CHEMICAL-BIOLOGICAL ATTACK: ACHILLES HEEL OF THE AIR EXPEDITIONARY FORCE?

by

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Air University

Maxwell Air Force Base, Alabama

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The Author

Colonel Byron C. Hepburn, M.D., is one of eight USAF pilot-physicians. Prior to residence at the Air War College in 1998-1999, he served with the 33rd Flight Test Squadron and coordinated all human factors testing on the C-17A. These tests included aeromedical, chemical defense, night vision, and oxygen systems evaluations. Additionally, he is actively involved in aircrew pharmacological research with the Air Force Research Laboratory and the French Institute of Aerospace Medicine. Other assignments have included a tour as Chief of Aerospace Medicine, 437th AMDS, staff physician, USAF Academy Hospital, and Deputy Chief of Standardization, 11th AAS. Colonel Hepburn is a distinguished graduate of the U.S. Air Force Academy and Squadron Officers School. He holds a masters equivalent from the University of Geneva, Switzerland and a M.D. from the Uniformed Services University of the Health Sciences. He is a Command Pilot with over 3,000 hours in the T-37, T-38, C-9A, and C-17A.

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I dedicate this work to the memory of my late father, Lieutenant Colonel James W. Hepburn, U.S. Army Chemical Corps. As commander of the 164th Chemical Company during WWII, his unit's offensive weapons capability helped deter the use of such weapons on our own forces. Later as Chief of the Chemical Corps Materiel Planning and Program office, his expertise was vital to the establishment of sound policy during the critical Cold War period. Colonel Hepburn's love of family and country lives through the lives of his children and grandchildren.

Abstract

The U.S. National Security Strategy calls for our armed forces to help shape the international environment, respond to threats and crises, and prepare now for an uncertain future. To assist in the execution of this strategy, the U.S. Air Force is developing a new operational entity, the Air Expeditionary Force. This force will be tailored to quickly respond to crises or conflicts at any point on the globe. Given its technological and materiel superiority, the force will have no conventional equal. However, to effectively accomplish its mission the Air Expeditionary Force must have minimal redundancy in personnel and equipment and be supported over extended distances by airlift. These characteristics make the force particularly vulnerable to an asymmetric attack by chemical and biological weapons.

Despite formal international prohibitions against chemical-biological weapons, recent history has documented their use against civilian and military personnel with significant consequences. Currently, twenty-five nations are known to have chemical-biological weapons and it is presumed non-state actors, such as terrorists groups have acquired them as well.

Air Force leadership must neither exaggerate nor trivialize the chemical-biological threat to the Air Expeditionary Force. This paper calls for an objective and ongoing analysis of the threat and appropriate organizational response, through the creation of an Air Expeditionary Force Chemical-Biological Threat Team. This multifunctional group would evaluate how the expeditionary forces are planned, organized, trained and equipped to deal with the chemical-biological threat. With this concerted approach, the Air Expeditionary Force should avert chemical-biological defeat and prove a formidable operational entity well into the 21st century.

I. Introduction

> *"I believe the proliferation of weapons of mass destruction presents the greatest threat that the world has ever known."*
>
> Secretary of Defense William S. Cohen[1]

The U.S. has entered a post-Cold War era that is characterized by continued regional crises and transnational threats. Given U.S. global interests and formal responsibilities, the U.S. Air Force will increasingly be called upon to help shape and stabilize this often chaotic and dangerous international scene. The Air Expeditionary Force will be a key operational element in this process. It will be tailored to respond rapidly and effectively to selected regional crises or conflicts at any point on the globe.[2] With technological materiel superiority, this force will have no conventional equal. As a consequence, future adversaries will be likely to employ asymmetric threats against the U.S. to "democratize the battlefield."[3] Two of those asymmetric threats are weapons of mass destruction, specifically, chemical and biological weapons.

Despite formal international prohibitions against chemical-biological weapons, recent history has clearly documented their global presence and lethality. These weapons can be used across the spectrum of conflict to achieve varied effects from the immediate death of an individual to lasting strategic effects across entire theaters of operation. Because of their relatively low cost, ease of production, and increasing lethality, chemical and biological weapons are now an integral part of the arsenals of many potential adversaries. Their presence or potential use cannot be discounted.

For the U.S. to objectively respond to this threat, it is essential that leaders, both military and civilian, first come to clearly and objectively understand the capabilities of such weapons. This study provides a basic review of the historical use of such weapons and documents their recent use by state and non-state actors. It then details the specific categories of both classes of weapons and defines their military significance. With this basic foundation, the study then focuses on the unique implications of the chemical-biological threat to the operational concept of the Air Expeditionary Force. Areas of vulnerability to these weapons are documented for each phase of military action from predeployment to redeployment. Finally, the study advocates a formal process to evaluate the capabilities needed to successfully meet this threat, and offers representative

solutions to present deficiencies in the areas of planning, organization, training, and equipment.

