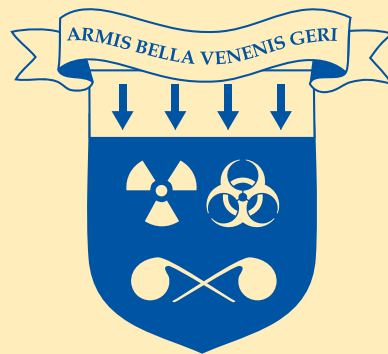


Future Warfare Series No. 61

Nuclear, Biological, and Chemical Defense in the 21st Century

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by

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Preface

A quick word to explain why we are publishing a 25-year-old monograph that was originally published by the U.S. Army Center for Strategic Leadership in 1995. We don't get many submissions that deal with the challenges of countering weapons of mass destruction or chemical-biological defense these days. In no small sense, the peak of academic writing on this subject has passed, although the danger posed by adversarial use of these weapons still remains. As a result, it is always a good thing to remind people of what clear vision and strong rationale looks like for people of our particular security community, even in a dated thesis.

Col. Richard (Rick) Jackson was a young officer when the U.S. Army decided to disestablish the Chemical Corps (1973) and then reversed that decision in 1976 to rebuild a necessary capability for modern warfare. As a result, the late 1970s and early 1980s were fertile ground for developing new doctrine and equipment for the U.S. Army. He performed an operational analysis for the Fox NBC Reconnaissance System (M93A1/M93A1P1 Fox) and briefed the analysis to the Under Secretary of the Army and the Vice Chief of Staff of the Army. This system would prove to be invaluable during Operation Desert Shield/Storm, in which he was the 82nd Airborne Division's chemical officer. It was after that operation that Colonel Jackson took pen to paper on this topic.

Over the past 25 years, the Army's doctrine and terms used for chemical-biological defense have changed, but the basic requirements have not. Rick Jackson's keen description of the "future threat" in the 21st century turned out to be very accurate, and his recommendations are still as valid and useful as they were then. It would be a mistake for anyone today to think that this mission has gone away, or that it would be more useful to move funds for developing chemical-biological defense equipment to researching medical countermeasures for natural infectious diseases.

Where is today's Rick Jackson? I think we're still looking for him or her.

ALBERT J. MAURONI
Director, USAF Center for
Strategic Deterrence Studies

Foreword

The defense against weapons of mass destruction (WMD) is a critical, but often neglected, topic.

In recognition of the importance of this area, the Army War College was tasked to perform a macro-level assessment of Title 10 and doctrinal issues associated with WMD as a part of the Chief of Staff, Army's 1994 Louisiana Maneuvers (LAM) initiatives. The resultant study, *Weapons of Mass Destruction: Title 10 Implications for the Military*, recommended changes to doctrine service, Title 10 responsibilities, and capabilities, and challenged others to perform further analysis in several key areas.

This study responds to the challenge, building upon the insight gained in the "Title 10" paper to develop an operational concept for defense against weapons of mass destruction in the 21st century. It proposes a shift in the doctrinal tenets of WMD defense to explore Information Age technology and provides a road map into the future for each doctrinal area. As such, it provides a foundation for the Nuclear, Biological, and Chemical defense of the 21st century Army using Information Age tools.

The Center for Strategic Leadership is pleased to continue its contribution to the ongoing analysis of the WMD environment and Force XXI.

DOUGLAS B. CAMPBELL

Professor,
Strategic Wargaming and Simulation
Director, Center for Strategic Leadership

About the Author

Colonel Richard A. Jackson is a graduate of the Army Command and General Staff College, Fort Leavenworth, Kansas, and the Army War College, Carlisle Barracks, Pennsylvania. He commanded at the battalion level and has been selected for brigade-level command. He served as a chemical officer in the 2nd Infantry Division in the Republic of South Korea and with the 2nd Armored Cavalry Regiment in Germany. He was also the division chemical officer in Operations Desert Shield/Desert Storm. Colonel Jackson is now the Director of Combat Development at the U.S. Army Chemical School at Fort McClelland, Alabama.

The author would like to thank the following individuals for their advice and support:

Col. John Gorrell, U.S. Army
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Col. Glenn Trimmer, U.S. Air Force

Executive Summary

This study analyzes the challenges that face the U.S. military in the critical area of defense against nuclear, biological, and chemical (NBC) weapons, which are also referred to as weapons of mass destruction (WMD). It provides a summary of the post-Cold War threat, and discusses the implications of the current proliferation of NBC weapons and their means of delivery among potential adversaries. It then provides recommendations to counter this threat, while retaining the advantages necessary to fight and win battles in the 21st century.

The Threat

The use of NBC weapons against U.S. forces is actually more probable now than it was in the past. The proliferation of NBC capabilities, coupled with the changing character of the post-Cold War threat, has lowered the international threshold for NBC weapon use. Tomorrow's opponents will have small stockpiles, but short-range ballistic missile and cruise missile technology will enable the adversary to threaten U.S. forces throughout the depth of force projection operations. Our enemies will have a small number of delivery means, but they will be willing to use these weapons to provide a strategic and political advantage that is disproportionate to the military effect of the weapons.

Force XXI Imperatives

The Army's Force XXI initiative will use information technology to give the U.S. Army a powerful advantage on the future battlefield. In order to win, the Army must maintain its Information Age "Force XXI" advantages in an NBC threat environment. The changing threat, however, has the potential to greatly reduce U.S. force operational tempo, and cause us to forfeit the edge that we need to fight and win on the future battlefield. The impact of the loss of operational tempo is so great that it becomes a coequal goal of the NBC defense system, along with the more traditional imperative of force protection.

New Directions for Defense

The U.S. military can greatly improve its NBC defense capability and the way it operates, by taking advantage of Information Age technology in the following ways:

Doctrine – Maximize the effectiveness of our joint force

- Make NBC defense a joint service function
- Focus on both maintaining operational tempo and force protection

- Adopt a three-faceted doctrinal framework – situational awareness, protection, and recovery

Training – Train our leaders for the NBC battlefield

- Focus on the training of leaders and units
- Train the way we will fight – as a joint force

Situational Awareness – Provide the Commander with a clear picture of the NBC Battlefield

- Develop a joint force NBC warning and reporting system
- Use non-hierarchical warning systems
- Pass warning directly to those affected
- Develop a system of internettted NBC detectors

Protection – Provide the soldier with simple, comfortable, and effective NBC defense equipment

- Develop less degrading protective equipment that is fully compatible with other soldier equipment
- Reduce the logistics associated with NBC protection

Recovery – After NBC attack, rapidly restore units to full combat potential

- Speed up the recovery process
- Decentralize the decontamination process so that it can keep up with Force XXI operations
- Focus decontamination assets where they are actually needed
- Improve decontamination technology.

Conclusions

The future can be bright, but only if the U.S. military makes a clear, unequivocal, joint service commitment to NBC defense. Improvements in information technology can produce a “leap-ahead” in NBC defense readiness. This will protect the force and ensure that the U.S. military is ready for combat in an NBC threat environment.

