

FIVE-DIMENSIONAL (CYBER) WARFIGHTING:
CAN THE ARMY AFTER NEXT BE DEFEATED
THROUGH COMPLEX CONCEPTS
AND TECHNOLOGIES?

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March 10, 1998

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The author would like to thank Dr. Stephen Sloan, Mr. John Dering, Lieutenant Colonel Matt Begert, Major Larry Richards, Chief Warrant Officer Charles "Sid" Heal, and Deputy John Sullivan for their valuable comments on an earlier draft of this study. Interpretations and opinions remain the author's responsibility.

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This monograph was originally presented at the U.S. Army War College's Annual Strategy Conference held March 31-April 2, 1998. The Strategic Studies Institute is pleased to publish the paper as part of its Conference Series.

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FOREWORD

The theme for the U.S. Army War College's Ninth Annual Strategy Conference (April 1998) is "Challenging the United States Symmetrically and Asymmetrically: Can America Be Defeated?"

In this paper from the conference, Dr. Robert J. Bunker of California State University, San Bernardino, answers the question with an emphatic "yes." He expounds a scenario in which a future enemy (BlackFor) concedes that the U.S. Army's (BlueFor) superior technology, advanced weaponry, and proven record of success in recent military operations make it virtually invulnerable to conventional forms of symmetric attack. Therefore, BlackFor seeks asymmetric ways to obviate BlueFor's advantages.

BlackFor devises a five-dimensional, holistic approach to warfare that uses the three dimensions of land, sea, and aerospace but also incorporates the temporal and cyber dimensions of warfare. This approach to warfare exploits BlueFor's weaknesses while maximizing BlackFor's limited areas of technological capability. Dr. Bunker's scenario frontally assaults some of the premises he sees emerging from the Army After Next Project. It posits not a new peer competitor for the United States, but a new type of enemy for which, in Dr. Bunker's view, we will be ill-prepared, given our likely force development azimuths over the next two decades.

It may be tempting to dismiss the possibility of an enemy possessing all the capabilities Dr. Bunker describes. Nonetheless, his paper points to potential changes in warfare that, even partially effected, must absorb our Army's professional attention as we address the challenges of the next century.

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BIOGRAPHICAL SKETCH OF THE AUTHOR

ROBERT J. BUNKER attended California State Polytechnic University, Pomona and the Claremont Graduate University. He holds a Ph.D. in political science and an M.A. in government and bachelors' degrees in anthropology/geography, social science, behavioral science, and history. Dr. Bunker is Adjunct Professor, National Security Studies Program, California State University, San Bernardino, and Professor, Unconventional Warfare, American Military University, Manassas Park, Virginia. He has served as a consultant to both the military and law enforcement communities. His research focus is on the influence of technology on warfare and political organization and on the national security implications of emerging forms of warfare. Dr. Bunker's works have appeared in *Parameters*, *Special Warfare*, *Army RDA*, *Military Intelligence*, *Red Thrust Star*, *Airpower Journal*, *Marine Corps Gazette*, *Institute of Land Warfare Papers*, *Institute For National Security Studies Occasional Papers*, and various law enforcement publications, military encyclopedias, and in book chapters.

FIVE-DIMENSIONAL (CYBER) WARFIGHTING: CAN THE ARMY AFTER NEXT BE DEFEATED THROUGH COMPLEX CONCEPTS AND TECHNOLOGIES?

With the end of the Cold War, U.S. national security perceptions concerning “Who is the threat?” have been thrown into free fall along with those governmental and military institutions meant to contend with it. Resulting from the spreading chaos and ambiguity in the nation-state system, which stem from the simultaneous processes of fragmentation and regionalization, a new question now needs to be asked—“What is the threat?”

Increasingly, national security experts have argued that gray area phenomena, “. . . where control has shifted from legitimate governments to new half-political, half-criminal powers,” will become the dominant threat.¹ Such entities flourish in the growing failed-state operational environment where a condition of “not war—not crime” prevails and nation-state forces operating within it find themselves facing a severe capability gap.² These entities disregard Western based “laws of war” and “rules of engagement” and are not concerned about such conventions as “legitimacy” or “public opinion.”

Of further significance is the recognition that we are beginning the transition from the modern to the post-modern epoch in Western civilization. Past periods of transition such as this have historically witnessed the two collinear trends of the blurring of crime and war, along with shifts in social classes, economic modes, and motive sources which ultimately result in the fall of one civilization and its replacement by another more advanced one.³ During the earlier shift from the medieval to the modern epoch, three new forms of social and political organization developed—dynastic- (proto nation-) states, city-states, and

city-leagues—as competitors to the then dominant feudal structure,⁴ in tandem with the domination of the battlefield by the non-state soldier. Ultimately the early nation-state form and its mercenary armies won out over both these competitors and the preexisting civilization based upon Church, empire, and fief.

As the shift to the post-modern epoch becomes more pronounced, we can expect similar competitors to the nation-state form and our modern civilization to emerge along with the accompanying non-state soldier. One such projected warmaking entity, “Black,” and its advanced means of waging war will be discussed in this paper. It is based upon an organizational structure far different than the classical hierarchy to which we are accustomed. Rather, it is nonlinear in function, composed of informational paths analogous to webs and nets, and basic units characterized as nodes and free-floating cells.⁵ Such an organizational structure allows for the greater exploitation of post-mechanical energy sources, advanced technologies, and new warfighting concepts which will come to dominate what we will term “war” in the decades to come.

Warfighting Scenario.

The future isn't what it use to be!

Blue Sports Figure

The military forces of Black (BlackFor) will be engaged in a land warfare conflict with the army of Blue (BlueFor), which represents the Army After Next (AAN) in the 2020-2025 time frame. The basis of this engagement results from Black's sustained terrorist campaign directed against Blue's homeland. Black is a major military competitor who is hostile to the cultural and strategic interests of the United States and its allies.⁶ This competitor is not a nation-state. For that reason its existence is in variance with “the orthodox position within the Army and the Department of

Defense [which] holds that the strategic environment of 2020 will be much like that of 1997.”⁷

This competitor represents a new warmaking entity which can be considered both non- and post-Western in orientation. Its criminal and warmaking functions are intertwined as is its decisionmaking structure which is more networked than hierarchical. Black's geographic boundaries may or may not be contiguous, not all of its territories may be delineated, and some may reside within zones currently occupied by failed states.⁸ The common feature of Black's transnational territories is that they will likely include heavily urbanized coastal zones containing sprawling slums. (See Table 1.)

	1950	1990	2015
“Million Cities”	50	270	516
“Megacities” [pop. > 8 million]	Worldwide: 2 Developing World: 0	Worldwide: 21 Developing World: 16	Worldwide: 33 Developing World: 27
Reprinted from Marine Corps Combat Development Command, “A Concept for Future Military Operations on Urbanized Terrain,” <i>Marine Corps Gazette</i> , Insert, Vol. 81, No. 10, October 1997, p. A-1.			

Table 1. Trends in Urbanization.

Black is in competition with the Westphalian nation-state form, and its potential regional successor(s), over the world's future social and political organization.⁹ By American standards, this new “network- or cyber-state” is both illegitimate and criminal. Black is highly entrepreneurial in nature, not ethically constrained in its conduct of war, and relies heavily on the “new warrior class” for its military recruits.¹⁰ More than one military scholar has referred to this entity as a “confederation of high-tech criminals and barbarians.”

The decisive American military victory in the Gulf War in 1991 and its ensuing Revolution in Military Affairs (RMA) have not been lost on the senior leadership of Black.

Having successfully built upon the Force XXI and Army XXI programs, BlueFor is viewed as the world's dominant land power force. Black leaders have long considered any symmetrical attempt at taking on BlueFor to be suicidal.¹¹ Conventional Black forces which would move in the “n-by-n” mile battlespace box dominated by BlueFor and its sister services would be sensed, fixed in time and space, and destroyed or neutralized by precision guided strikes and fires.¹²

As an outcome, Black leaders have had no alternative but to accept that BlueFor cannot now nor can they in the future ever be defeated on the battlefield as it is currently defined. This conclusion persists despite those asymmetric responses to BlueFor's firepower and information dominance discovered at the FY 97 Leavenworth Games.¹³ To concede that BlueFor was the dominant land power force would forever marginalize BlackFor, something which the leadership of Black would never accept. Instead, its leaders looked to the new complex concepts and technologies which were developing to overcome BlueFor battlefield dominance. Ultimately, they allowed BlackFor to redefine the battlefield to its own advantage and purposefully restructure its military forces around new concepts of operation (CONOPS). These new CONOPS are known as five-dimensional (cyber) warfighting.

Scientific Assumptions.

It is better to ask the right questions and get the wrong answers than to ask the wrong questions and get the right answers.