In short, the chemical-biological weapons threat to the Air Expeditionary Force exists today and will increase in the future. It must be addressed in an objective long-term manner and should not be trivialized nor exaggerated. With a strong Air Force commitment to fight and win in a chemical-biological environment, the Air Expeditionary Force will be in a better position to meet its future challenges and prevail. Without such a commitment, the USAF might one day face a chemical-biological disaster on a future battlefield. There is no other rational USAF option other than to thoroughly prepare to meet the chemical-biological threat.

II. The Chemical-Biological Weapons Threat

The History of Chemical and Biological Weapons

> *"Whether or not gas will be employed in future wars is a matter of conjecture. But the effect is so deadly to the unprepared that we can never afford to neglect the question."*
>
> General John J. Pershing[4]

Chemical and biological agents have been a part of human conflict throughout history. During the Peloponnesian War (431-404 B.C.) the Spartans used noxious smoke containing arsenic for attacks against Athenian-allied cities.[5] During the 14th century, attacking Tartars catapulted plague-infected cadavers into the city of Kaffa (now Feodosia, Ukraine). The subsequent outbreak of the plague resulted in the conquest of the city.[6] The U.S. military first confronted chemical weapons during World War I when the enemy used mustard and chlorine gases. During that conflict over one million allied and enemy casualties were attributed to chemical attack.[7] Russian armies suffered 50 percent of those casualties because of their inability to field any effective defensive measures.[8] During World War II, the Japanese used biological agents, including the bacteria that cause anthrax, plague, and cholera, in at least 11 Chinese cities.[9]

Efforts to restrict the use of chemical and biological weapons began with the Greeks and Romans, who condemned the use of poison in war as a violation of *ius gentium,* the law of nations.[10] In recent times, a fundamental tenet of international law has been that weapons should not be used if their effects cause. suffering disproportionate to their military utility.[11] [12] The potential of chemical-biological weapons to cause protracted human suffering and injury to non-combatants makes them particularly egregious in the eyes of the law. This concept was emphasized in the 1874 International Declaration Concerning the Laws and Customs of War, which included a prohibition against poison or poisoned arms.[13] The subsequent Geneva Protocol of 1925 also prohibited the use of gases and bacteriological weapons.[14] Finally, the 1972 *Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological and Toxin Weapons and on Their Destruction* and the 1997 *Chemical Weapons Convention* are the most recent steps in that direction. These treaties prohibit the use, development, production, stockpiling, and transfer of chemical-biological weapons.[15]

Despite these prohibitions, several significant examples of chemical-biological weapons use have occurred in recent years. During the Iran-Iraqi War (1980-88), Iraq used chemical agents including mustard and the nerve agent, Tabun, to produce approximately 45,000 Iranian casualties.[16] The Iraqis, who were trained and influenced by Soviet advisors, effectively used these chemical agents against the human-wave attacks of the much less prepared Iranian infantry.[17] Additionally, on March 19, 1988, Iraqi airplanes bombed the Kurdish village of Halabja with cyanide and mustard filled explosives and killed 5,000 Kurds and injured an additional 7,000.[18] As a consequence of these effective attacks and an ineffectual international response, military experts have argued the "chemical warfare threshold" has been substantially lowered.[19] To compound this problem, recent events have demonstrated that chemical weapons are now in the hands of terrorist and cult groups. The March 20, 1995, Aum Shinrikyo (Supreme Truth) cult's Sarin gas attack on the Tokyo subway produced 5,500 casualties and 12 deaths.[20]

The most serious finding in the recent history of chemical-biological warfare has been the public disclosure of the Soviet biological weapons program. At its zenith during the late 1980s, 60,000 scientists and staff personnel worked in some 40 research and production facilities.[21] Despite the dissolution of the Soviet Union, it is presumed that Russia has retained a biological weapons research and production capability. More importantly, it is known that many scientists working for Biopreparat were left without work. While some of the scientists went to the U.S. or Great Britain, others are believed to have gone to Iraq, Iran, Syria, Libya, and China.[22] It has been reported Iran is now offering former Soviet scientists $5,000 per month to work on their biological weapons program.[23] This worldwide spread of expertise in biological weapons is a significant event and will increase the threat to U.S. forces in the decades to come.