A Challenge in Three Dimensions

“Rather than a single, focused threat, America’s 21st century Army faces a broad range of challenges.”

General Gordon R. Sullivan,
Chief of Staff, United States Army

“The security challenge having the most serious ramifications for U.S. interests will come from the proliferation of WMD. The strategic-political effects of WMD overshadow their military utility.”

TRADOC Pamphlet 525-5,
Force XXI Operations

Change is bombarding the United States from many directions. This presents the armed forces with the challenge of either exploiting the change, or running the risk of being engulfed by it. The Force XXI initiative is designed to move the Army into the vanguard of this change and create a force that is fully capable of meeting its 21st century challenges. Success on the battlefield will go to the force that is able to employ its diverse and complex capabilities in a synchronized and synergistic manner. Despite change, therefore, the ability to operate in a nuclear, biological, and chemical weapons (NBC), often referred to as weapons of mass destruction (WMD), environment is one of the capabilities that will remain a critical requirement for the future military.

Weapons of Mass *Disruption*

The NBC threat to U.S. forces has changed. NBC weapons have a political impact that is disproportionate to their military value. The threat of, or use of, NBC weaponry on a nation or military force can have a psychological impact that far exceeds the actual or potential military effects of the weapons themselves. The threat of chemical or biological warheads on Iraqi Scud missiles during the 1991 Persian Gulf War had serious long-term psychological and political ramifications for Israel.¹

Future adversaries will deploy weapons against U.S. power projection operations to their political and psychological impact. The weapons will be used to produce NBC casualties, shock the world with the resultant high-visibility media coverage, weaken coalitions, and put U.S. national will to the test. Adversaries will pick their targets and opportunities to maximize the psychological impact of their smaller stockpiles. As an illustration, chemical weapons produced less than five percent of the more than one million Iran-Iraq War casualties.²

“Nevertheless, [they] had a critical effect on the Iranian military and civilian morale by late 1987 and during the Iraqi counteroffensives and ‘war of the cities’ in 1988. Sheer killing power is not the key measure of success: it is rather the

strategic, tactical, and psycho-political impact of the use of such weapons.”³ The primary military threat to future U.S. power projection capability will be in the disruption of operational tempo, not in the actual NBC casualties.

The purpose of this paper is to begin a dialogue on how the U.S. military should defend itself against NBC weapons in the 21st century. It will identify changes in the environment, and make recommendations for improving our defensive posture. Unless the military changes the way it does business, a limited amount of NBC weapons use will result in a substantial degradation in effectiveness, and cause the force to forfeit many of its Force XXI advantages. To be successful in future warfare, the United States must maintain a strong NBC defense capability.

The Future NBC Threat

“In fact, in most areas where U.S. forces could potentially be engaged on a larger scale, many of the most likely adversaries already possess chemical or biological weapons. Moreover, some of these states appear determined to acquire nuclear weapons. Weapon of mass destruction in the hands of a hostile regional power could threaten not only U.S. lives and U.S. interests, but also the viability of its regional power projection strategy.”

Secretary of Defense’s Annual Report
to Congress, February 1995

The future threat will be more complex than during the Cold War era. Adversaries in regional conflicts, and even non-state players, will have limited NBC stockpiles. Regional powers will have the delivery means necessary to threaten their opponents at great distances. These entities may also be more likely to use NBC to further their interests.

More Players

Now, the world is more complex and integrated than at any previous time in history. The growing global interdependence means that events throughout the world impact on the United States with increasing frequency.⁴ The familiar U.S.-Soviet bipolar competition has been replaced by an explosion of nation-state and non-state actors that are pursuing their own diverse interests, both regionally and globally. Coalitions are less predictable, and often issue-driven, such as the Gulf War, where Syria lined up with the United States against Iraq. Regional conflict is now the greatest threat to the interests of the United States, and more countries are involved.

A growing number of these regional states have NBC weapons. In addition to the five declared nuclear-weapons states (United States, Russia, the United Kingdom, France, and China), there are at least 20 other nations who have acquired, or are trying to acquire nuclear, biological, or chemical weapons.⁵ Such countries

have the political will to go against international arms and control initiatives to increase their security.

Most new NBC powers will have limited NBC stockpiles, due to technical, security, and resource restrictions. There will be similar limitations on state-of-the-art delivery means. Particularly in the case of nuclear weapons, a regional power's stockpile may be limited to a few operational weapons. Nonetheless, the psychological aspect of NBC weaponry allows countries to have a substantial capability with a small NBC stockpile. A few nuclear or biological weapons, in particular, can have a major strategic impact. These limited amounts of weaponry can produce a significant shift in the regional balance of power at a much cheaper price than a buildup of conventional forces.

More Likely

The advent of the New World Order has altered the battlefield calculus and lowered the threshold for NBC employment.⁶ The employment of nuclear, biological, and chemicals weapons is actually more probable today than it was in the past.⁷ "Particularly ominous is the fact that states now working the hardest to develop weapons of mass destruction are for the most part located in unstable regions of the world, where bitter and unresolved rivalries have erupted into war in the recent past and hold the prospect of doing so again."⁸ Thus it seems probable that the world will see more chemical and biological agent use in regional conflicts, as was the case in the Iran-Iraq war.

Nuclear weapons may be used in future regional conflicts. The India-Pakistan situation is an example of a potential conflict between two states with at least nuclear weapon technology, if not actual stockpiles. According to the U.S. State Department, "South Asia is the one area of the world where a regional conflict has the potential to escalate to a nuclear exchange, with devastating consequences in the region and beyond."⁹

In addition to existing threats, countries and non-state groups that can be characterized as "Terrorizers" will develop NBC capability to threaten other states, to increase their regional prestige, and may employ their NBC weapons to rapidly alter the psychological balance of a conflict. A study of chemical warfare since World War I lists five conflicts where there is an international consensus that chemical weapons were used. In four of the five cases, chemical weapons were used by a country relatively early in a conflict, when other effective military options were available.¹⁰

In these instances, it appears that chemical warfare was used to seize the psychological offensive – to terrorize and intimidate the adversary. Terrorizers are countries whose political and military attitudes permit the first use of NBC weapons in aggressive pursuit of their national interests. Their political structures sanction the development and use of NBC, and military leadership and doctrine supports the first use of NBC in a conflict. Egyptian use of chemical weapons against the Yemeni Royalists in 1963-1967 is an illustrative use of chemical weaponry as a strategic terror weapon.

The apparent deterrent effect of an NBC weapon stockpile leads to yet another threat of likely weapon use, by a “survivalist” state. These countries may develop NBC capability to deter conventional attack or the use of NBC weapons against their state, and will probably employ NBC capabilities as a weapon of last resort or insurance policy to guarantee the survival of their country in an all-out conflict. They differ from their terrorizer counterparts in that their political leadership believes in the defensive use of NBC. They may even adopt policies of no first use or retaliation in kind.

