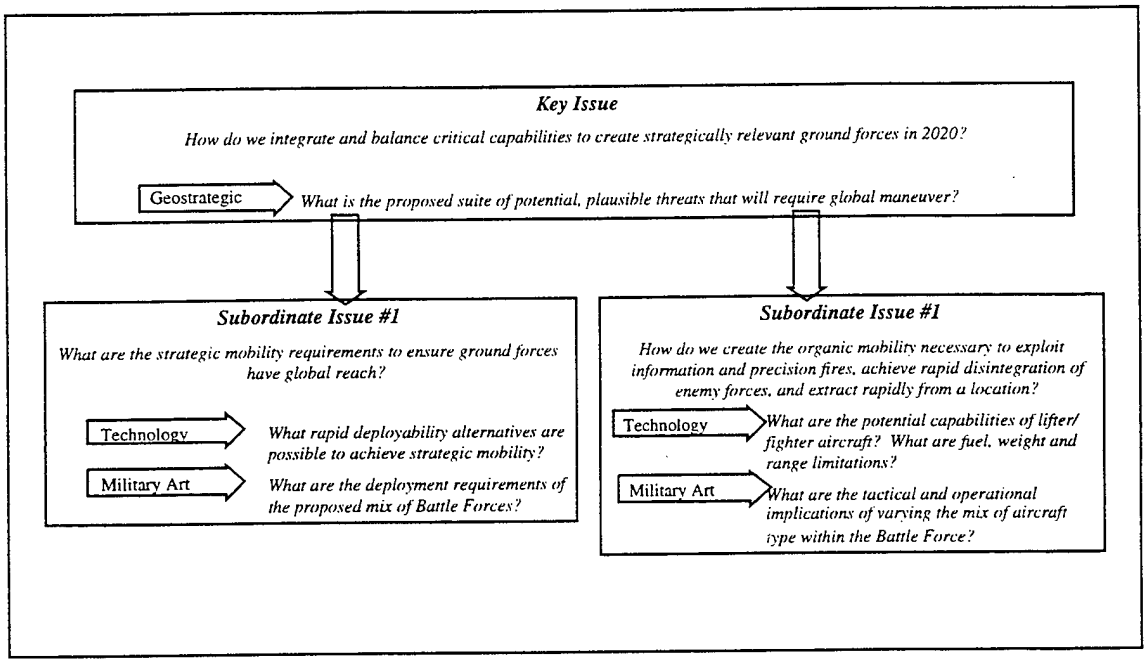
[33] J. Mohan Malik, "The Sources and Nature of Future Conflicts in the Asia-Pacific Region," *Comparative Strategy,* Volume 16, 1997.

Key Issues in Evolution to the Future

- How can overseas presence and power projection be balanced in a *force stationing* strategy that sets the stage for global maneuver?
- What new challenges will be posed by increased global economic, military, and social interconnectivity in establishing and maintaining alliances, *partnerships* and global collective security arrangements?
- How can nontraditional *deterrent* measures be integrated with traditional ones to create powerful and persuasive deterrent options in 2020?
- When is it more advantageous to *escalate* or even strike first? How do we recognize those circumstances and take action?
- How will the dimension of *space* be integrated into future warfare? How will space capabilities in 2020 complement land, air and sea forces?
- How do we integrate the spectrum of information capabilities into a cohesive *IO* campaign that creates the desired level of information dominance?
- A smart enemy will not challenge the strengths of our *decisive forces* head-on, but may turn them against us; what are our vulnerabilities and how can we protect them against asymmetric or indirect actions?
- How do we integrate and balance critical capabilities to create strategically relevant *ground forces* in 2020?
- What information, policies, directives, and authorities are needed to facilitate *decisionmaking* in time-constrained scenarios?

In review, the most critical issues raised as a result of analysis of the WWG are provided here. As discussed earlier, these are the issues that we believe capture the essence of the important changes in warfare in 2020, within the missions to reassure, deter, and compel. These issues are offered as WWG input to the AAN June CSA Report. They also serve as a benchmark for future games; it will be interesting to note whether these issues come to the forefront in the next WWG with a different mix of players.

The AAN project is focused broadly on four axes of the future: geostrategic setting, technology, military art, and human and organizational behavior. Consider the following notional example that indicates how these recommended issues might link to the axes, and suggests specific study efforts that might be undertaken within those axes.



We suggest that the nine study issues shown here, and their relevant subordinate components, be considered in the development of annual program objectives, weaving them into the analysis effort for future AAN cycles where appropriate.

REFERENCES

1996 Summer Study Task Force, Defense Science Board. *Tactics and Technology for 21st Century Military Superiority.* Washington, DC: Office of the Secretary of Defense, October 1996.

Belenky, Gregory. Ed. *Contemporary Studies in Combat Psychiatry.* New York: Greenwood Press, 1987.

_____. *Sleep, Sleep Deprivation, and Human Performance in Continuous Operations.* Washington, DC: Dept. of Military Psychiatry, Walter Reed Army Institute of Research, 1997.

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security* (Winter 1992/93): 82-90.

Biddle, Stephen. "Victory Misunderstood: What the Gulf War Tells Us about the Future of Conflict." *International Security* 21, No. 2, (1996): 139-179.

Bracken, Paul. "The Military After Next." *The Washington Quarterly* 16, No. 4, (1993): 157-74.

Chang, Ike. *New Sources of Revenue via Other Transactions: An Application to Army R&D.* Santa Monica, Ca.: RAND Research Study, March 1997.

Clausewitz, Carl von. *On War,* Ed. and Trans. by Michael Howard and Peter Paret. Princeton: Princeton University Press, 1976.