The world is now entering a new era in the history of chemical-biological weapons. This era began with the biotechnology revolution in the 1970s, specifically with the advent of genetically engineered agents. Advances in biotechnology have blurred the distinction between chemical and biological toxins now that "mid spectrum" agents can be produced, which include powerful toxins, bioregulators, and physiologically active compounds. As this technology has advanced, their lethality has increased exponentially.[24] It is quite likely the threat of the future will be the simultaneous employment of multiple chemical and biological agents that are engineered to evade detection and negate vaccines and medicines. As the U.S. is no longer

involved in offensive biological and chemical weapons research, there is also a potential that new agents will be produced of which it has no knowledge This is a serious concern as the U.S. defensive capability may be inadequate or ineffective against such agents.[25]

Despite the proliferation of chemical-biological weapons, many officials discount their significance to military forces. To begin, these weapons involve two scientific disciplines (chemistry and biology) that may seem foreign and irrelevant to many strategic policy makers. Furthermore, for the U.S. leadership there is no recent memory of the effects of such weapons on its forces. As a consequence, for many it is difficult to conceptualize the military impact of chemical and biological weapons. At the same time, for those who have come to understand the potential power of chemical-biological weapons and their specific human effects, there may be a basic psychological coping mechanism at play. Additionally, many in the U.S. and abroad have come to believe, perhaps naively, that the international conventions that prohibit the use of chemical-biological weapons will be respected. History is replete with examples to the contrary. Finally, many believe the Gulf War demonstrated the U.S. ability to deter the use of chemical-biological weapons. From this experience, it may then be optimistically assumed no future adversary would dare to employ such weapons against U.S. forces for fear of overwhelming retaliation. Although certainly a desired objective, this may be a simplistic assumption. Some have argued the U.S. was deterred from continuing the Gulf War due to Saddam Hussein's chemical-biological weapons capability and his resolve to use them if his regime was threatened.[26]

Chemical Agents

> *"You can take the most beat-up army in the world, and if they choose to stand and fight, you are going to take casualties; if they choose to dump chemicals on you, they might even win."*
>
> General H. Norman Schwarzkopf[27]

A basic understanding of both chemical and biological weapons must first be grasped before one begins to consider viable responses. Chemical agents include choking, nerve, blood, blister, vomiting, tear, and incapacitating agents (see Table 1).[28] These agents result in varied human affects from death to transient incapacitation. *Choking agents* affect the unprotected victim through damage to the respiratory tract. Tissues are injured to the point where fluid accumulates in the lungs, and death results.

Nerve agents alter the function of the nervous system and cause convulsions and death through respiratory paralysis. *Blood agents* block the exchange of oxygen at the cellular level and are fatal. While *blister agents* can produce fatalities, their greater effect is to cause incapacitation. Exposure to blister agents severely irritates the eyes, lungs, and skin. Consequently, it is presumed these agents will be used to transiently incapacitate forces and limit the use of an area or specific equipment.[29] Finally, *vomiting agents* may be deployed first in a chemical attack because they are not detected by present defensive systems. These arsenic based agents cause great discomfort and can force troops to remove or avoid use of their protective masks. In this debilitated, non-protected state, troops would then be vulnerable to a lethal second wave nerve agent attack.[30]

Of additional grave concern is the advent of more potent chemical agents. Recent examples include two Russian nerve agents that are eight times as potent as the currently most powerful nerve agent known as "VX."[31] The discussion of such advanced agents is beyond the scope of this unclassified study but it is essential to have an awareness that the chemical threat is increasing.[32]

Chemical weapons can achieve rapid and varied physiologic effects from minor eye irritation to death. For instance, one small drop of the nerve agent Sarin can kill within minutes after skin contact.[33] Chemical weapons are often liquids or solids that give off vapor at ambient temperatures and can be delivered in a variety of means. Aircraft, unmanned aerial vehicles, cruise missiles, ballistic missiles or artillery shells, and mines are all potential means to deliver these weapons. It must be emphasized even unsophisticated weapons, such as mortars, can effectively deliver significant quantities of chemical agents. During World War II, eight 4.2 inch mortars could fire approximately one ton of a toxic agent within two minutes at a range of over two miles.[34]