Survivalists may not acknowledge their NBC weapon ownership, but tend to leak the capability, in general terms, to their adversaries – thus realizing the full deterrent effect. These cases are harder to document, but the alleged Israeli nuclear capability may be a good example of the classic survivalist possession of NBC weapons. Presumably, these countries will withhold the use of NBC weapons until there is a significant threat to their vital national interests, but will then employ NBC capabilities as weapons of last resort. Growing numbers of survivalists thus contribute to the increasing likelihood of NBC use.

Proliferation is occurring in areas of regional conflict, and NBC weapon use in one or more of these conflicts is very likely. This is the new, post-Cold War NBC threat.

The Changing Operational Environment

“Merely building a smaller version of our Cold War Army – the victorious Army of the Cold War and Desert Storm – will not answer America’s expanding national security needs. We need a new, better Army to meet the challenges of the 21st century.”

Togo D. West, Jr., Secretary of the Army
and General Gordon R. Sullivan, Chief of
Staff of the Army

“Rapid improvements in technology are disrupting established ways of doing business. American technological superiority cannot be guaranteed. As in the past, a revolutionary advance in technology could result in reordering of economic or military power.”

TRADOC Pamphlet 525-5
Force XXI Operations

Technology – A Double Edged Sword

The history of warfare is the history of surprise and innovation. Future adversaries will not use today’s weapons on tomorrow’s battlefields. NBC defense strategies must be robust enough to withstand new and unexpected weapons and delivery systems. Unfortunately, technological advances will provide adversaries of the United States with increasingly sophisticated ways to deliver these weapons.

A few short years ago, the U.S. armed forces maintained technological edge on their adversaries through classified military research and development. Defense-related research and development was at the cutting edge of technology, and the resultant products were eventually allowed to filter into the civilian sector. This situation is now reversed. There has been a tremendous increase in the rate of technological change. The defense industry has been unable to keep the lead in this technological sprint. Currently, civilian technology is for the most part, ahead of military technology.¹¹ Much of the civilian technology can be adapted and used for military purposes.

Worldwide availability of this advanced civilian technology will improve the quality of the weapons of U.S. adversaries. Virtually all opponents will have some state-of-the-art equipment. Even non-state actors may have modern surface to air missiles, anti-armor weapons, or communications technology. Space-based navigation, communication, and intelligence assets will be available to all. With the use of ballistic missile, cruise missile, and aircraft delivery platforms, possessors of NBC munitions will have the means to put their opponents at risk at extended range.

NBC weapons will be used to produce casualties, and reduce operational tempo. Future adversaries may strike U.S. or coalition forces with NBC weapons early in the deployment process, possibly at ports or airfields. The purpose of the attack would be to create a large number of casualties, and generate a shock among

the U.S. and coalition forces that would reverberate throughout the world. The ultimate aim of the attack would be to demonstrate the ineffectiveness of U.S. and coalition defenses, and to put national and coalition will to the test. The threat of these attacks will cause the United States and the coalition to take protective measures during the deployment. These protective measures, such as use of alternate port facilities, dispersion, forward positioning of NBC defense units, and stockpiling of NBC defense equipment, will slow the deployment and reduce operational tempo – whether the adversary uses NBC weapons or not.

This is a significant change in the environment for U.S. power projection. In past power projection operations, a large portion of deploying U.S. military forces could expect a measure of sanctuary, due to distance. Airbases and ports were selected based on the effective distance of enemy weaponry. This will no longer be possible. Adversaries will be able to threaten U.S. forces with NBC throughout the depth of their deployment.

Fortunately, this advanced technology will also provide some powerful tools to counter these adversaries. The challenge of Force XXI is to exploit this capability to our maximum possible benefit.

Technology by Itself is Not Enough

Mere possession of a new technology does not guarantee a military advantage. Victory will go to the force that combines technological development with doctrinal innovation and organizational adaptation to produce a significant increase in military capability.¹² This phenomenon, called a “Revolution in Military Affairs,” becomes visible when a military force puts it all together on the battlefield. The most often cited example is the German blitzkrieg of World War II. The Germans used common technology available to their opponents – the airplane, the radio, and the tank. They achieved success by developing the doctrine and organizations that combined these technological tools in a synergistic and devastating combination that changed the character of warfare in World War II.

The Force XXI Imperatives

The Army’s current program to adapt its forces and concepts to the new operational environment is known as Force XXI. The Force XXI initiative is an effort to fundamentally re-engineer the U.S. Army, from top to bottom, to fight and win America’s future wars. It represents a major commitment to understand and exploit the explosion of information management, information processing and communications technology that is cumulatively referred to as the Information Age.¹³

Five basic trends will shape the operation environment in the 21st century.¹⁴

- Greater lethality and dispersion
- Increased volume and precision of fire
- Better integrative technology leading to increased efficiency and effectiveness
- Increasing ability of smaller units to create decisive results
- Greater invisibility and increased detectability

Successful future strategies for defense against NBC weapons will account for these changes in force capability and exploit the tools given to us by Information Age technology.

Supporting Force XXI New Directions for NBC Defense

NBC Defense Methods Must Keep Pace

The challenge is to extend the “Revolution in Military Affairs” to NBC defense. The military NBC defense capabilities must support the overall operational concept. If this is not the case, a vulnerability is created. The vulnerability, a lack of operability under NBC conditions, encourages an adversary to use NBC weapons. A robust NBC defense capability is an essential component of U.S. deterrent strategy. The future joint force must be fully capable of combat operations under NBC conditions.

How NBC Defense Contributes to the Fight

The operational-level commander generates power through the interaction of six elements. “In the environment in which Force XXI will operate, power will derive from the ability of a force to:

- Sense the enemy, itself, and its environment;
- Strike an opponent decisively;
- Protect itself from the attacks of the opponent;
- Move freely in the area of operations;
- Exercise control over sub elements; and
- Sustain itself.”¹⁵

NBC defense actions contribute to operational power in each of these elements by allowing the force to maintain an advantage in operational tempo under NBC conditions, and by protecting the force. Thus, the coequal goals of the NBC defense system are to maintain operational tempo and protect the force. (*See Figure 1*)