Combined Arms Support Command. *Revolution in Military Logistics Campaign Plan—The Way Ahead.* Draft. Fort Lee, Virginia, 1997.

Creveld, Martin van. *Command in War.* Cambridge, Mass: Harvard University Press, 1985.

_____. *Technology and War: From 2000 B.C. to the Present.* New York: The Free Press, 1991.

Dubik, James M. and Gordon R. Sullivan. "War in the Information Age." *Military Review* 74, No. 4, (April 1994): 46-62.

DuPicq, A. *Battle Studies* <1846>. Reprint, Harrisburg, Pa: Stackpole Books, 1958.

Ericsson, K. Anders and Neil Charness. "Expert Performance: Its Structure and Acquisition." *American Psychologist* 49, No. 8, (1994):725-47.

Fuel-Efficient Task Group, Army After Next. *White Paper: Fuel-Efficient Army After Next.* Dated, 10 March 1997.

Fukuyama, Francis and Abe Shulsky. *The "Virtual Corporation" and Army Organization, Final Draft.* Santa Monica, California: RAND, 1997.

Gabriel, Richard A. and Paul L. Savage. *Crisis in Command. Mismanagement in the Army.* New York: Hill and Wang, 1978.

Gal, Reuven. "Courage Under Stress." in S. Brenitz, Ed., *Stress in Israel.* New York: Van Nostrand Reinhold, 1983.

Galing, LTC Steve. *Making Better Use of Army Assets: Generating Revenue.* RAND Research Study. Arroyo Center, March 1997.

Gray, Colin S. "The Changing Nature of Warfare?" *Naval War College Review* (Spring 1996): 7-22.

Hanson, Frederick R. *Psychological Factors of Adaptation in Combat.* Washington, DC: Department of Defense Research and Development Board, June 1951.

Hayes, John R. *The Complete Problem Solver, 2nd Ed.* Hillsdale, New Jersey: 1989.

Huntington, Samuel P. *The Soldier and the State. The Theory and Politics of Civil-Military Relations.* Cambridge, MA: Belknap Press, 1967.

Jones, Franklin D. Et. al. *Military Psychiatry, Part I: Warfare, Weapons, and the Casualty.* Falls Church, Virginia: Office of the Surgeon General, United States Army, 1995.

Keegan, John. *The Face of Battle.* London: Jonathan Cape, 1976.

Kellet, A. *Combat Motivation.* Boston: Kluwer-Nijhoff, 1982.

Kirkland, Fairs R. "Assessing COHORT." *Army* 40, No. 5, (1990): 44-50.

_____. Et al. "Human Dimensions in Force Projection: Discipline Under Fire." *Military Review* 76, No. 2, (1996): 57-64.

Klein, Gary A. and Caroline E. Zsambok. Eds. *Naturalistic Decision Making in Command and Control.* Mahwah, New Jersey: 1997.

Lazarus, Richard S. and Susan Folkman. *Stress, Appraisal, and Coping.* New York: Springer, 1984.

Marlowe, David H. *Cohesion, Anticipated Breakdown, and Endurance in Battle: Considerations for Severe and High Intensity Combat.* Washington, DC: Dept. of Military Psychiatry, Walter Reed Army Institute of Research, 1979.

_____. Ed. *New Manning System Field Evaluation, Technical Report Nos. 1-5.* Washington, DC: Walter Reed Army Institute of Research, Department of Military Psychiatry, 1985-87.

Marshall, S.L.A. *Men Against Fire.* New York: William Morrow, 1947.

Martin, James A. Et al. Eds. *The Gulf War and Mental Health.* New York: Praeger, 1996.

Mastaglio, Thomas W. and Robert Callahan. "A Large-Scale Complex Virtual Environment for Team Training." *Computer* (July 1995): 49-56.

_____. and Thomas R. Rozman. "Expanding Training Horizons." *Army* 44, No. 2, (1994): 38-42.

National Research Council. *Enhancing Organizational Performance.* Washington, DC: National Academy Press, 1997.

Rachman, Stanley J. *Fear and Courage.* San Francisco: W. H. Freeman and Company, 1978.

Rowland, David. "The Application of Historical Analysis to Measure the Effects of Battlefield Stress on Performance in Combat." *Journal of Defence Science* 1, No. 1, (1996): 107-112.

Sarkesian, Sam. Ed. *Combat Effectiveness: Cohesion, Stress, and the Volunteer Military.* Beverly Hills: Sage, 1980.

Scales, Robert H., Jr. *Firepower in Limited War.* Novato, California: Presidio Press, 1995.

_____. "Cycles of War and Information Age Warfare: The Essence of the Army After Next Project." *Armed Forces Journal International.* Forthcoming.

Sinnreich, Richard Hart. "To Stand And Fight." *Army,* Forthcoming, 1997.

Tiger, Lionel. *Optimism: The Biology of Hope.* New York: Simon and Schuster, 1979.

United States, Department of the Army. *TRADOC Pamphlet 525-5: Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century.* Fort Monroe, Va.: Headquarters, US Army Training and Doctrine Command, 1 August 1994.

US Army, Deputy Chief of Staff for Doctrine. *Technology Workshop Report.* Fort Monroe, Va.: Headquarters, US Army Training and Doctrine Command, 17 April 1997.

Van Riper, Paul LTG, USMC and MG Robert Scales, USA. "Preparing for War in the 21st Century." *Strategic Review.* Forthcoming.

Watts, Barry D. *Clausewitzian Friction and War. McNair Paper* 52. Washington, DC: Institute for National Strategic Studies, National Defense University, 1996.

Yukl, Gary, Robert Morrison and Brian Hall. *Effective Military Leadership in Combat and Non-Combat Situations.* Washington, DC: Army Research Institute for the Behavioral and Social Sciences, 1994.