The presence of chemical weapons in a military environment varies from those that degrade after several minutes to those that persist for weeks. As a consequence, the tactical value of chemical weapons does not necessarily rest on their ability to kill an adversary. A persistent chemical agent, such as mustard gas, could be dispersed on a desired location prior to the arrival of U.S. forces in order to deny the use of terrain or equipment. When actually placed on a military force, the greatest value of chemical weapons lies in their capacity to rapidly degrade the effectiveness of the force for a defined period, and to increase its vulnerability to follow-on conventional attack. For a poorly prepared force, "even a small and relatively harmless chemical agent attack can produce results out of all proportion to the efforts involved from

the attacker."[35] The U.S. Army Chemical and Nuclear Exercises demonstrated that the mere wearing of protective gear leads to additional casualties, loss of unit efficiency, reduced operational tempo, and degraded operational effectiveness.[36] Finally, the psychological impact of chemical weapons use may also be militarily significant. The terror effect of such weapons may drive "troops who feel they are defenseless ... to break and run after minimal losses."[37]

Table 1. Major Known Chemical Warfare Agents

Agent Class	Agent	Persistence	Rate of Action
Nerve	Tabun (GA)	Low	Very rapid
	Sarin (GB) *	Low	Very rapid
	Soman (GD)	Moderate	Very rapid
	GF	Moderate	Very rapid
	VX*	Very high	Rapid
Blister	Sulfur mustard	Very high	Delayed
	Nitrogen mustard	Moderate-Very High	Delayed
	Phosgene oxime	Low	Immediate
	Lewisite	High	Rapid
	Phenyldichloroarisine	Low-Moderate	Rapid
	Ethyldichloroarsine	Moderate	Delayed
	Methyldichloroarsine	Low	Rapid
Choking	Phosgene	Low	Delayed
	Diphosgene	Low	Variable
Blood	Hydrogen cyanide	Low	Rapid
	Cyanogen chloride	Low	Rapid
	Arsine	Low	Delayed
Riot control (vomiting)	Diphenylchloroarsine	Low	Rapid
	Diphenycyanoarsine	Low	Rapid
	Adamsite		Rapid
Riot control (tear gas)	Chloroacetophenone	Low	Immediate
	Chloropicrin	Low-High	Immediate
	Bromobenzylcyanide	Moderate-Very high	Immediate
	O-chlorobenzylidene Malononitrile	Low-High ..	Immediate
Psychochernicals	3-Quinuclidinyl benzilate	High	Delayed

Source: U.S. intelligence data adapted from Bill Gertz, "Horror Weapons," *AIR FORCE Magazine 79,* no. 1 (January 1996): 46.

*Persistency of chemical agents varies based on wind, temperature, and precipitation. In general, Sarin is effective for 1/4 -4 hours, while VX can remain active from three days to three weeks.[38]

Biological Agents

While chemical agents represent a distinct threat to U.S. forces, biological weapons are an even more serious concern. Leaders should look to history to grasp the impact such pathogens can have on military forces. Up to the advent of antibiotics in World War II, deaths due to infectious disease and non-battle injuries always far exceeded those caused by actual combat.[39] Now, with biological weapons, adversaries have the capacity to deliberately produce epidemic rates of disease among U. S. and allied forces.

Biological weapons include pathogens or living microorganisms that cause disease in man: bacteria, fungi, rickettsia, and viruses. This category of weapons also includes toxins, which are poisonous chemical compounds produced by living organisms. All of these agents produce debilitating or fatal illness among those who breathe, drink or absorb them through the skin.[40] Of the 160 known natural pathogens, more than 60 are discussed in the open literature as potential biological agents[41] (Table #2).

Bacterial agents can be highly lethal, extremely contagious, and have the potential to cause widespread epidemics. If a force is adequately prepared, most illnesses caused by bacteria can be prevented by vaccination and are treatable with antibiotics if diagnosed in the early stages. However, with improved genetic engineering and biotechnological methods, strains may be developed which are more pathogenic, antibiotic resistant, and able to resist the protection afforded by conventional vaccines. For example, it was reported that the Soviets had developed a technique to microencapsulate agents, which would make them more resilient to environmental factors, such as heat and ultraviolet light.[42] Additionally, it has recently been reported Israeli scientists are using information from the South African biological weapons program to produce pathogens that are ethnic specific.[43] While this allegation has not been substantiated, it does raise the suspicion of a new dimension to biological weapons.

Viruses are also quite infectious, and many have the potential to be lethal (e.g., Yellow fever, Ebola). Of greater concern from a weapons standpoint are the viruses that incapacitate personnel without producing fatalities. Dengue Fever and Venezuelan Equine Encephalitis viruses both are capable of prostrating personnel for a period of several weeks. For a force with limited manpower, or limited means of reinforcement, a two-week period of inaction could mean victory for the adversary. Finally, rapid acting toxins must be viewed as agents that are likely to be used by terrorists or covert forces. Toxins, such as botulinum, are not affected by antibiotics and could

produce significant numbers of fatalities if placed, for example, on the food of an unsuspecting force.