Black Chief Science Advisor

To understand the assumptions behind five-dimensional warfighting, a short overview of the influence of science on the evolution of technology and warfare is required. This provides Black leadership with a baseline of change allowing it to forecast the “. . . major long-term shifts rather

than small, incremental, linear steps derived directly from current events.”¹⁴

Black's basic assumption is that battlespace, as it is currently defined, represents a three-dimensional box modified by the dimension of time (the fourth-dimension).¹⁵ BlueFor is said to “rule the cube.” Western history suggests that battlespace was not always four-dimensional. In fact, the medieval battlefield was three-dimensional in nature—composed of two spatial dimensions and a temporal one. This was the case because science in the Middle Ages was very backward by modern standards.¹⁶

The art of medieval warfighting represented an extension of this primitive science. It was conducted by armored noblemen on horseback wielding lance and sword supported by their retainers. Stone-walled castles provided an all but impenetrable vertical defense against armies lacking the proper equipment and logistical stamina to overcome high walls or conduct a long-term siege. Still, these scientific and warfighting views were adequate for the needs of a three-dimensionally based civilization founded on animal motive sources. As long as similar “armies” with like technologies and operational concepts fought each other on the battlefields of Europe, medieval civilization flourished.

The lesson learned by Black is that this earlier civilization eventually came crashing down at the hands of those who employed advanced warfighting methods.¹⁷ The firearm and cannon, which exploited four-dimensional space for warfighting purposes, were weapons against which the knight and the castle were defenseless. Further, they provided a standoff capability which allowed the user to remain “off the battlefield” of the earlier weapons system and fortification form. This change from medieval to modern battlespace can be viewed in Figure 1.¹⁸ It provides a comparison between the knight and the new threat force based upon the mercenary.

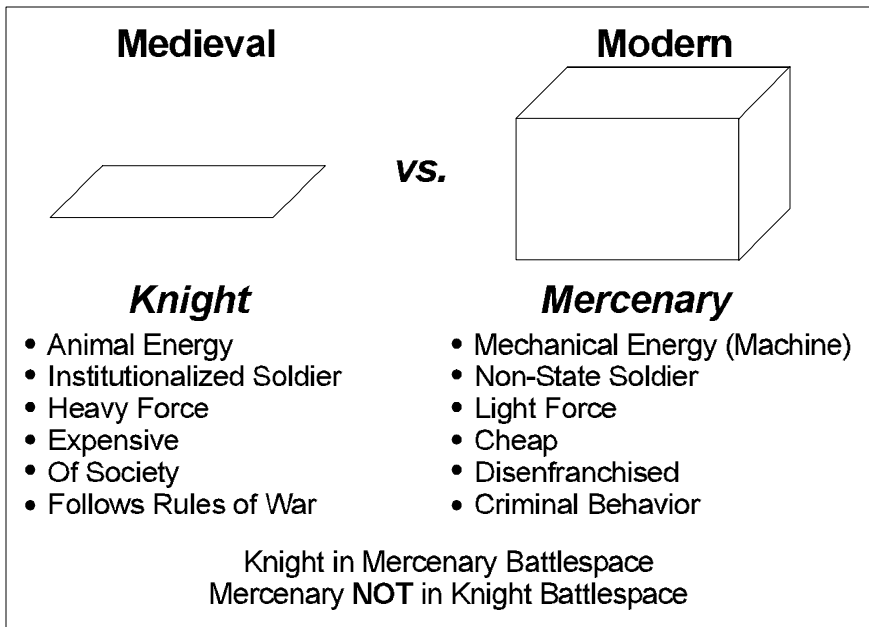


Figure 1. Medieval to Modern Battlespace.

Medieval civilization gave way to modern civilization founded on mechanical motive sources. This 500-year-old civilization of which Blue is the dominant state is, like its predecessor, based on its own level of science. In this instance, it is derived from four-dimensional thinking based upon Newtonian physics, linear dynamics, proportionality, synchronized processes, and reductionist principles. BlueFor warfighting techniques, while built upon highly refined mechanical forces (the Army XXI legacy), represent an extension of these centuries-old scientific principles.

Black's leadership was well aware that numerous scholars had argued that the world was in a transition between modern and post-modern civilization. Their own "renaissance state" was evidence of that fact with its emergent post-mechanical energy sources, webbed informational structure, knowledge based economy, and progressive views toward organ harvesting and cloning, drug use, sexual consent, neural implants, and bio-engineering. Shifts in scientific perceptions based on

quantum physics, nonlinear dynamics, and chaos and complexity theory further supported those perceptions. Using the shift from three-dimensional to four-dimensional warfighting as a baseline, Black's leadership projected that a similar transition was underway.¹⁹ If BlackFor could fully capitalize on this opportunity, it could make a quantum leap in military capability over BlueFor and defeat it. Black could then begin to establish its five-dimensionally-based civilization as the successor to the dimensionally inferior one belonging to the West.

Complex Concepts and Technologies.

While we based our military reorganization on change equivalent to the 1920s and 1930s, they looked to change on the scale of the Dark Ages and the Renaissance.

BlueFor Commander

Numerous forms of complex concepts and innovative technologies are emerging which challenge Newtonian views of war.²⁰ They can be found in such Blue works as the National Research Council's 1992-93 *STAR 21: Strategic Technologies for the Army of the Twenty-First Century* books, Brian Nichipourk and Carl Builder's 1995 *Information Technologies and the Future of Land Warfare*, and John Arquilla and David Ronfeldt's 1996 *The Advent of Netwar*.²¹ For Black's purposes, a few of the lesser explored forms will be examined to help facilitate its development of five-dimensional warfighting capabilities: advanced battlespace concepts, advanced non-lethal weapons, chaos and complexity theory, and robotics platforms and machine soldiers.²²

Advanced Battlespace. The basic theoretical outline of advanced, or five-dimensional, battlespace was provided in a BlueFor War College journal article.²³ It will suffice to say that it fuses the traditional three-dimensional battlespace cube (i.e., humanspace) and time (a fourth dimensional attribute) with the addition of a fifth-dimensional

battlespace overlay which exists beyond the range of human senses (i.e., cyberspace). (See Figure 2.)

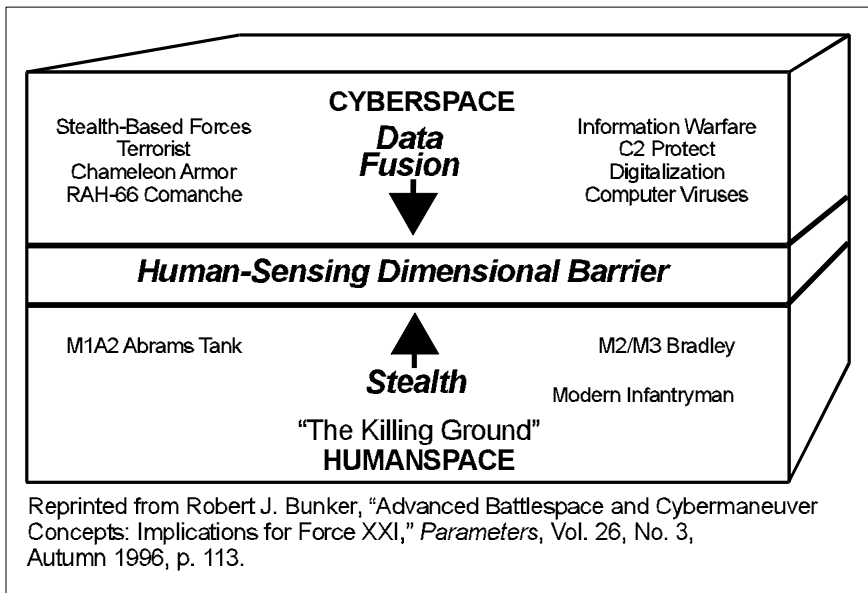


Figure 2. Spatial Premises of Advanced Battlespace.

The basic utility of this advanced form of battlespace is that it allows the physical limitations of four-dimensional space to be overcome for warfighting purposes. The cyber-dimension thus allows the potential for the barriers of time and space to be literally dissolved.²⁴ The massive warfighting advantage this represents can begin to be understood by concepts of spatial warping and dimensional shifting.²⁵ Spatial warping overcomes the limitations of physical range for both defensive and offensive purposes. Both spatial contraction and expansion principles can be used to warp four-dimensional space (see Figure 3). Spatial contraction takes two distant points in time and space and brings them together. This principle provides the underlying basis of telemedicine. A military doctor separated by thousands of kilometers from a wounded Blue soldier is able to directly interact with that soldier and, if

need be, conduct surgery. Spatial expansion takes two immediate points in time and space and distances them from one another. The principle can be understood by thinking about a Black warrior in civilian garb. This combatant can be standing five meters from a Blue soldier but, for all intents and purposes, could be standing thousands of kilometers away because he or she has exited four-dimensional battlespace *via* stealth-masking.

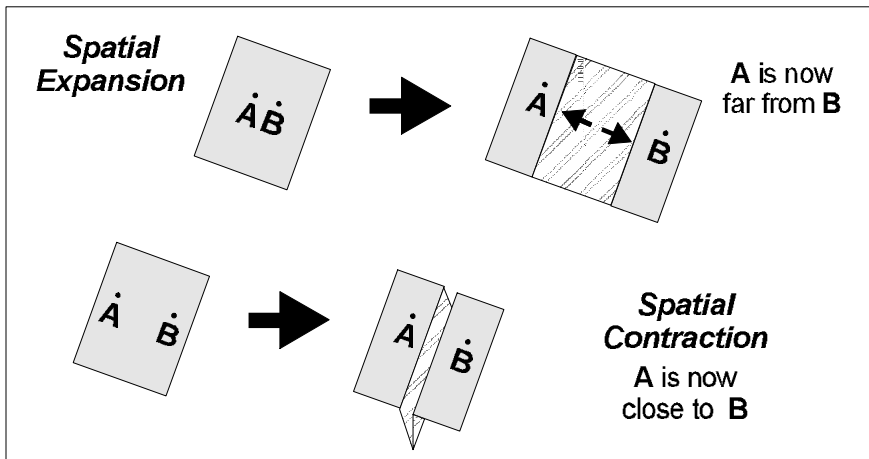


Figure 3. Spatial Warping of Modern Battlespace.