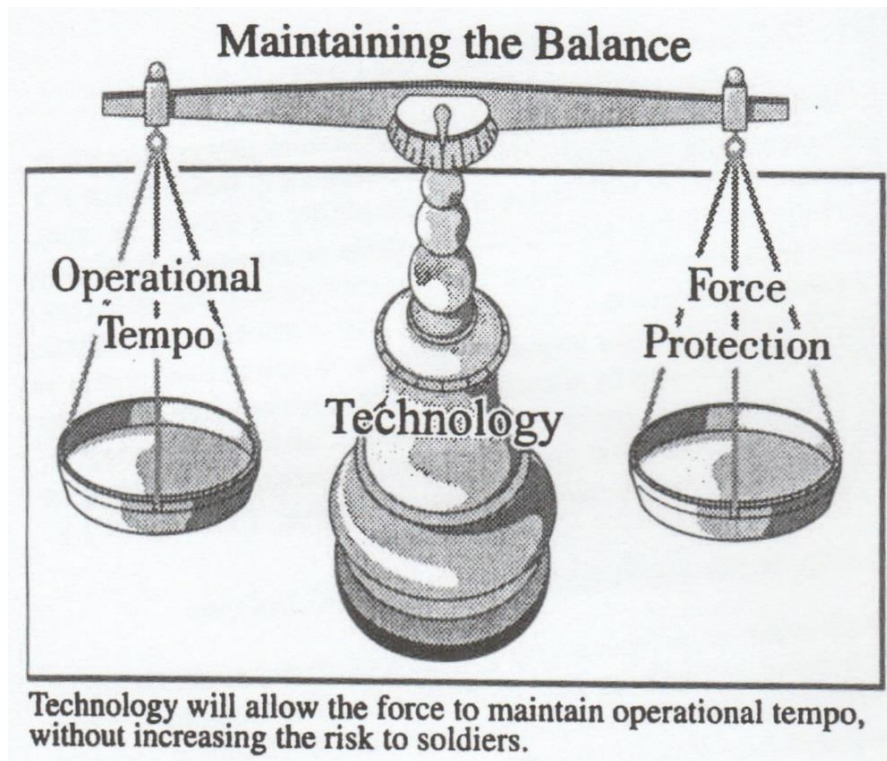


Figure 1: Technology will allow the force to maintain operational tempo without increasing the risk to soldiers.

A Change in the Fundamental Focus of NBC Defense

Two events in our recent past give us a window into the future of NBC defense in the Force XXI environment. The Combined Arms in a Nuclear and Chemical Environment Force Development Test and Experimentation (CANE FDTE) was a series of Army field tests conducted in the late 1980s and early 1990s. The CANE FDTE provides substantial insight into the impact that chemical protective measures have on the operational tempo and effectiveness of a force. These tests showed that NBC defense measures, such as the wearing of personal protective equipment (masks, suits, boots, gloves), can greatly reduce force effectiveness. The CANE FDTE also showed that NBC defense training can reduce this loss of effectiveness.

The second defining event was the 1990-1991 Persian Gulf War. The United States fielded a force that was trained, equipped, and organized for NBC defense. In spite of extensive peacetime preparation, shortcomings in U.S. force NBC defense posture were evident. Iraq's threat of NBC weapons use caused U.S. forces to take extensive NBC defense precautions, and spend extended periods in full protective clothing when there was no NBC attack. Tens of thousands of U.S. military personnel spent hours, or days, in some form of chemical protective equipment. During the Scud missile attacks on Dhahran and Riyadh, Saudi Arabia,

units throughout Saudi Arabia went into full chemical protective clothing. This results in a significant degradation of operational capability. Units operating in full military oriented protective posture gear (MOPP 4) are degraded by approximately 50 percent in their ability to accomplish their mission.¹⁶

Commanders took precautionary measures to protect the lives of soldiers, and in doing so, reduced their operational tempo. The net effect was a reduction in overall force effectiveness, even though no chemical weapons were used.

Protecting the force is an intuitive and important issue on the battlefield. It has been the traditional focus of the Army's NBC defense strategy. While force protection will remain a critical goal, the changing environment has created a new focus for NBC defense efforts. The new threat, when coupled with the Force XXI mandate to be able to fight numerically superior forces with a smaller, qualitatively superior force, changes the fundamental thrust of the NBC defense strategy. Operational tempo is now the Achilles Heel of the combat force.

Protective measures degrade efficiency, and affect large numbers of troops, whether there is an NBC attack or not. NBC attacks may be deadly, but will only affect a small portion of the force (recall the previous "less than five percent casualty" figure given for the Iran-Iraq War). Future adversaries can slow U.S. operational tempo by the limited use of chemical or biological weapons sufficient to force soldiers into cumbersome protective measures. This will cause the Army to forfeit its Force XXI qualitative advantages to the enemy – an unacceptable consequence. Fortunately, the Information Age provides the military with a solution to this problem.

Exploiting Information Age Technology

Information Age technology can allow the force to maintain its operational tempo, and fight and win in an NBC environment. Rapid transmission of information, and computer-aided assessment and evaluation could revolutionize the way forces fight the NBC defensive battle. The hypothetical scenario illustrated in the Annex shows how enhancements in information technology can improve NBC defense capabilities. Three measures stand out as being necessary elements for success in the future:

- Managing theater NBC defense on a joint service basis
- Developing intelligent sensor-to-soldier warning systems
- Speeding up the recovery process

Manage Theater NBC Defense on a Joint Service Basis

The NBC defense effort needs shared information throughout the joint battlespace to orchestrate critical defensive measures, especially in multiservice, rear-area locations, such as ports. Currently, NBC defense is a service responsibility. Continuing this approach, NBC defense will hinder the full exploitation of Information Age technology, fail to provide the most effective use

of our limited resources, and will not result in the best force protection for the Joint/Coalition Force.

The Persian Gulf conflict provides an example of the need for a joint information system. The greater Dhahran, Saudi Arabia area was a major air and sea point of entry for U.S. forces. There was a myriad of units, primarily Army and Air Force, both “stationed” in Dhahran, and “passing through” the port area. There was no single source of NBC threat information for the area. Some units received information from their higher headquarters. Some units made ad hoc arrangements to get warning data from adjacent units, and some units had very little, if any, information at all.

When the Scud missile attacks occurred in January 1991, there was mass confusion over the possibility of chemical contamination in the area. Some units spent hours in full chemical protection in the belief that a chemical attack had occurred, or was imminent, while adjacent units took no protective action at all.¹⁷ This was not because of different service or command philosophies on risk-taking. The situation occurred because there was no common situational awareness of the NBC threat.

Adversaries will be able to threaten U.S. power projection efforts from the point of entry into the theater to the front lines of the battle area. Ports, airfields, and other similar locations with intermingled joint forces will be prime targets. In order to counter this vulnerability and maximize efficiency, a joint approach is necessary. These jointly-inhabited operational areas need to be identified as joint battlespaces for NBC defensive purposes. The goal is then to develop an architecture of warning, protection, and recovery processes that optimize the protection of the joint force. The joint force commander becomes the leader of the NBC defense team. Warning information can be passed to all within the battlespace, using non-hierarchical information systems. NBC detection, reconnaissance, and decontamination can be done on an area basis, regardless of service affiliation. This will eliminate duplicate capability, and provide greater coverage with fewer resources. The effects of NBC weapons are felt on an area basis. Weapons effects do not move along unit or service lines. Consequently, joint force protection measures should also be implemented on an area-wide basis.

Develop Intelligent Sensor-to-Soldier Warning Systems

The key to maintaining operational tempo is to take protective measures only when there is an actual NBC hazard. This requires an integrated sensor system to warn soldiers in time to take protective action. “Smart” systems are necessary to take advantage of information availability, and may acquire data from many sources. Diverse systems, such as ballistic missile trackers, air defense radars, and NBC detectors can be integrated into a smart system that sends a warning down to the soldier level. Automated assessment methods would filter out isolated false alarms, and only send warnings to those personnel that are affected. This makes the “invisible” hazards of NBC weapons “visible” to commanders and soldiers. A smart sensor system provides an expanded situational awareness, allowing the force to maintain its operational tempo by minimizing the percentage of the force that is

encapsulated in protective equipment. (See Figure 2) Units would no longer go into MOPP 4 as a precautionary measure. When alerted by the sensors, they would rapidly take protective measures prior to the arrival of the hazard. This sensor system, operating in the joint battlespace, would allow the force to lower its protective posture, without unacceptably increasing the risk to soldiers. This is a critical capability to maintain operational tempo.