Biological weapons attacks can occur covertly because they are not immediately sensed by man, and the ability to detect them via technical means is limited. Without initial detection, the distributor can strike and still be far removed from the attack site prior to the emergence of symptoms among infected personnel. Furthermore, early symptoms may mimic those caused by organisms in the natural environment, and thus may be discounted as a minor illness until the disease progresses to the point where treatment is ineffective. These qualities of biologic weapons may make it extremely difficult to attribute the attack to a specific perpetrator.[44] Furthermore, the potential scope and impact of these weapons means that one must view them as strategically important.[45] Entire lines of supply or a theater of operation could be affected by a communicable disease agent and operations might essentially cease in the wake of a biological weapon attack.[46]

The biological weapons threat to the Air Expeditionary Force will increase in the future. For the state or non-state actor with limited resources, biological "weapons effects" are much less expensive to produce than conventional, chemical, or nuclear weapons. Biological weapons can achieve the same casualty rates per square kilometer as conventional weapons at a fraction of the cost.[47] Additionally, the production of biological agents is uncomplicated and equipment used in their production is readily found on the open market. It is believed that "a major biological arsenal could be built with $10,000 worth of equipment."[48] First, a biological pathogen can simply be reproduced in great quantity through the use of fermentors that are purchased from the pharmaceutical, agricultural, or brewing industries.[49] Once a sufficient quantity of pathogen is obtained, commercially available "centrifuges, strainers, and freeze dryers" are then used to concentrate and purify the desired agent.[50] The detection of the entire production processes is extremely difficult, as these activities can be concealed in rooms the size of a garage and often resemble legitimate scientific activity.[51]

Even though the replication of a biologic organism is uncomplicated, the subsequent conversion into a viable offensive agent, or "weaponization," necessitates an acquired expertise. Historically, this expertise has resided only among states with adequate scientific resources and robust offensive biologic weapons programs. Unfortunately, many analysts of biological warfare now feel this expertise may be purchased, leading to the conclusion that new state and non-state actors may acquire a biological weapons capability.

Once weaponized. biological agents can be dispersed via many of the same platforms that are used for chemical weapons, notably missiles, aircraft, and artillery. However, the most worrisome delivery vehicle to disseminate biological weapons over an extensive area will be a precision guided cruise missile. Multiple small, slow, and low-flying cruise missiles launched at night over a circuitous course would be extremely difficult for a military force to detect and destroy. Because the effect of a biological weapon per pound is extremely high, less than 50 kilograms of an agent could easily cover an airbase or port.[52] The low payload requirement of biological agents coupled with the unique offensive qualities of the cruise missiles may make this combination of weapons a "major security threat."[53] While such advanced delivery vehicles as missiles cannot be ignored, biological agents are also ideally suited to "small scale attacks by unconventional methods."[54] The clandestine contamination of a force's food and water or dispersal of biological agents via simple ground-based aerosol generators or sprayers is quite plausible and capable of producing significant casualties.

Table 2. Catalog of Significant Biological Agents

Bacteria	Fungi'	Rickettsia	Viruses	Toxins
Bacillus anthracis	Coccidioides immitis	Coxiella burneti	Dengue fever	Aflatoxin
Brucella species		Reckettsia typhi (rnooseri)	Influenza	Botulinurn
Malleomyces mallei	Histoplasma capsulation		Rift Valley fever	Ricin
Malleomyces pseudornallei		Rickettsia prowazeki	Variola (Smallpox)	Staphylo-coccus
Mycobacterium tuberculosis	Nocardia Asteroides		Venezuelan equine encephalitis	
Salmonella typhimurium		Rickettsia tsutsugamushi	Yellow fever	
Shigella				
Vibrio cholerae				

Sources: USAF Scientific Advisory Board, "Report on United States Air Force Expeditionary Forces," Vol 3 Appendix!, February 1998. 1-43.

Office of the Secretary of Defense, "Proliferation: Threat and Response," November 1997.

Nations with Chemical-Biological Weapons Capability

Today, at least 25 nations have a chemical-biological weapons capability, and the sophistication of their agents is increasing. The Arms Control and Disarmament Agency has specifically cited Iran, Libya, and Syria for their efforts to develop "robust" biological weapons capabilities.[55]

Information regarding chemical-biological weapons is easily disseminated on the Internet, and advances in the sciences are helping to make the production and distribution of the weapons more feasible for groups with limited resources.[56] In the post-Cold War environment, where major power defense sponsorship of many states has been reduced, governments with limited means may place more emphasis on their chemical-biological capability. As mentioned, the acquisition and subsequent "maintenance" costs of such weapons are much less than those associated with conventional systems. Additionally, with chemical-biological weapons such states are not as tied to suppliers for technical support, critical parts, and munitions. Consequently, these states may be less restrained by the threat of trade restrictions or sanctions.