Dimensional shifting overcomes the limitations of physical structures for defensive and offensive purposes. In this case, range and time are not the considerations, but four-dimensionality itself. Body and vehicular armor and hardened hangers, underground bunkers, and command posts stop the penetrative and blast effects of physical projectiles from causing damage. Their effectiveness can be calculated by modern scientific formulas based upon thickness and density. While a flak jacket may stop a grenade fragment, it will do little against a 7.62mm rifle round. On the other hand, bullets and other projectiles are limited by the laws of ballistics and high velocity impact mechanics to that damage they can inflict to physical structures. Against the frontal armor of a Blue M1A2 Abrams, a conventionally fired small caliber round, like the

aforementioned 7.62mm, would have no effect because of its lack of penetrative capability.

A weapon with dimensionally shifted capabilities can overcome traditional defenses such as vehicular armor by passing through its physical seams and even its molecular bonds unimpeded. (See Figure 4.) By traveling through the structural matrix of the armor, it is thus able to avoid its defensive physical properties. On the other hand, a dimensionally shifted defense could be created by projecting a force shield around a physical object. This invisible field would not be able to affect a conventional projectile passing through it, however, that is not the intent. The field would be configured to dampen or negate dimensionally shifted attacks and those conventional weapons whose bonds and

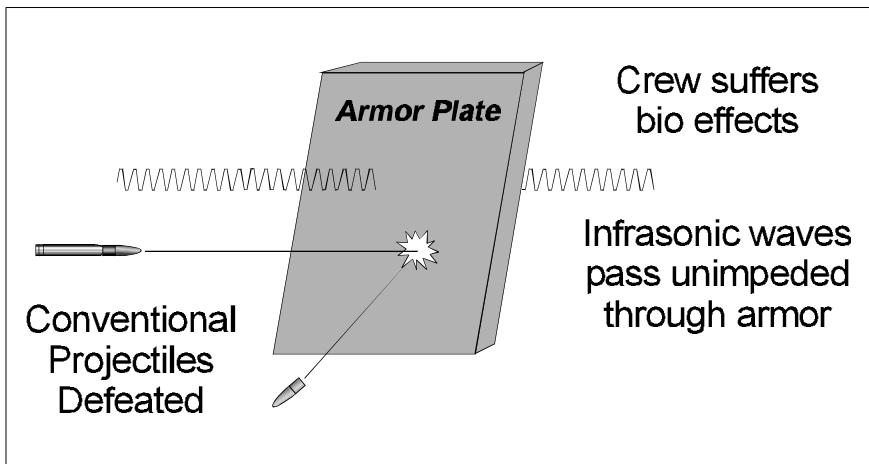


Figure 4. Dimensionally Shifted Attack through Vehicular Armor.

relationships based upon international systems and subsystems, such as electronic fuzing, can be influenced. An example of such field generation can be seen with the Shortstop system deployed to Bosnia.²⁶ While weapons with dimensional shifting, and in some cases spatial warping, capabilities would appear to be the stuff of science fiction, they are not. Some can already be purchased on the

international arms market or be constructed from electronics parts sold at commercial retailers.²⁷

Advanced Non-Lethal Weapons. Since the 1960s, over 600 documents have been published on non-lethal weapons.²⁸ Most of these weapons operate conventionally. Examples include flash-bang and sting-ball grenades, batons, net-guns, caltrops, sticky and aqueous foams, rubber and wooden bullets, ring-airfoil and sponge projectiles, and riot-control agents. Based upon past experience with these lower tier weapons in Somalia, one Blue military officer stated:

Non-lethal weapons do not provide a new element of national power, as some have suggested. They are merely an extension of military force to fill the gap between warnings and deadly force.²⁹

While technically correct regarding the weapons actually employed in Somalia, this generalization applied to all non-lethal weapons would be inaccurate. An upper tier of these weapons also exists which includes electromagnetic and directed energy weapons such as radio frequency weapons (RFW), high power microwave (HPM), lasers, optical munitions, acoustics, and biodeteriorating organisms, vortexes, and computer programs. These advanced weapons are at odds with the Blue conventional military paradigm based on four-dimensional thinking. They don't shoot physical projectiles or rely upon penetration, fragmentation, or blast effects to achieve their results. In many applications they are not intended to even kill people or destroy objects but disable or disrupt them instead. Further, their elevated energy power sources and force projection mechanism requirements are, for the most part, post-mechanical in nature. Because of the alien characteristics of these weapons, the potential they offer is often misunderstood by Blue military officers and the institutions to which they belong:

... The last thing the military needs at this point is a family of weapons that has only limited tactical use in operations other than war and offers no clear advantage over other nonlethal methods.³⁰

For five-dimensional warfighting requirements, however, advanced non-lethal weapons are integral. Their utility in offering tailored politico-military force to the situation at hand has already been widely recognized. This allows a military unit to selectively engage up and down the force continuum as required. Still, it could be argued that gaining this new capability may represent more of a linear progression of modern force application, than a qualitative breakthrough in warfighting. As a result, the truly revolutionary aspect of these weapons may be their ability to operate in and influence five-dimensional battlespace and the synergy that capability offers with the application of tailored force.³¹

The warfighting advantages they possess can be expressed by their ability to engage in dimensionally shifted attacks. The most basic form of such an attack is bypassing a physical defense such as tank armor. An acoustic weapon based on infra-sound can travel great distances and easily penetrate most buildings and vehicles. The long wavelengths of such a very low frequency sound can create biophysical effects in a tank's crew ranging from nausea, loss of bowels, disorientation, vomiting, potential internal organ damage or even death.³² Another method of attack would be to fire a conventional round containing a pulsed electromagnetic warhead against a tank's armor. The warhead would detonate against the tank releasing a high energy burst of short duration which would energize it and thereby fry all of its electrical components. Low frequency electromagnetic field generators and warheads will also be critical for BlackFor as they will allow destruction of BlueFor electronics which are protected against electromagnetic pulse (EMP), conventional RFWs and HPM.³³

Another form of dimensionally shifted attack appears to offer the ability for bond/relationship targeting. The space between two points or a grouping of points is attacked rather than the points themselves. This target set can range from the bonds holding molecules together, to the space between human synapses, to an air gap of an engine, to electromagnetic pathways between communication nodes. One weapon example would be liquid metal embrittlement (LME) agents. Such agents alter the molecular structure of base metals or alloys.³⁴ A successful LME strike against the support columns of a bridge would conceivably make the structure collapse under its own weight. Another example would be the employment of cheap “acetylene Molotov cocktails” or rocket propelled grenades in urban terrain against armored fighting vehicles (AFVs). A one pound device would create an acetylene gas bubble seven feet in diameter which would be sucked into the air intake of a diesel engine that would cause the fuel in each cylinder to ignite prematurely, with enough force to break piston rods.³⁵ Further, the targeting of gaps is particularly evident in HPM and high power millimeter wave (HPMMW) weapons. Gaps and seams serve as the pathway by which intense electromagnetic (EM) fields enter into the interior and components of the target.

As an outcome of the dimensionally shifted nature of these weapons, the problem of environmental degradation is also overcome. Many of these weapons are devoid of physical and chemical elements or utilize ones which do not generate collateral damage to the environment, as in the case of lead and depleted uranium-based projectiles or conventional explosives. In a world where environmental security is at times becoming a dominant consideration, the value of such weaponry characteristics cannot be understated.

The spatial warping characteristic of upper tier non-lethal weapons can be readily viewed by using the example of a laser beam. Based upon the principle of spatial contraction, which seeks to take two points in time and

space and collapse them together, this beam travels between the two points at 186,000 miles per second. For all intents and purposes, it instantaneously leaves the muzzle of the shooter's weapon and reaches the designated target. The physical range, be it in meters or even kilometers, has no bearing on this compressed "time window" because the human senses operate outside of it.³⁶ Further, because light travels at absolute velocity there can be no advanced warning of an attack.

The physics involved are far different than those of a conventional kinetic-kill round whose speed in thousands of feet per second results in a time of flight which may, depending on the physical range, end up making it miss the target or, as in the case of a wire-guided anti-tank round, get the firer killed while waiting for the munition to impact it. This time differential advantage, gained from spatial warping, may ultimately provide post-mechanical forces the ability to respond to conventional attacks with anti-lethal means if their stealth-masking has been compromised. It also suggests that emerging scientific forms need to be explored to better understand the non-linear potential that five-dimensional warfighting offers.

Chaos and Complexity Theory. One such form of scientific inquiry appears to offer great utility in this regard. Since the mid-to-late 1980s, a growing body of Blue literature based on chaos and complexity theory has developed.³⁷ Terms such as spontaneous self-organization, adaptation, and upheavals at the edge of chaos have been used to describe this new science.³⁸ Much of the momentum behind it has been generated by the Santa Fe Institute with its internationally known staff and fellows.