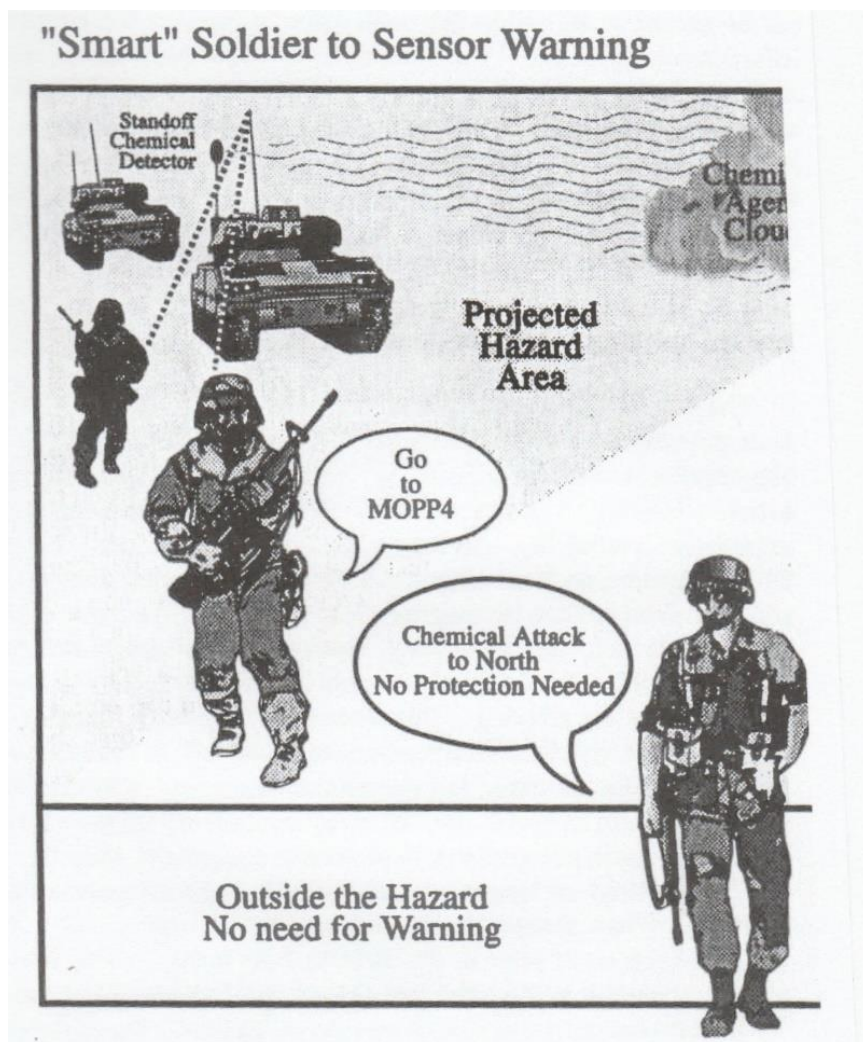


Figure 2: "Smart" soldier-to-sensor warning.

Speed Up the Recovery Process

Recognizing that hazard avoidance will not always be feasible. Current doctrine lists decontamination as a major element of our NBC defense strategy. With the shift to an operational tempo focus, the battlefield process of concern becomes recovery. The recovery period begins when a soldier dons protective equipment, and ends when the soldier resumes normal operations. Minimizing the recovery time maximizes the operational tempo of the force.

Once soldiers don protective equipment, the goal becomes to get them out of the encapsulation as quickly as possible so that they can resume normal operations. This applies whether the soldier was actually exposed to an NBC hazard or not. If there is no NBC hazard, the unit should rapidly return to normal operations. The advanced sensor system discussed previously would minimize the number of these situations and rapidly notify the unit of the “clean” status of the battlespace. If the unit is actually subjected to an NBC hazard, it continues to operate, but attempts to recover as soon as possible.

One of the most time-consuming elements of the recovery process is decontamination. Computer simulations and live agent test data shows that only a fraction of the vehicles in a unit will be significantly contaminated in a chemical attack. The Force XXI trends of greater dispersion, smaller elements, and greater invisibility will further reduce the percentage of a unit that is actually hit. The rapid identification of uncontaminated vehicles will allow units to recover quickly, resume normal operations with uncontaminated vehicles, and focus on the decontamination of the relatively few contaminated vehicles. Advanced detection equipment can rapidly identify the contaminated vehicles and equipment, so that the decontamination effort can be focused where it is needed. This will greatly speed up the recovery process.

A Proposed New Framework Doctrine to Support Force XXI

The major thrust areas of joint NBC defense management, sensor-to-soldier shared information systems, and rapid recovery can be incorporated into a revised NBC defense doctrine:

- Make NBC defense a joint operation
- Focus on maintaining operational tempo under NBC threat conditions and force protection
- Change the doctrinal focus from contamination avoidance, protection, and decontamination to situational awareness, protection, and recovery
- Provide enhanced NBC defense training

Situational Awareness

The goals of the situational awareness system are threefold. The first is keep soldiers out of protective equipment without increasing risk. Second, when a hazard is present, we must warn soldiers of the hazard so that they may take protective action prior to becoming a casualty. Third, we must provide information to commanders so that they can visualize the NBC battlefield, and plan and operate under NBC conditions.

Situational awareness of NBC hazards is a subset of the overall situational awareness of the battlefield, and a subset of the “sense” element of operational power. Simply stated, all joint force units and elements should know their own location, the location of any NBC hazards, and whether the NBC hazard will affect their operation. Under most circumstances, the enemy cannot contaminate the entire area of operations. The majority of units will spend most of their time under “clean” conditions, and will not need to take any protective measures. In the past, the protection level was increased, which (due to degradation caused by protective equipment) decreased the operational tempo when there was no hazard present.