This proliferation represents a complicated national security challenge for the United States and a real operational threat for the Air Expeditionary Force.[57] As shown in Table 3, states are likely to develop chemical-biological weapons as a relatively inexpensive force multiplier or to exert influence on a regional level.[58] As a rule, these proliferents are likely to have unsettled internal politics and loose weapons command and control arrangements. As a consequence, the chance of accidental or unauthorized use of these weapons is increased.[59] The chemical-biological threat is further increased when these states share their weapons capability with other states or non-state actors.

Non-state actors, such as terrorist groups, crime syndicates, and extremist organizations, are also able to acquire chemical-biological weapons capabilities.[60] These non-state groups often have significant resources, and are elusive and less vulnerable to traditional deterrent options (international law, economic sanctions .....). Many are not politically motivated or constrained but are "driven by revenge, racial or ethnic hatred, religious fanaticism, or doomsday and apocalyptic philosophies."[61] As a consequence, when armed with chemical-biological weapons these non-state actors become more significant threats to the Air Expeditionary Force.

One recent example of non-state threats has been the international terrorist group, al Qaida. In August 1998, the U.S. Government stated that al Qaida, under the direction of Osama bin Laden, had developed a chemical weapons production capability. In response to the group's bombing of U.S. embassies in Kenya and Tanzania on August 7, 1998, the U.S. destroyed the Shifa pharmaceutical plant in Khartoum, Sudan. This plant had purported ties to al Qaida and was alleged to produce the nerve agent VX.[62] Bin Laden, however, remains at large and his organization supports extremists in more than 20 countries.[63] The risk of a chemical-biological attack on our deployed forces by al Qaida and other similar groups remains a grave concern.

Table 3. Biological and Chemical Weapons Possession and Programs

Country	Biological Weapons	Chemical Weapons
Afghanistan		PP
Bosnia		SP*
Burma		PP
Chile		SP
China	PP	PP
Cuba		SP
Egypt	SP	PP
Ethiopia		PP
France	Destroyed	SP
India	PP	PC
Iran	PP	PC
Iraq	CI	PC
Israel	SP**	PP
Kazakstan		PP
Libya	SP	SP
North Korea	PP	PP
Pakistan	PP	SP
Russia	PC	PC
Serbia		SP*
Somalia		SP
South Africa	SP***	SP***
South Korea		SP
Syria	PP	PP
Taiwan	PP	PP
Thailand		SP
Ukraine		PP
United Kingdom	Destroyed	
United States	Destroyed	PC
Vietnam		PP

Key: PC - Possession Confirmed PP - Probable Possession
SP - Suspected Programs CI - Clear Intent
Blanks indicate None

Source: Schneider, Barry R., Future War and Counterproliferation U.S. Military Responses to NBC Proliferation Threats, (Westport, CT: Praeger, 1999), 5.

* Deja News: "Chemical Weapons in Bosnia," November 20, 1998, available from http://x1dejanews.com/getdoc.xp?an=413979213.3&context=918400584.169430010&hitnum=0

**The Sunday Times: "Israel Planning "Ethnic" Bomb as As Saddam Caves In," November 15, 1998, available from http://www.Sunday-times.co.uk/news/pages/sti/98/11/15/stifgnmid0300r4.html?1124027

*** BBC Online Network, "South Africa's Truth Commission Starts Chemical Weapons Hearing," June 8, 1998, available from http://193.130.149.130/hi/english/world/africa/newsid_109000/109308.stm

III. The Air Expeditionary Force

The immediate post-Cold War period was characterized by optimism that the demise of the Soviet threat would reduce the need for the size, of the military that the U.S. previously maintained. Consequently, the U.S. Air Force experienced a significant reduction in overseas base structure and personnel strengths. Although Air Force manpower was reduced by one-third, contingency deployments increased fourfold.[64] This increased level of operations has taken a significant toll on the Air Force. To respond to this reality, senior Air Force leadership has sought to provide stability for the force through the routine deployment of Air Expeditionary Forces.

The Air Force leadership has also seen the need to shift from the previous "threat-based Cold War garrison force, focused on containment, to a capabilities-based expeditionary force focused on responsiveness."[65] This force will allow the U.S. to rapidly project combat power in defense of its global interests and responsibilities. The Air Expeditionary Forces will be "tailored to meet the needs of the Joint Force Commander both for lethal and non-lethal applications."[66] On the low end of the operational spectrum the expeditionary force may be called on to engage in a humanitarian support mission following a natural disaster. As a deterrent force, it also will be able to support known requirements to rotate personnel and equipment for long-term U.S. commitments in such areas as Southwest Asia.