The basis of this evolving science is post-Newtonian in orientation. This means:

... the arrangement of nature—life and its complications, such as warfare—is nonlinear. It defines activities in which inputs and outputs are not proportional; where phenomena are *unpredictable, but within bounds, self-organizing*; where

unpredictability frustrates planning; where solution as self-organization defeats control; and where a premium is placed on holistic, intuitive processes. It rewards those who excel in the calculus of bounds as the variable of management and command.³⁹

It is at variance with Newtonian concepts based on four-dimensional perceptions: proportionality, reductionist processes, and the absolute nature of space and time central to Newtonian thinking. These views have already found an ally with Blue's Marine Corps. Since 1994, this service has adopted ideas related to nonlinear dynamics and complexity theory as implicit assumptions underlying their maneuver warfare doctrine. In the 1997 edition of MCDP-1 *Warfighting*, these ideas are evident.⁴⁰ In addition, an argument has been made that recent air power concepts based on the Five Ring model, OODA loop, and parallel warfare rely upon ideas intrinsic to complexity.⁴¹ These ideas have also caught the attention of Blue's National Defense University which co-sponsored a symposium on *Complexity, Global Politics and National Security* in November 1996 with the RAND Corporation.⁴²

A few five-dimensional warfighting applications of this theory can already be recognized for their utility. The first two represent maneuver-based and target-based operational approaches which strive for the same outcome—the disruption of an opponent.

Synergistic Attack. This is an attack based on the nonlinear premise that a certain amount of input can provide a disproportionate amount of output. This represents the basic underlying assumption of maneuver warfare conducted by BlueFor's sister service the Marine Corps. In essence, "Rather than pursuing the cumulative destruction of every component in the enemy arsenal, the goal is to attack the enemy 'system'—to incapacitate the enemy *systematically*. Enemy components may remain untouched but cannot function as part of a cohesive whole."⁴³

This form of attack relies upon properly conducted attacks in time and space against enemy weaknesses, their physical and moral bonds/relationships, to create an increasingly deteriorating situation rather than mass materiel (e.g., four-dimensional) destruction based on attrition. It is considered inherently risky because of the four-dimensional exposure of attacking units with their open flanks but deemed worth the price of failure for the warfighting advantages gained.

Cross-System Effects. System targeting based on linkages between points, rather than the points themselves, offers a means to provide cross-system effects such as cascading breakdowns. Engineering techniques known as nodal analyses offer the ability to understand the impact of destroying certain nodes within a network. For military purposes, adaptive networks, such as an opponent's economy or command and control structure, could thus be targeted and either disrupted or brought down. Because this is a targeting approach to warfighting, Blue Air Force officers have taken the lead in developing it.⁴⁴

It should also be noted that terrorist groups and local warlords recognized earlier the utility of disruption against Blue interests by targeting the bonds/relationships underpinning the Clausewitzian trinity of its society.⁴⁵ Similar operational concepts have thus already been developed and utilized by non-state warmaking groups:

In a 'failed-state' scenario where Western forces are up against non-national groups, these groups are successfully utilizing [five-]dimensional battlespace against them. For defensive purposes they are using idea-generated cyberspace so as not to be acquired and killed or neutralized. For offensive purposes, they are using technology-generated cyberspace against the West. Via real-time media broadcasts and, more recently, websites, they are allowed to bring 'the people' of the Westphalian nation-state to the physical battlefield so that they can be subjected to its horrors . . . these groups rely upon an alternative target set focused upon breaking the bonds/relationships which hold 'the people,' 'the government,' and the

military of the Westphalian nation-state together. The primary means of attacking this target set is by those criminal activities which we in the West term 'acts of terrorism.'⁴⁶

Two other applications offer additional potentials for warfighting advantage.

Command by Influence. Blue forces have long been recognized to be at an immense disadvantage when operating against non-traditional opponents in restrictive terrain such as mountains, jungles, and cities. Their plans and actions are both transparent and predictable, while those of opposing forces remain shrouded in darkness. Command-by-influence offers a means to provide a networked military unit the ability to fight toward a common outcome. It is created by providing a commander's mental visualization (i.e., intent and/or concept of operations) to his subordinates who can then use their local situational awareness to shape their actions toward the common goal. This symbolic imagery process represents a system of controlled chaos.⁴⁷ It offers immense advantages over linear command-and-control because of its increased information flows and adaptive quality stemming from a unit's ability to fight toward a shared image.

Phase Weaponry. A matter state exists between solid and fluid structures known as a "phase transition." In dynamical systems, the condition between order and chaos is known as "complexity." Similar patterns appear to apply toward cellular automata classes and computation.⁴⁸ Based on these analogies, an advanced weaponry state between matter (i.e., solid projectiles) and energy (i.e., electromagnetic wavelengths) could reasonably be expected to exist. Such a "phase state," found in the void between humanspace and cyberspace, complements the previously stated need for a dimensionally shifted defense. Possibly an early form now exists in the Blue's Navy Research Lab's "Agile Mirror" effort which seeks to generate a dense ionized plasma gas sphere, whose surface looks like metal, as an advanced radar sensing capability for ships and aircraft.⁴⁹

Since it retains some physical properties, it might be not only able to defeat five-dimensional attacks but also four-dimensional ones based upon projectiles. It has already been recognized that plasma sheeting may allow protection against HPM and EMP and in addition may lead to stealth type effects by tailoring radar cross section (RCS) of the object being defended.

As a counter to this defense, “phase weaponry” would conceivably be developed which would alter its structure to pass through the “phase shielding” modulations it encounters. One delivery method could be based on a hollowed laser beam filled with an ionized substance whose frequency could be tuned as it senses the modulation of the shielding it comes in contact with.

Robotics Platforms and Machine Soldiers. Another set of complex technologies of utility to Black, derived from advances in computer science, expert systems, and artificial intelligence, miniaturization, and robotics, are manifested in military aerial platforms and teleoperated vehicles. Such platforms and vehicles are currently viewed as an adjunct to Blue conventional military forces. They have been traditionally employed for scouting, as in the case of remotely piloted vehicles (RPVs), and for bomb-disposal and minefield clearing. During the late 1980s, a congressional ban on placing weapons on unmanned systems was enacted because of their potential for killing noncombatants.⁵⁰ This effectively stopped the development of BlueFor machine soldiers.⁵¹ However, from a computer science perspective, this ban has long been broken. The “if armed and tripwire triggered, then explode” logic of a land mine makes it a robot even if Western perceptions are oblivious to this fact.⁵²

From a post-Western perspective, these technologies offer the means to knowingly create robot soldiers as allies of the new warrior class. Rather than expensive behemoths on the scale of a main battle tank, the machine soldiers BlackFor prefers are small, compact, and cheap. Once deployed in complex terrain, they do not require logistical

support, get tired or sick, or become frightened from suppressive fires or encirclement while waiting for Blue forces to activate their sensors.⁵³ One example of a machine soldier is the static ground holding “\$19.95 Military Robot.” (See Figure 5.)

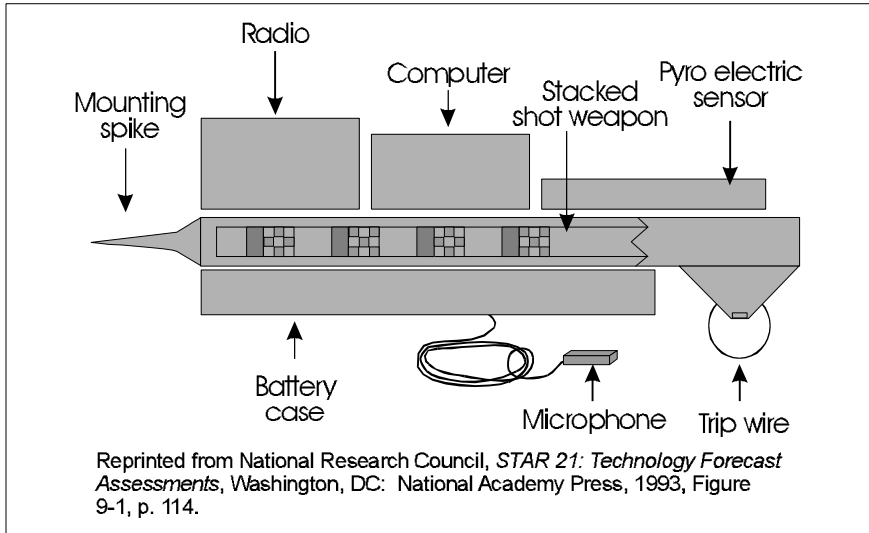


Figure 5. \$19.95 Military Robot.

Another example is the biomorphic robot. This is a robot which resembles an insect with six legs, is the metric equivalent of half a foot to a foot long, and has a price range from twenty to a few thousand dollars, depending on its construction materials and level of programming sophistication. The most basic biomorphic robots can recharge using their solar cells, avoid perilous terrain, and fulfill some sort of simple mission. This makes them sophisticated enough to become silent hunter-killer systems in urban terrain. Given the mission of finding better ground, such as under a BlueFor tank or next to a Bluefor soldier, and then either detonating or activating their payload, they become deadly opponents. These robots could be allowed to wander independently or could be slaved to some sort of beacon or global positioning system (GPS) for a network centric zonal defense.⁵⁴

A final form of machine soldier is the nano-robot or microelectromechanical system (MEMS). Alone such microscopic robots are insignificant but working together in hundreds or thousands, they could be employed as battlefield sensors or smart weapons.⁵⁵ They offer great potential as scouts for biomorphic robots or as a means to infiltrate and degrade BlueFor mechanical systems by means of the delivery of tiny electric shocks or LME agents.