Enhanced situational awareness will increase force readiness by eliminating the need to unnecessarily don protective equipment when no hazard is present, and will provide a warning of an actual NBC attack in sufficient time for soldiers to take protective measures. In order to achieve situational awareness, the joint force must:

- Know the NBC threat prior to the initiation of hostilities
- Develop indicators of imminent NBC use by adversaries
- Identify potential NBC weapons prior to their impact/release
- Predict the impact/release point of incoming NBC weapons
- Detect and identify NBC hazards
- Know the weather conditions in the impact/release/hazard area
- Develop a hazard estimate, based on estimates of weapon performance and weather data
- Know the location of joint force units
- Have a means to selectively warn units in the hazard area, so they can take protective measures prior to hazard arrival
- Have a means to notify elements of the force of any long-term hazard zones, so that they can avoid contaminated areas

The object of an NBC hazard detection system is, ultimately, to warn a soldier, sailor, airman or Marine of a hazard. If the soldier is warned and is able to take protective action prior to being affected by the hazard, the system worked. If the detector sent a false alarm, or did not provide a warning to the soldier in time, the system failed. Rather than developing individual detectors, combat developers need to expand their thinking to detection systems. These systems could be multiple detectors and sensors of different types, arranged in an array, and electronically

linked. This would allow the detectors and other sensors to achieve synergy and compensate for weaknesses or technological limitations in any single detector or sensor. This concept is called “cooperative detection” and may include, for example, the integration of information from intelligence systems, theater missile defense systems, NBC reconnaissance systems, standoff detectors, and point detectors. As a result, the array may be able to “see” agents that no single detector could detect, with a minimal probability of a false alarm, and rapidly transmit its alarm to units in the hazard envelope. False alarms reduce operational tempo, and ultimately, cause soldiers to ignore the alarm warning. False alarms must be virtually eliminated in order to implement the sensor-to-soldier warning system. Information transmission is an integral part of the detection system. The world’s smartest detector is worthless if no one gets its warning alarm. The successful NBC warning and reporting system will have a seamless transmission of information, across service lines, on an area basis, to warn affected units.

Protection

The goal of the protection system is to protect personnel and equipment from the effects of NBC hazards. Protective equipment should be configured so that a soldier can rapidly transition from a condition of no (or partial) NBC protection and insignificant degradation – to full NBC protection. Effort should continue to develop individual and collective protection systems to reduce degradation, and allow units to maintain a high operational tempo while in protective posture. The logistics burden associated with NBC defense equipment must be reduced. Protective equipment, as much as possible, should be serviceable for the duration of the conflict if no attack occurs. Reusable equipment is preferable to disposable equipment.

The concept for biological defense will be different than for chemical and nuclear defense. In the year 2010, severe limitations will remain in the ability to rapidly detect and identify biological agents. Technology will not allow accurate real-time warning of a biological attack so that protective measures can be taken prior to exposure. Soldiers will be exposed to biological agents before the attack is confirmed. Until the real-time technology is available, doctrine needs to focus on accurate identification of threats, a broad-based vaccination capability, early discovery of a biological attack (the identification of an attack, and the causative agent within, say one hour), and broad-spectrum, post-attack medical treatments that can be rapidly administered to large numbers of forces. Medical vaccines and treatments will be the cornerstone of the biological defense system.

Recovery

The aim of the recovery system is to have personnel and units return to normal operations as quickly as possible, after a real or suspected NBC attack. As contamination avoidance was expanded to include all elements of situational awareness, decontamination should be expanded to look at the whole recovery process. The recovery process supports the Force XXI concepts of demassification,

battlespace expansion, survivability and tempo. As mentioned earlier, the key to speeding up the decontamination process is to rapidly sort out the uncontaminated people and equipment, and return them and their equipment to normal operations. Units require rapid and accurate detection equipment for this purpose. The reduction of the logistics burden associated with decontamination is a key enabler in the decentralization process.

Requirements for large quantities of water and decontaminant should be reduced or eliminated. Reusable equipment is preferable to replaceable equipment. Restoration of full operational tempo requires that soldiers rapidly be able to remove their respiratory protection after NBC attack. The decontamination paradigm must change through doctrinal and technological innovation. The movement of large units to a brigade support area for a lengthy decontamination process is unacceptable in a Force XXI environment. The answer to rapid recovery is to decentralize the recovery (and decontamination) process. A complete decontamination capability should be available at the battalion task force equivalent-level. Decontamination at any higher level will result in an unacceptable reduction in operational tempo.

Training

The CANE FDTE showed the gain in operational effectiveness that can be realized by a trained force. Soldier-level NBC defense skills are perishable. A solid base of institutional and unit training is required for each individual. Once this level of proficiency is obtained, these skills can be quickly refreshed during the deployment process. Leader training is less perishable and more complex. It cannot be learned during the deployment process. Leaders should be trained in how to fight under NBC conditions, and the centerpiece of this training should be at the Combat Training Centers and in Battle Command Training Program. This is the absolute best leadership training in the Army, and it is the place where the Army's best NBC training should take place. Training time at these events is very limited. The goal is to give leaders the same quality and challenges in their NBC defense training as they currently get in their combat arms training, within the resources that are available. These training programs prepared soldiers to fight and win in their first combat experience – the Persian Gulf War, and did it well. Now, NBC defensive training must be upgraded so that the first American combat under NBC conditions will enjoy equal success.

NBC defense is a joint issue, and requires joint force NBC training. Exercises that deploy joint forces can train in NBC defense and make information flow and protective measures a seamless process that flows across service lines. Joint force exercises need to be demanding NBC exercises with an extensive after-action assessment process.

Conclusions

The current NBC defense doctrine, equipment, and organization will not carry the United States military into the 21st century. There is a need to re-engineer the U.S. approach to operations in an NBC threat environment. The improvements should focus on two imperatives: maintaining operational tempo and protecting the force. The keys to success in the future are:

- Adequate resourcing of NBC defense programs
- A joint service approach to NBC defense
- A shift in doctrine to emphasize operational tempo and force protection as co-equal goals
- Using Information Age technology to improve warning systems
- Faster recovery from NBC attack
- An aggressive NBC defense training program

The future can be bright, but only if adequate resources are provided. Joint service research, development, acquisition, and training initiatives will provide for more effective use of our scarce funding, but the United States must make a clear, unequivocal commitment to be the world leader in NBC defense.

Many doctrinal and capability improvements are needed, but three areas clearly stand out. First, the challenges of the NBC threat require a joint force defense strategy, and a joint force leader to orchestrate NBC defense operations. Managing NBC defense on a joint force basis will improve force protection and the utilization of scarce resources. Second, establishing advanced sensor systems with sensor-to-soldier links is the key to maintaining operational tempo. Third, improvements in the recovery process are needed to rapidly return forces to the conflict.

These changes, while not guaranteeing that U.S. forces will achieve decisive victory on the future battlefield, will ensure that no adversary can do so through the employment of NBC weapons.