With its rapid response capability, the Air Expeditionary Force is designed to be a key contributor to the success of U.S. national military strategy, which requires its forces to be able to fight and win two nearly simultaneous major theater wars. Accordingly, if used in more than MOOTWS and small-scale conflicts, the Air Expeditionary Force's speed, range, and power would be particularly valuable in the early phases of conflict. These qualities will help the force to halt an enemy's initial advances short of their intended objectives.[67] As a consequence, there would be fewer allied lives and less terrain lost and the. follow-on forces will ideally confront a much more manageable operational situation.

The U.S. Air Force is establishing 10 Air Expeditionary Forces that will be deployed for 90 days approximately every 15 months.[68] Current plans also envision two dedicated on-call Air Expeditionary Wings that will be operationally ready at all times for rapid deployment to trouble spots. Should both scheduled wings be deployed, a third would be activated and placed on ready status.

Each Air Expeditionary Force will be tailored to complete its defined mission: Current planning envisions a force comprised of 40 aircraft: a mix of ground-attack, air-to-air, and air-defense-suppression platforms. Tankers and bombers also will be included in the force package as needed. For each Air Expeditionary Force, its aircraft and support assets will be drawn from different bases and amalgamated into a single unit.

The Air Expeditionary Force will be minimally equipped and able to rapidly deploy to any geographic area. Although this force is designed to move rapidly to austere bases, a faster and more capable operation is obtained by employing locations that have ample infrastructure and prepositioned equipment.[69] These forces will be light in composition and hence have reduced airlift requirements, lean as asset redundancy will be minimized, and lethal in view of their ability to conduct decisive military operations. To support a force that is comprised of only essential assets, a timely support capability will have to exist to provide time-sensitive delivery of additionally required personnel and materiel through rapid airlift and sealift.

The Air Expeditionary Force is an evolving concept. A new section of the Air Force staff, the Directorate for Expeditionary Aerospace Force Implementation, has recently been created. This staff is currently writing support plans to achieve an operational capability by 2000. The development. of these support plans requires some critical assumptions be made at the outset. First, an evaluation of the potential threats confronting the force must be accomplished, as this will drive force composition and support requirements. In this regard, it is envisioned the Air Expeditionary Force will operate in a highly unpredictable security environment. Unlike the previous 50 years, our forces will not have the luxury of knowing where we will operate or who we will confront and with what composition of weapons. As a consequence the force will need to have the operational flexibility to operate in extreme environments and rapidly tailor its composition to evolving threats. Currently, it is assumed the force will encounter no peer competitor in conventional weapons and that the threat from chemical-biological attack is minimal.[70]

This "minimal" chemical-biological weapons threat assessment may be based on the assumption the force will not face a viable missile, aircraft, or artillery threat to deliver such agents. Further, some might assume that U.S. nuclear superiority might deter adversaries from using chemical-biological weapons. Finally, this conclusion may be drawn from the fact that there have not been any chemical or biological attacks on U.S. forces since World War I. In short, contemporary intelligence analysts may not believe such a

threat is credible until U.S. forces experience it. Nonetheless, this analysis must be reevaluated for each deployment, particularly as potential adversaries increase their missile, cruise missile, and unmanned aerial vehicle capabilities. Furthermore, it must be remembered that during Desert Storm the planning assumption was for a high probability of chemical-biological weapons attack.[71] The prudent tactician must assume that the Air Force will potentially intervene in situations where the adversaries are equal to if not more capable than Iraq in the chemical-biological weapons area in the future.

More importantly, the "minimal threat" planning assumption also discounts the possibility of a more unconventional biological strike. For example, an adversary's special operations team could strike the expeditionary force clandestinely through the dissemination of an agent in the force's food and water. Additionally, ground, sea, or air sprayers may be used to attack a down-wind Air Expeditionary Force base. Irrespective of the level of risk assigned to chemical-biological weapons, the threat is real. U.S. intelligence indicates that 25 states now have chemical-biological weapons programs. Consequently, should the Air Expeditionary Force show significant vulnerabilities to this threat, potential adversaries might focus their energies on an enhanced chemical-biological weapons capability. In short, a lack of strength in this area weakens deterrence and may exacerbate an already evolving threat. Enemies who perceive they cannot win a conventional conflict with the U.S. may be tempted to attack with chemical-biological weapons to level the playing field and take advantage of U.S. vulnerabilities to these weapons of mass destruction.