To limit fratricide, identification friend-or-foe (IFF) implants can be worn by Black soldiers in regions where machine soldiers have been positioned or are freely moving. The smaller of these robots can be delivered by mortars or air-delivery systems, such as cruise missiles, to channel Blue forces into killing zones or to reinfest urban canyon terrain which Blue has painstakingly cleared and captured.⁵⁶ Sensor links can be provided to these robots to allow for BlackFor “telepresence” as required.

In addition to machine soldiers, BlackFor will employ unmanned aerial vehicles (UAVs) as both sensor and weapons platforms.⁵⁷ They can be used to fix BlueFor elements in time and space and breakup armor and infantry assaults by direct fires of advanced non-lethal weaponry. Further, they can be configured to directly contend with BlueFor attack helicopters by either going after their engines by means of radio frequency weapons, against their air intake system by means of cloggers, or targeting their blades and rotors using entanglers.

Other synthetic soldier options available to BlackFor, not discussed, include cyborgs, composed of animals or insects with computer implants, and plants, such as certain palms, whose fronds can serve as radio frequency antennas for advanced weaponry.

Five-Dimensional Warfighting.

Don't do anything four-dimensionally that you can do five-dimensionally.

BlackFor Commander

The basic strategy of the leadership of Black is to wage war against Blue in a post-Western manner just as a mercenary captain or dynastic prince waged war against a feudal lord in a post-medieval (e.g., early modern) manner. The change in battlespace involved can be viewed in Figure 6.⁵⁸ It provides a comparison between armor and mechanized forces fielded by BlueFor and terrorists and mercenaries fielded by BlackFor. The goal of BlackFor is to remain “off the battlefield” dominated by BlueFor. Not surprisingly, it is reminiscent of the knight vs. mercenary struggle portrayed earlier in Figure 1.

The overriding philosophy of Black is “small, fast, stealthy, ruthless, and cheap.”⁵⁹ Because this is a post-Western approach to warfighting, it represents a “Clash of Civilizations” never imagined by Samuel Huntington or Blue's more traditionalist leaders.⁶⁰ To implement this form of warfighting against Blue, an “Order of Battle” has been created by Black. It is divided into AAN related and AAN directed actions. Pre-AAN related actions can be thought of as strategic level concerns. For this scenario's purposes, it is assumed that Black is carrying out a massive terrorist campaign against Blue's homeland and does not want to be linked to these attacks. This campaign could be based on

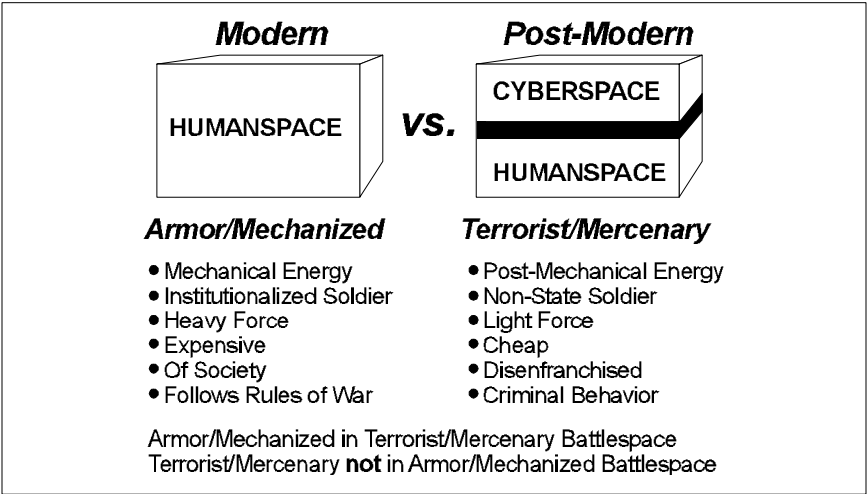


Figure 6. Modern to Post-Modern Battlespace.

any combination of physical and/or virtual forms of terrorist activity. Initially other entities, nation-states, or sub-national groups were set up to take the blame for these attacks.

AAN related actions take place after Black has been linked to the terrorist campaign. BlueFor and her sister services engage in standoff precision strikes against Black to stop the terrorist assault. This fails to deter Black. AAN directed actions are in response to a ground campaign in which BlueFor is sent in to physically invade Black's territories to stop these attacks and decisively defeat Black.

AAN Related Actions. When Blue finds out that it is fighting Black, Black will not easily allow Blue to locate its forces and assets because of the precision strike danger. Since Blue “rules the cube,” Black will attempt to deny BlueFor and her sister services their four-dimensional standoff capability advantages via dimensional shifting of forces. At this time, Black will preemptively attack Blue's intelligence-gathering satellites via ballistic missiles or small ground based lasers.⁶¹

If Black forces and assets are located and precision struck by Blue, they will be placed in combinations of hard to hit, hardened sites, mixed with innocent civilians and hostages, and either under or next to foreign embassies or in other “ethically challenging sites” like prisoner or Red Cross camps. The potential exists to store Hazmat materials in some sites so that the vapors released could be used to cause a media event.

Black will begin using real time media links, television and internet, to visually show the world the brutality of Blue's actions. At the same time, if Blue pilots or SOF operatives are captured, images of their mutilated bodies being dragged through the streets “in retaliation” to Blue actions will be fed to real time media links. The initiation of a global terrorism campaign against Blue assets, including its children in foreign schools and tourists, and internet based attacks to disrupt Blue's infrastructure, degrade its

bonds between its people and government, and break up the arrival sequence of ground forces will also now take place. Black further has the option to physically, virtually, or dual-dimensionally threaten or attack third party states or entities, either allied or hostile to Blue, to complicate the conflict as Iraq did to Israel with its Scud missiles during the Gulf War.

AAN Directed Actions. When Blue brings in land warfare forces, Black will defend in complex terrain (urban, suburban, mountains, forests, jungles)⁶² so it can fight from cyberspace and deny Blue its qualitative four-dimensional advantages. Further, such terrain as cities can swallow up immense numbers of soldiers and deny BlueFor much of its legacy armor and mechanized force advantages. No Black “soldiers” are to wear uniforms except for those set up in complex terrain killing zones as “bait” for BlueFor elements.

In the ground war, Black will be fighting under the following concepts of operation: stealthing and cyber-shielding, cybermaneuver, and bond/relationship targeting. These CONOPS as opposed to those from the Joint Vision 2010 Legacy can be viewed in Table 2.⁶³

These Joint Vision 2010 Legacy CONOPS have been modified by recent BlueFor lessons learned from AAN study results. These results based on surface-to-space continuum, split-based operations, interdependence, hybrid forces, and mature leaders leading cohesive units do not alter BlueFor’s

CONOPS	Blue: Four-Dimensionally Based	Black: Five- Dimensionally Based
Defense	Full-Dimensional Protection	Stealthing and Cybershielding
Movement	Dominant Maneuver	Cybershielding
Fires	Precision Engagement	Bond/Relationship Targeting

Table 2. Blue 2010 Legacy vs. Black CONOPS.

four-dimensional warfighting orientation.⁶⁴ The complex concept of interdependence is most significant for Black. Within it, “Time is [said to be] the enemy of a force that depends on knowledge and speed for effectiveness.”⁶⁵ While time for BlueFor is an opponent—stemming from loss of shock effect, force sustainment costs, and changing public attitudes—for Black, it is an ally. Black is a force that depends on anti-knowledge and bond/relationship targeting for its effectiveness much like the Vietcong and other non-Western groups. Unlike BlueFor, it does not seek to engage in quick and decisive Clausewitzian-like battles. Black CONOPS are as follows:

Stealthing: The application of sensory defeating procedures and technologies to allow military forces to seemingly exit four-dimensional space by means of spatial warping. This is a primary form of defense for light forces which seek five-dimensional space (cyberspace) as a defensive bastion. This capability can be derived from either violating the modern rules of war or by employing advanced technologies.

Cybershielding: The capability of defeating a precision strike by means of generating an invisible shield around a force which has been stripped of its stealthing and acquired in time and space. The shield could either prematurely detonate a precision guided munition *via* electronic impulses, or potentially project a semi-solid “phase state” as a physical barrier. This secondary form of defense is derived from advanced non-lethal weaponry with dimensional shifting capability.

Cybermaneuver: The capability of maneuvering outside of traditional four-dimensional space (humanspace) into five-dimensional space (cyberspace). This capability is derived from the stealthing of military forces. It allows maneuver to take place outside of BlueFor's “battlespace cube” which represents the spatial killing ground of future war.

Bond/Relationship Targeting: The capability to precisely break the bonds/relationships giving form and substance to physical, and potentially five-dimensional, structures. Derived from concepts of terrorism, synergistic attack, and cross-system effects, this offensive CONOP can be applied against targets ranging from nation-states to military systems to individuals. An example of this form of targeting can be seen in Figure 7, which represents the Clausewitzian Target Set being assaulted by BlackFor beginning with its initial terrorist campaign against Blue's homeland.