Endnotes

1. "The long-term psychological and political impact of these experiences is difficult to measure, but likely to be significant. The association of chemical warfare with the Holocaust will amplify the impact for the Jewish population. In short, the Gulf War had a major impact on Israel, and it would be a mistake to underestimate or belittle its impact." Extracted from Gerald M. Steinberg, "Israeli Responses to the Threat of Chemical Warfare," *Armed Forces and Society*, vol. 21, no. 1, Fall 1993, p. 98.
2. U.S. Congress, Office of Technology Assessment, *Proliferation of Weapon of Mass Destruction: Assessing the Risks* (Washington D.C.: U.S. Government Printing Office, August 1993), p. 58.
3. Anthony H. Cordesman, *Weapons of Mass Destruction in the Middle East* (London: Brassey's UK, 1991), p. 92.
4. Honorable William J. Perry, *Report of the Secretary of Defense to the President and the Congress* (Washington D.C.: U.S. Government Printing Office, February 1995), p. 1.
5. *Ibid*, p. 25.
6. "Assessing the Risks," see the section on "Erosion of Norms," p. 71.
7. Prepared remarks of Secretary of Defense Les Aspin to the National Academy of Sciences Committee on International Security and Arms Control, Washington D.C., *DOD Defense Issues*, vol. 8, no. 68, "The Defense Counterproliferation Initiative Created," Dec. 7, 1993.
8. "Assessing the Risks," p. 11.
9. Robin Raphel, "U.S. Policy Toward South Asia," *U.S. State Department Dispatch*, vol. 6, no. 13, March 27, 1995, p. 248.
10. The framework of "Terrorizers and Survivalists" is an extension of the thesis contained in an article by Robert Mandel, "Chemical Warfare: Act of Intimidation or Desperation?," *Armed Forces and Society*, vol. 19, no. 2., Winter 1993, pps. 187-208. In this article, Mandel selected the Italo-Ethiopian War of 1935-36; the Sino-Japanese War of 1937-45; the Egyptian-Yemeni War of 1963-67; the Soviet-Afghan War of 1979-89 and the Iran-Iraq War of 1980-88 as the "internationally accepted" uses of chemical warfare. There may be some controversy about the inclusion of these conflicts and more likely, the exclusion of others. Using the categories proposed in our article, the initiation of chemical warfare by Iraq in the Iran-Iraq War was a "survivalist" employment. The other four fell in the "terrorizer" category.
11. Michael J. Mazarr, *The Revolution in Military Affairs, A Framework for Defense Planning*, (Carlisle, Pa.: U.S. Army War College, June 10, 1995), p. 23.
12. See James R. FitzSimonds and Jan M. van Tol, "Revolutions in Military Affairs," *Joint Force Quarterly*, no. 4, Spring 1995.
13. There is a huge body of literature on this and related subjects. A few of the basic primers on the subject are: Alvin and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21 Century* (Boston, Mass.: Little, Brown and Company, 1993); Gen. Gordon R. Sullivan and Col. James M. Dubik, *War in the Information Age* (Carlisle, Pa.: U.S. Army War College, Strategic Studies Institute, February 1993); and Gen. Gordon R. Sullivan and Lt. Col. Anthony M. Corrales, *The Army in the Information Age* (Carlisle, Pa.: U.S. Army War College, Strategic Studies Institute, March 1995).

14. These trends are identified in Gen. Gordon R. Sullivan and Lt. Col. Anthony M. Coroalles, *The Army in the Information Age* (Carlisle, Pa.: U.S. Army War College, Strategic Studies Institute, March 1995).

15. Sullivan and Coroalles, p 4.

16. The “about 50 percent” is a reasonable, but not precise, figure. The measured degradation in MOPP 4 varies significantly, depending on the task being performed, the time in protective clothing, the level of soldier training, the type of protective equipment, the temperature, and other factors. The U.S. Army Chemical School’s Combined Arms in a Nuclear/Chemical Environment (CANE) Force Development Test & Experimentation (FDTE) has a wealth of information on the degradation experienced under a given set of conditions. The 50-percent figure is an attempt by the author to average the degradation over all tasks and conditions to provide a single number. It is based on the full range of CANE FDTE results. See the Summary Evaluation Report for CANE FDTE: *Close Combat Light*, May 1993, for illustrative data.

17. Personal observation by the author during the Persian Gulf War.

Annex - An Illustrative Scenario

Up to this point, this article has dealt conceptually with the “face of future war.” Now, the art of the possible will be discussed in familiar context – a second Persian Gulf War. This narrative shows how better information management could improve NBC detection protection, and decontamination efforts – and improve the force protection of the joint force.

Somewhere in the Persian Gulf, Year 2010

It was hard to believe that it happened again, reflected the tired Army lieutenant colonel. He and his driver sat in their dusty battered HMMWV on top of a sandy hill. A hot, dry wind was at their back as he watched a long line of vehicles being checked for low-levels of chemical and biological contamination prior to movement to the port for redeployment. Watching this was about as interesting as watching paint dry. The process was going well, but it took a long time. Fighting an urge to sleep, he stared at the activity in front of him and let his mind go over what had happened.

Twenty years earlier the lieutenant colonel had been a young second lieutenant in the 82nd Airborne Division. Right after the Chemical Officer’s Basic Course and Ranger School, he deployed to the Persian Gulf with his Battalion Task Force. He hadn’t been in the “real Army” for three months, and he was responsible for protecting 800 soldiers from nuclear, biological, and chemical weapons. He always remembered the talk that he had with that old division chemical officer in the XVIII Airborne Corps marshaling area. It was like the chalk talk before a football game, going over the threat, training, equipment checks, and more equipment checks. They never got “slimed” in that war. Now, three things were different. It was 20 years later and he was the old division chemical officer. Now, the enemy used chemical and biological weapons this time.

We fought the war a lot differently than we did in 1991, he thought. The enemy had gotten a lot better. They had new, high-tech equipment in almost every area, but the bottom line was still the same. This time, everything happened faster. We got there quicker – good thing, because now they attacked while we were deploying. The Air Force, Navy, Marines, and Army tore them up from the air, even better than before. This time the ground forces had to hold the line until we completed the deployment. It worked pretty well. We got them so confused, it wasn’t much of a fight. We owned the day. We owned the night. We also owned the land, the sea, the air, space, time, and the electrons. When we went on the offensive, it was awesome. The theater commander-in chief wielded the joint and combined force like it was a sword in his hand. The 100 hours of 1991 became the 40 hours of 2010 – the most devastating combat operation that the world has ever seen. It was orchestrated like the finale of the 1812 Overture, every force and battlefield operating system performing on cue, in tune, and combining into a crescendo of combat that utterly destroyed the enemy’s will to fight. You knew we really had something when you saw tens of thousands of highly trained enemy soldiers, alive and uninjured, but confused, dazed, and stunned. In a period of hours,

we turned an armed force that terrorized the region for 10 years into an aimless, wandering mob, incapable of any military action.

Tank for tank, our equipment wasn't all that much different. The big difference was that we knew where they were, what they were doing, and what they were going to do. We also knew where we were, what we were doing, and what we were going to do – down to the individual soldier level. Information, not bullets, carried the day for us.

The only thing that messed up this otherwise splendid little war was the use of chemical and biological warfare in a desperate attempt to delay our offensive. It didn't work, but it sure made life more interesting.

He looked through the sandy haze at the reddish-orange sun that was winning its battle to fry every living thing in this corner of the world, and thought about the chemical and biological attacks like they were in his distant past. But it just happened a few weeks ago.

It would have been much different in 1991. It was funny, he thought. We haven't made huge progress in protective equipment, detectors, and decontaminants since the first war. The equipment we have is really improved versions of the 1990s stuff. What made the difference was communications, analysis and information flow.