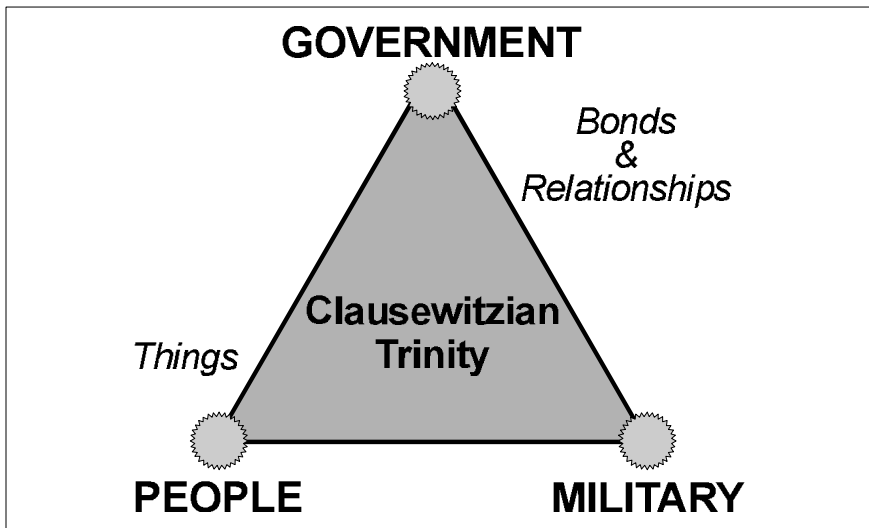


Figure 7. Clausewitzian Target Set.

What is significantly different between BlueFor and BlackFor CONOPS is their relationship to information. BlueFor CONOPS based on the Joint Vision 2010 Legacy, while said to be derived from information superiority, require information operations to take place in addition to the CONOPS themselves, much like an appliqué. BlackFor CONOPS, however, represent organic information operations applied to warfighting. Each one is seamlessly post-mechanical in orientation unlike the unwieldy “bolt-

on” between BlueFor mechanical CONOPS and post-mechanical information operations.

In the ground war, BlackFor will focus on employing military forces based on advanced non-lethal weaponry, phase technology (projected), and machine systems from complex terrain.⁶⁶ Advanced non-lethal weapons will be used primarily to target the bonds/relationships of Blue materiel, personnel, and infrastructure (both informational and physical). Long-term disabling and disruption of BlueFor personnel is preferred over lethal force because of the logistical burden it will create on BlueFor support services and the further undermining of Blue's trinitarian bonds and relationships that it will create.

Counter-optical lasers, radio-frequency and microwave devices, software weapons, acoustic projectors, acetylene rocket propelled grenades (RPGs), and EMP mortars will be stressed rather than conventional armaments, which will serve in a subordinated role. Many of these advanced non-lethal weapons systems can be expected to have either smart or brilliant guidance systems like more traditionally based aircraft- and artillery-delivered munitions such as the Sensor Fuzed Weapon (SFW), the Sense and Destroy Armor (SADARM) projectile, and the Brilliant Antiarmor (BAT) glider.⁶⁷

Anti-lethal weaponry, as a subset of non-lethal weaponry, will also be employed. Such weaponry can range from those which provide cybershielding, such as a “Faraday Cage” variant against microwave attack, to stealthing *via* active and metamorphic camouflage systems.⁶⁸ Direct research into phase technology will have taken place as will capitalization upon research programs that Blue starts and then drops. If this line of research is successful, “phase state” weaponry will be utilized by BlackFor for both defensive and offensive purposes.

Robotics platforms and machine soldiers, specifically small cheap systems, will be used in mass in support of Black forces. These unmanned systems can either be

human or independently controlled with emphasis on the latter. Static systems, biomorphic robots, microelectromechanical systems (MEMS), and UAVs will make BlueFor operations in complex terrain extremely hazardous. Such machine forces will not surrender and can be used to reinfest BlueFor rear areas, and urban zones which have been cleared out and pacified, by means of artillery and air-delivery systems.

In addition, mercenaries will be employed to augment Black's non-nation state soldiers. They can offer additional capabilities not normally possessed by Black forces. Further, since they can be hired for short duration contract work, they offer potential cost savings for Black. Such mercenaries can range from terrorists to private security and intelligence firms. (See Table 3.) The precedent for the use of such forces took place back in the 1990s with Executive Outcomes' corporate contracts in failed African states and Mexican drug cartels hiring of ex-foreign and ex-U.S. special forces soldiers.⁶⁹

Finally, Black forces will rely upon a networked form of command and control (C^2) rather than a traditional hierarchical one which is susceptible to leadership decapitation and easy disruption. This more robust system will capitalize on command-by-influence concepts, not only for human forces, but also for machine forces. Its exploitation of a C^2 method based upon a symbolic imagery process coupled with a nonlinear defense in complex terrain makes BlackFor a very resilient, complex and adaptive opponent. In some ways, this form of defense is similar to the Swedish military's proposed defensive "cell concept."⁷⁰ However, in this instance, BlackFor's employment of advanced non-lethal weaponry and machine soldiers would be technically superior to BlueFor's legacy based armor forces.

Type	Capability
Terrorists	Bombings, RF Weaponry, WMD
Hackers	Internet Based Attacks, Misleading Intelligence Postings
Media	Real Time News Feeds, Websites, News Bias, Disinformation
Ex-Special Forces	Assassinations, Kidnappings
Drug Cartels	Drug Flow Manipulation, Dosage Tampering, Additive/Toxin Tampering
Mercenary Corporations	Ground Fighting (High Tech) & Operational Intelligence Services
Private Militias & Guerrillas	Ground Fighting (Low Tech)
Private Security & Intelligence Firms	Key Asset Protection & Strategic Intelligence/Counter-Intelligence

Table 3. Black's Employment of Mercenaries.

Can the AAN Be Defeated?

Our leaders called them criminals, not soldiers. How does that explain what happened to my platoon?

Surviving BlueFor Soldier

The overriding question, based upon the above five-dimensional warfighting scenario, is: Could BlackFor defeat BlueFor? If we accept the June 1993 FM 100-5 *Operations* concept of decisive victory as the only way BlueFor can "win," then BlackFor will come out victorious:

*The Army must be capable of achieving decisive victory. The Army must maintain the capability to put overwhelming combat power on the battlefield to defeat enemies through a total force effort. It produces forces of the highest quality, able to deploy rapidly, to fight, to win quickly with minimum casualties. That is decisive victory.*⁷¹

Based upon this scenario, BlueFor would be denied the following key components of its definition of victory:

- “the capability to put overwhelming combat power on the battlefield . . .”
- “. . ., to win quickly . . .”
- “. . . with minimum casualties . . .”
- “. . . [achieve] decisive victory.”

The traditional four-dimensional battlefield, based upon open spaces and non-complex terrain, which BlueFor dominates was surrendered by BlackFor the moment hostilities began because it represents killing ground. Instead, BlueFor would be required to place its combat power directly within complex terrain containing BlackFor's stealth-masked forces, both human and machine, mixed in with innocent civilians. BlueFor's legacy mechanized forces would lose much of their qualitative superiority in such terrain and be susceptible to BlackFor's advanced technologies and CONOPS.

In heavily urbanized coastal zones containing sprawling slums such as a massive Mogadishu-like environment, BlackFor would be defending in the equivalent of a number of World War II Stalingrads. The German army fighting over that city lost tens of thousands of men prior to being cut off and decimated. If BlueFor lost a fraction of that number, the operation would be deemed a disaster. The question arises whether BlueFor would possess sufficient soldiers in its ranks to even engage in such an undertaking. Time also becomes a factor. Large scale urban operations and the ensuing terrorist/guerrilla campaign likely to follow, even if the urban centers could be occupied, far exceed any notion of a quick win on BlueFor's behalf. BlueFor would have to counter terrorists, narco-groups, and gangs in a “police” type setting for which its forces are not suited.

To further erode BlueFor's potential for victory, its ability to defeat Black decisively comes into question. Black represents a new warmaking entity based on a heavily internetted command structure—its relationships are more weblike than hierarchical. Physical terrain is meaningless to this entity, it does not field an army which can be decisively defeated in open battle, and its leadership is stealth-masked and transnational. As a result, traditional Clausewitzian centers of gravity or, for that matter, concepts of defeat do not apply.

What is most striking about these observations is that they appear to support three of the emerging impressions of the 1997 Summer AAN Wargame held in September:

- Future conflicts may have very unique characteristics.
- Conflict may be about controlling time and influence, not about seizing terrain or defeating military forces.
- Resolution of such conflicts may not imply “victory” in the conventional sense.⁷²

That wargame saw Blue facing an Orange opposing force, modeled on a hybrid insurgency, conducting operations within the territory of the Green nation-state which represented a fragile, corrupt democracy. While Orange in that wargame represented an “expanding non-nation state,” in this report Black represents a “post-nation state entity.”⁷³ The difference is the political perception of the opposing force as a non-nation-state insurgency as opposed to a nation-state killer—something far more threatening to the Western nation-state form because it seeks to replace it.

Implications.

We don't have to get the future right, just less wrong than our opponents.

A Black Military Analyst

The emergence of complex, adaptive socio-political entities as challengers to the nation-state form raises immense concerns for the Army After Next. Such a network-like entity, should its network expand to take on the form of a major military competitor, would represent a national security threat alien to the American view of war and the strategic context in which it is waged.⁷⁴ Given the historical emergence of medieval structures (as the successor to the classical city-state) and the modern nation-state (as the successor to the Church, empire, and fief) during periods of epochal change as we may now be in, such a development is not infeasible.

Conceivably in the decades to come, such a network-like entity could develop from a wide range of sources including the drug cartels of Latin and South America, the organized crime groups found in parts of the Far East, or the Russian successor state if it continues on its current path of becoming a “kleptocracy.” Stemming from its unique organizational strengths, criminally derived ethics and ability to engage in five-dimensional warfighting, this entity would likely defeat an Army After Next based upon current concepts of decisive victory and the traditional four-dimensional perceptions underpinning it. Derived from this perception and others raised in this report, a number of implications for 21st century land warfare exist:

- Newtonian views of warfighting are rapidly becoming representative of a spatially obsolete battlefield form. Complex concepts and technologies are promoting a new form of warfighting based upon five-dimensional space. Such radically new means of waging war are at variance with the institutional Army and the society

which it defends. As a result, five-dimensional warfighting will likely be proscribed by an Army leadership wedded to heavy mechanized forces, overwhelming firepower and seizing ground, until faced with catastrophic defeat on the battlefield.

- The *Force XXI Operations* perception of complex, adaptive armies belonging solely to developed nations (e.g., post-industrial) appears to be in error.⁷⁵ Such “armies” may more often be initially characteristic of non-nation state entities configured around the new-warrior class and former military personnel. Many of these “armies” will form themselves into mercenary companies offering their services to the highest bidder and employ five-dimensional, rather than four-dimensional, warfighting principles. They could usher in a new global “Age of Mercenaries” and, if left unchecked, may result in U.S. firms such as MPRI competing with the U.S. Army over foreign military operations.
- Achieving decisive victory, as it is currently defined, against complex and highly adaptable non-nation state entities will become untenable. As a consequence, traditional concepts of ground based military deterrence will also become insufficient. This will require the U.S. Army to reexamine both its concepts of victory and defeat and deterrence as it develops the AAN project. Such a strategic reexamination would come into conflict with deeply held American views of warfare.
- Bond/relationship targeting represents a powerful new offensive CONOP. This is in direct opposition to the warfighting perceptions based on precision engagement in JV 2010. While precision engagement may serve as a means toward bond/relationship targeting, on its own it only represents an incremental increase over today's four-dimensional

capabilities by making attrition warfare more precise. Bond/relationship targeting offers the conceptual means of disrupting entire systems and entities rather than gradually attriting them via precision based physical destruction as was attempted and failed in Vietnam.

- The potential fusion of non-state soldiers with an advanced form of battlespace (i.e., five-dimensional) and weaponry (i.e., upper-tier non-lethals and information based) along with new CONOPS (i.e., stealthing, cybershielding, *et al.*) makes for an increasingly dangerous threat to American national security. To date, this synergistic threat has not been addressed in Army literature on future warfighting and as a result currently represents a “gaping hole” in Army futures threat analysis.
- Failed-state environments may be conducive to the growth of successor forms of social and political organization to the nation-state. New warmaking entities which evolve in these environments and are allowed to grow and expand to create vast global “criminal” networks may represent an emergent threat to our national security.
- By 2020-2025, the appearance of the 21st century equivalent of *The Prince* could be expected to take place. It would provide a more concise methodology and ideological rationale for breaking America's domination of warfare than V.K. Nair's *War in the Gulf: Lessons for the Third World*, published in 1991, ever did. Distributed by means of the internet, such a manifesto could serve to fully shatter the Western nation-state's monopoly on warfare in much the same manner as Machiavelli's work broke the monopoly then held by the Medieval Church.

These implications suggest that warfighting as the Army understands it is undergoing a massive trans-

formation. This change transcends the military arts at the RMA level and encompasses the fundamental social and political organization of human civilization based upon emergent sciences, technologies, and motive sources.⁷⁶ As a result it faces a revolution in political and military affairs (RPMA) and not a much smaller RMA. The danger now exists that the Army After Next may be configured around an increasingly obsolescent form of warfighting, with the addition of advanced technology and concept appliques, rather than attempting to make a break with the past and fully reconfigure itself around advanced warfighting principles as nation-state successor forms will do.

This creeping trend is evident in the Army's unwillingness, or inability, to question its basic assumptions of warfighting. Since the advent of the Force XXI program, Army modal warfare analysis—earlier Tofflerian and now Cycles of War based—has centered on the change from the industrial to the information age. This represents the time period which has defined our nation's and army's institutional existence. The current form of analysis for the AAN centers on change between the Napoleonic era, the American Civil War, the First World War, the early 1960s, and the Gulf War.⁷⁷ It represents a linear projection of a past based upon both Newtonian and Clausewitzian concepts of warfighting.

Such traditional analysis is in direct variance with the non-linear concepts and technologies discussed in this monograph. Further, it fails to recognize the greater patterns of Western modal warfare change. As a result, it must now be considered to represent a direct impediment to the AAN project. If the institutional mindset such analysis is derived from is not overcome, it will potentially set up the Army After Next and the American public for a strategic defeat many magnitudes greater than anything ever before experienced in our nation's history. Regardless of the personal and career sacrifices involved in facing this sobering reality, such a strategic defeat is something which our senior Army leadership can never allow to take place.

ENDNOTES

1. Xavier Raufer, "Gray Areas; A New Security Threat," *Political Warfare*, Spring 1992, p. 1.
2. Robert J. Bunker, "Failed-State Operational Environment Concepts," *Military Review*, Insights, Vol. 77, No. 5, September-October 1997, pp. 90-92.
3. Robert J. Bunker, "Epochal Change: War Over Social and Political Organization," *Parameters*, Vol. 27, No. 2, Summer 1997, p. 15-25.
4. Hendrik Spruyt, *The Sovereign State and Its Competitors*, Princeton Studies in International History and Politics, Princeton, NJ: Princeton University Press, 1994, p. 184.
5. For early work in this area, see J.K. Zawodny, "Infrastructures of Terrorist Organizations," in Lawrence Z. Freedman and Yonah Alexander, eds., *Perspectives on Terrorism*, Wilmington, DE: Scholarly Resources, 1983, pp. 61-70.
6. United States Army, Training and Doctrine Command (TRADOC), *The Annual Report on The Army After Next (AAN) Project, July 1997*, Washington, DC: U.S. Government Printing Office, July 18, 1997, p. 9.
7. Steve Metz, "Which Army After Next? The Strategic Implications of Alternative Futures," *Parameters*, Vol. 27, No. 3, Autumn 1997, p. 15. Shortened version of *Strategic Horizons: The Military Implications of Alternative Futures*, Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, 1997.
8. This major military competitor represents one potential warmaking entity which could develop out of the alternative future security systems proposed by Steve Metz, pp. 15-26.
9. Robert J. Bunker, "Epochal Change: War Over Social and Political Organization," p. 19.
10. See Ralph Peters, "The New Warrior Class," *Parameters*, Vol. 24, No. 2, Summer 1994, pp. 16-26; and Charles J. Dunlap, Jr., "How We Lost the High-Tech War of 2007: A Warning for the Future," *The Weekly Standard*, January 29, 1996, pp. 22-28.

11. Such perceptions began to develop immediately after the Gulf War. See Brigadier V.K. Nair, VSM (Ret.), *War in the Gulf: Lessons for the Third World*, New Delhi: Lancer International, 1991.

12. This box is presently 200 x 200 miles; by 2020-2025 it will conceivably be expanded based on linear projections. Derived from William Owen's "system-of-systems" concept. For the perceived advantage this concept provides, see Joseph S. Nye, Jr. and William A. Owens, "America's Information Edge," *Foreign Affairs*, Vol. 75, No. 2, March-April 1996, pp. 20-36.

13. TRADOC, *The Annual Report on The Army After Next (AAN) Project*, July 1997, p. 14.

14. *Ibid.*, p. B-2.

15. Robert J. Bunker, "Advanced Battlespace and Cybermaneuver Concepts: Implications for Force XXI," *Parameters*, Vol. 26, No. 3, Autumn 1996, pp. 109-110.

16. Alan G.R. Smith, *Science and Society in the Sixteenth and Seventeenth Centuries*, History of European Civilization Library, Geoffrey Barraclough, ed., Harcourt Brace Jovanovich, Inc., 1972., pp. 9-27.

17. For this process of change, see Robert J. Bunker, "Epochal Change: War Over Social and Political Organization," pp. 15-25.

18. This figure was originally included in a featured presentation by the author at U.S. Army Test and Evaluation Command (TECOM), Test Technology Symposium '96 "Visions of Future Conflict—Test Technology Drivers," Johns Hopkins University, Laurel, MD, June 4, 1996.

19. An earlier shift from one- to two-dimensional warfighting took place during the transition from the classical to the medieval world. It represents a second baseline of dimensional warfighting change not discussed in this manuscript.

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21. National Research Council, *STAR 21: Strategic Technologies for the Army of the Twenty-First Century*, Washington, DC: National Academy Press, 1992; National Research Council, *STAR 21: Technology Forecast Assessments*, Washington, DC: National Academy Press, 1993; Brian Nichiporuk and Carl H. Builder, *Information Technologies and the Future of Land Warfare*, Santa Monica, CA: The Rand Corporation, Arroyo Center, 1995; and John Arquilla and David Ronfeldt, *The Advent of Netwar*, Santa Monica, CA: The Rand Corporation, 1996.