This time, the enemy saw the handwriting on the wall. When we started pouring into the country, they knew that they were in trouble. They hit us right away, and tried to push us back into the Gulf. Didn't work. They got hit bad, and pulled back to lick their wounds. When they saw us building up so fast, they panicked. They knew the end was near. They were looking for a way to stop us in our tracks. "Black Sunday" was their answer. Early on Sunday morning, they launched every ballistic and cruise missile they could find in a period of one hour. We did a great job of dispersing and hiding our tactical forces. They couldn't find or target our shooters. They took the easy way out and hit the two things that we couldn't hide – the ports and airfields. Luckily, we had gotten most of our Theater Missile Defense (TMD) systems in place. Unluckily, we took a couple of hits with chemicals on the fringes of our TMD coverage. Our division got hit as we were pulling out of the port. That didn't go too badly. Our theater-level systems spotted the cruise missiles coming in well in advance.

We really got serious about joint service nuclear, biological, and chemical defense (NBC) training and doctrine in the 1990s. Now all services integrated their NBC defense plans, just like TMD. When the warning went out, it was much different than in the First Persian Gulf War. Then, the Iraqis test-fired some Scud missiles in Iraq, and tens of thousands of GIs donned protective gear in Saudi Arabia for hours as the inaccurate and untimely warning filtered down the chain of command. Now, we made missile and aircraft warnings a "non-hierarchical joint service information system." What that really meant, he chuckled, is that you get the information directly to the guy who needs it, at the same time you tell the higher headquarters. No more taking hours to get information through the chain of command. We didn't alert the whole country either. Our computers had the current weather data and they knew every unit location. The computer figured out the hazard area and we flashed a warning out to all units that needed to take protective

action. The warning popped up on digital display units at company-equivalent level, across all the services, five minutes prior to impact. That made a huge difference.

We were already in our new lightweight protective suits. The protective suit is our standard combat uniform – we wear it all the time. Every soldier got the warning at least one minute prior to impact. That was all the time they needed. Virtually everyone got their masks on before the missile hit. The missile itself didn't do much damage, but we were in for some high adventure when the chemical attack alarm arrays started lighting up. We still have a false alarm problem with our chemical agent detectors, but we have networked them together and made the system smarter than any single alarm. Now a false alarm won't panic everyone. The computer figures out which alarm is activated, what the wind direction is, what the other alarms are reading, and sees if it makes sense. It virtually eliminated false alarms with no measurable delay in the warning time. It beats sorting things out in MOPP 4, like we did in the old days. Eliminating the false alarms really improved soldier performance. Now, when the chemical detector array alarms, they move out smartly.

This information flow and improved detection capability really changed our whole approach to chemical and biological warfare. Now, our commanders know the contamination status of their battlespace. They know what is dirty and what is clean. We have taken an "invisible" hazard and made it "visible" to our soldiers. We don't stop and go into protective equipment all the time like we used to do. Our situational awareness lets us operate without protective equipment because we know that we will have adequate warning of a hazard. We increased our combat capability without increasing our risk – with technology and information.

The decontamination went pretty well. The biggest single improvement we made in decon was that we quit decontaminating clean equipment. It sounds funny, but in the old days, we couldn't really figure out what was "dirty" and what was "clean," so we tended to decon everything. This time, my digital display unit started getting reports within 30 minutes. Our unit-level monitors were working well, sorting out dirty and clean. Only about 25 percent of the vehicles in one battalion were contaminated. Having a complete decon capability at battalion level made a huge difference. In the old days, we used to pull units out of battle into the brigade support area processing at massive decon sites. People and water everywhere, it looked like the car wash from Hell.

Our tactics won't let us do that anymore. We can't afford the time penalty, and we don't bunch up like that anymore. Now decon is one truck, one team, no water. The vehicle crew and the decon team do it all. Since we don't need water, we can do it almost anywhere. It went quickly. Kind of miss all the junk that we used to have around a decon site. We used replaceable overgarments, boots, gloves, and we used tons of decontaminates. Between our reusable clothing and equipment, and our sorting our dirty and clean, it hardly takes anything now. I bet the "loggies" don't miss the acres of NBC equipment that we used to stack up in the old days. Heck, we were doing so good, we even helped out a few Marines.

We do decontamination on an area basis now, regardless of service. This lets us use our decon assets more effectively. The Marines got a couple of vehicles hit, and their digital display units vectored them to our decon site. That's where our

joint doctrine and training paid off. Decon sites are “purple.” We all do them the same way. Told the Marines that they owed us. The Marine commander sent me a message on my digital display unit saying she would buy me a “virtual beer.” Now, 20 years later, and they still don’t drink beer here.

The biological attack wasn’t as simple. When the chemical attacks didn’t work, the boys up north were desperate, and got real ugly. Anthrax in the attack. Never thought that I would see it. The missiles came again, at night again. This time they detonated far upwind, outside of our TMD coverage. We couldn’t figure out what they were doing – until the biological detectors started lighting up. We had our bio detection teams out in an operational-level array. We didn’t own any at division level. They are a joint unit that was under theater-level control. Still, our battlespace was covered by overlapping teams. Rapid biological detection and identification is still an art, not a science. It will never be as simple as detecting nerve agent. These biological detection and identification teams are essentially remotes for the smart guys back in the States. We figured out long ago that when you get your biological detection results, there is a lot of assessment involved before you yell “Bio.”

We used to do it out in the field, at the biological detection company commander level. Then we figured out, with our communications capability, it was just as easy to send the information back to the States as it was to send over a hill. Now the information goes from the detector vehicle to a bunch of stateside doctors and scientists with access to our latest ultra-computers. They get the readouts directly from the vehicle, and can control the types of information that the vehicle provides to them. They check all of the information feeding in from all of the detection teams, do a tentative identification, and send back a hazard plot, as if they were sitting in the company commander’s vehicle. The chain of command then decides on a course of action, and puts out a warning, just like the chemical attack.

When we got the anthrax attack warning, the “bugs” had been in the air for about an hour. These biological pathogens can cover enormous areas, and the whole division was in the potential hazard zone. Made the division commander’s day when I told him that. Luckily, the entire division had been vaccinated. We went into our protective gear for six hours to reduce inhalation of the anthrax spores, and moved out of the hazard area. As a precaution, the division surgeon had us take oral antibiotics. We were heading out on the attack, so we didn’t even stop to decontaminate. We let the desert sun and sand go after the bugs. We won’t know how much of the anthrax hit our unit for a while. Our medical teams continuously pull air samples, even when there is no known NBC warfare, to pick up any unknown agents and to account for exposure to any non-NBC warfare environmental hazards. That gives us our hard evidence of the chemical and biological exposure, but it takes a while to get the results back. So much for the biological attack. The vaccine, the mask, and the antibiotics did the trick.

After that, we rolled north and did what we get paid to do. The plan came together, and again, almost everybody in the division will be going back home.

Oh well, enough of this laying around the HMMWV and pondering the past, thought the colonel. He saw a second lieutenant he knew down at the equipment monitoring site. I'll go down and talk with him, the colonel reflected. Who knows – he may be doing this again 20 years from now.

With a mild protest at being disturbed, the colonel's old bones shifted out of the HMMWV and started down the hill



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