22. For early thinking in the application of such emerging technologies, see Steven Metz and James Kievit, *The Revolution in Military Affairs and Conflict Short of War*, Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, July 25, 1994, pp. 5-11.

23. Originally termed four-dimensional warfighting, with time considered a fifth dimensional attribute. In order to avoid conflict with scientific writings, time has been reordered as the fourth dimensional attribute and cyberspace as the fifth dimensional attribute of advanced battlespace. See Robert J. Bunker, "Advanced Battlespace and Cybermaneuver Concepts: Implications for Force XXI," pp. 108-120. Further concept development can be found in Robert J. Bunker, Chapter 10, "Technology in a Neo-Clausewitzian Setting," in Gert de Nooy, ed., *The Clausewitzian Dictum and the Future of Western Military Strategy* Boston, MA: Kluwer Law International, 1997, pp. 137-165.

24. The possible (theoretical) folding of space leading to a space warp represents a more mature projected capability of fifth-dimensional warfighting. This insight is reminiscent of the higher dimensional spaces invoked and required for advanced physics problems such as unified field theories. For one application of these concepts, see K.C. Cole, "Scientists Report Primitive Step in Teleportation," *Los Angeles Times*, December 11, 1997, p. A30.

25. Spatial warping concepts partially derived from the paper, "Technology in a neo-Clausewitzian Setting," Experts-workshop for *The Clausewitzian Dictum and the Future of Western Military Strategy* Netherlands Institute of International Relations, Clingendael, in cooperation with the Netherlands Defence Staff and The Netherlands Defence College, The Hague, Netherlands, February 13-14, 1997.

26. Pat Cooper and Jeff Erlich, "U.S. Troops to Field Shortstop Against Shells in Bosnia," *Defense News*, Vol. 22, February 5-11, 1996, p. 22.

27. One such weapon is the Chinese ZM-87 Portable Laser Disturber. A brochure exists which cites its main specifications and

provides manufacturer contact information. Its major application is to injure or dazzle the eyes of an enemy combatant.

28. Robert J. Bunker, ed., *Nonlethal Weapons: Terms and References*, INSS Occasional Paper 15, Colorado Springs, CO: Institute for National Security Studies, U.S. Air Force Academy, July 1997.

29. F.M. Lorenz, "Non-Lethal Force: The Slippery Slope of War?," *Parameters*, Vol. 26, No. 3, Autumn 1996, p. 61.

30. Martin N. Stanton, "What Price Sticky Foam?," *Parameters*, Vol. 26, No. 3, Autumn 1996, p. 68. Reprinted from Proceedings.

31. This is far in advance of earlier projections based upon the 21st Century Politico-Military Force Spectrum which was developed prior to those regarding advanced battlespace. See Robert J. Bunker and T. Lindsay Moore, *Nonlethal Technology and Fourth Epoch War: A New Paradigm of Politico-Military Force*, Land Warfare Paper No. 23, Arlington, VA: The Institute of Land Warfare, Association United States Army, February 1996, p. 4.

32. Robert J. Bunker, ed., *Nonlethal Weapons: Terms and References*, pp. 2-3.

33. Scientific insights attributed to John Dering.

34. Arthur Knoth, "Disabling Technologies: A Critical Assessment," *International Defense Review*, July 1994, pp. 33-39.

35. Robert J. Bunker, ed., *Nonlethal Weapons: Terms and References*, p. 22. See Rolan K. Mar, "Bang-Less Tank Killer," *U.S. Naval Institute Proceedings*, Vol. 112, September 1986, pp. 112-113; and Stephen Budiansky, "All stuck up, no way to go," *U.S. News and World Report*, July 20, 1987, p. 62.

36. Term attributed to Lieutenant Colonel Matt Begert.

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38. See M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos*, New York: Touchstone, 1992, pp. 9-13.

39. Thomas J. Czerwinski, "Command and Control at the Crossroads," *Parameters*, Vol. 26, No. 3, Autumn 1996, p. 126.

40. This manual can be accessed at the Marine Corps Doctrine Division Home Page: <http://138.156.107.3/..docdiv/index.html>. It was approved June 20, 1997, by General Krulak, USMC, and Gen. Gray, USMC (Ret).

41. Steven M. Rinaldi, "Complexity Theory and Airpower: A New Paradigm for Airpower in the 21st Century," David S. Alberts and Thomas J. Czerwinski, eds., *Complexity, Global Politics and National Security*, Washington, DC: The Center for Advanced Concepts and Technology, Institute for National Strategic Studies, National Defense University, June 1997, pp. 280-290.

42. See the above volume published from these proceedings.

43. MCDP-1, *Warfighting*, Washington, DC: U.S. Government Printing Office, 1997. Downloaded from Marine Corps Doctrine Division Home Page.

44. Steven M. Rinaldi, pp. 291-294.

45. See Robert J. Bunker, "Failed-State Operational Environment Concepts," p. 91.

46. Robert J. Bunker, "Technology in a Neo-Clausewitzian Setting," pp. 147-148.

47. Thomas J. Czerwinski, pp. 126-128.

48. M. Mitchell Waldrop, pp. 222-235.

49. Pat Cooper, "U.S. Navy Scientists Tap Sun for Radar," *Defense News*, May 13-19, 1996, pp. 1, 33.

50. Pat Cooper, "U.S. Mulls Lethal Robots: DoD Takes Second Look at Unmanned Weaponry," *Defense News*, July 17-23, 1995, pp. 3, 29.

51. Some bomb disposal robots used by law enforcement mount shotguns to blast open suspicious briefcases. At best, such robots have been used against barricaded suspects only a few times. While U.S. military forces do not currently employ what would be considered armed robots or even have such a requirement, this may change in the near future because of industry competition. The Navy and Marine Corps are now being sold UAVs with dual reconnaissance and attack mission capabilities. Still the firing of these weapons will likely be under human

control. See George I. Seffers, "U.S. Industry Pushes Lethal UAVs," *Defense News*, October 27-November 2, 1997, pp. 3, 19.

52. National Research Council, *STAR 21: Technology Forecasts*, Washington, DC: National Academy Press, 1993, p. 113.

53. *Ibid.*, pp. 114-115.

54. Arthur Knoth, "March of the Insectoids," *International Defense Review*, November 1994, pp. 55-58.

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58. See Endnote 18.

59. Black's philosophy inspired by Maas Biolabs GmbH, "Maas. Small, fast, ruthless. All Edge." See William Gibson, *Burning Chrome*, New York: Ace Books, 1987, p. 116.

60. Samuel P. Huntington, "The Clash of Civilizations," *Foreign Affairs*, Vol. 72, No. 3, Summer 1993, pp. 22-49; and "If Not Civilizations, What?," *Foreign Affairs*, Vol. 72, No. 5, November/December 1993, pp. 186-194.

61. TRADOC, *The Annual Report on The Army After Next (AAN) Project*, July 1997, pp. C-19 to C-22.

62. *Ibid.*, p. 14.

63. See Joint Chiefs of Staff, *Concept for Future Joint Operations: Expanding Vision 2010*, Fort Monroe, VA: Joint Warfighting Center, May 1997.

64. TRADOC, *The Annual Report on The Army After Next (AAN) Project*, July 1997, pp. 17-20.

65. *Ibid.*, p. 19.

66. While weapons of mass destruction (WMD) exist in the Black arsenal, their direct contribution to BlackFor warfighting capabilities will not be considered because of the immense damage they would cause to Black territories. They may, however, be utilized by terrorists employed by Black against Blue's homeland so that Black is not left holding a "smoking gun."

67. Glenn W. Goodman, Jr., "Nowhere to Hide: New Smart Munitions Rain Certain Destruction from the Sky," *Armed Forces Journal International*, Vol. 135, Vol. 3, October 1997, pp. 58-64.

68. Robert J. Bunker, ed., *Nonlethal Weapons: Terms and References*, pp. 4-6.

69. For the rise of such groups, see David Isenberg, *Soldiers of Fortune Ltd.: A Profile of Today's Private Sector Corporate Mercenary Firms*, Washington, DC: Center for Defense Information, November 1997. For Mexican cartel employment of former U.S. soldiers, see "Around the Nation: Texas," *Law Enforcement News*, October 31, 1997, p. 3.

70. Brian Nichiporuk and Carl H. Builder, pp. 52-54.

71. United States Army, FM 100-5, *Operations*, Washington, DC: U.S. Government Printing Office, June 1993, p. 1-5.

72. TRADOC Analysis Center, *Emerging Impressions Report: Army After Next Summer Wargame 1997*, Briefing Slides, September 24, 1997.

73. *Ibid.*

74. United States Army, FM 100-5, *Operations*, pp. 1-2 to 1-5.

75. United States Army, TRADOC Pamphlet 525-5, *Force XXI Operations*, Fort Monroe, VA: Training and Doctrine Command, August 1, 1994, p. 2-5.

76. For an overview of the traditionalist view of the RMA and what a strategic revolution would entail, see Steven Metz, "The Revolution in Military Affairs: Orthodoxy and Beyond," in Earl H. Tilford, ed., *World View: The 1997 Strategic Assessment from the Strategic Studies*

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