Air Expeditionary Force Vulnerabilities to the Chemical-Biological Threat

As U.S. forces have attained a conventional superiority, potential adversaries are now more likely to employ asymmetric means of attack against its personnel. Of those asymmetric threats, a chemical-biological attack at home or abroad could severely impact the mission of strategic force projection.[72] The *Report of the Quadrennial Defense Review* issued in May 1997 reinforces this notion, and counsels U.S. defense planners to assume that the use of chemical and biological weapons is a "likely condition of future warfare."[73] Furthermore, *Joint Vision 2010* articulates the need for full dimensional protection against the chemical-biological threat "to ensure our forces can maintain freedom of action ... while providing defenses for our forces and facilities at all levels."[74]

A "light, lean, and lethal" Air Expeditionary Force has particular vulnerabilities to a chemical-biological attack across all phases of operations. As this force will play a critical role in the future national defense strategy, such an attack could have serious consequences for the U.S. and its allies. A recent study by the Air Force Scientific Advisory Board has confirmed in detail the threat posed by chemical-biological weapons to the Air Expeditionary Force concept.[75]

In a general sense, the Air Expeditionary Force will operate in a geopolitical environment characterized by uncertainty. It will face adversaries with varied force capabilities and concepts of operation who may employ multiple simultaneous threats. However, to rapidly project its power the expeditionary force must deploy with only essential personnel and equipment. These assets must be rapidly tailored to meet and overcome an adversary. Should the chemical-biological weapons threat not be adequately considered, distinct vulnerabilities are present during each phase of Air Expeditionary Force operations.

Predeployment Vulnerability. Susceptibility to chemical-biological attack begins at the various U.S. bases that are tasked to support the Air Expeditionary Force. Currently, stateside bases have minimal chemical-biological defense capabilities and would be most vulnerable to a terrorist incident. If a base that provides key assets to the expeditionary package is hit, the expeditionary force may be rendered ineffective due to incomplete composition or delay in departure.

Furthermore, should the Air Expeditionary Force lack a robust chemical-biological defense capability, senior U.S. leadership may be reluctant to employ the force if there is a significant threat that such an attack might occur in a given theater. Additionally, with a limited defense capability, the expeditionary force would have difficulty in immediately using a forward operating base that had previously sustained a strike with a persistent chemical agent or one under a continuous chemical-biological threat. In both instances an Air Expeditionary Force with poor chemical-biological defensive capability would be "neutralized" in the United States and unable to engage in planned operations with potentially significant ramifications.

Deployment Vulnerability. Once deployment begins, the *CB 2010* Study noted that the expeditionary force will be particularly vulnerable to chemical-biological attack during the force projection phase of the operation, because time-sensitive logistics flows are channeled through critical transportation nodes.[76] Without unrestricted access to theater-based ports

and airfields, expeditionary forces "cannot be brought to bear and sustained in a timely and effective manner."[77] These sea and air ports of debarkation often have limited security, which makes access by terrorists relatively easy. Additionally, the sea and air ports are primarily manned by local nationals, who will be "particularly vulnerable to CBW [chemical-biological weapons] use and related psychological warfare."[78] As a rule, these civilians have no chemical-biological readiness training or defensive equipment, are not presently vaccinated against the leading biological weapons threat, anthrax, and are not required to take medicinal prophylaxis for a possible attack.

Similar concerns should be raised for the commercial component of our strategic airlift fleet. Currently, 50 percent of the Air Mobility Command's strategic airlift capacity is from commercial aircraft augmentation.[79] The civilian pilots for this fleet also lack appropriate vaccination, training, and equipment. Their ability to successfully operate today in a chemical-biological environment is questionable.

Employment Vulnerability. The Air Expeditionary Force is vulnerable to attack by chemical-biological weapons "from the first entry to a forward operating location."[80] Historically, the Air Force has assumed that bases in rear areas would operate in a secure environment. However, in the case of certain chemical-biological threats, this assumption loses validity. The *National Security Strategy for a New Century* indicates such weapons provide "rogue states, terrorists, and international crime organizations the means to inflict terrible damage on . . . our troops abroad."[81] Chemical-biological attacks on the expeditionary force could take many forms. At the high end of conflict spectrum, an integrated chemical, biological, and conventional munitions attack delivered by missiles or cruise missiles could produce devastating consequences to the force. Sustained chemical attack alone could "have disastrous effects on both airlift throughput and combat sortie generation."[82] More likely, however, are biological attacks by terrorist or special operations forces. While such attacks could result in a "show stopping" mass casualty situation, they could also produce a degradation of unit performance if disguised as a "natural" disease outbreak.

Sustained Operations Vulnerability. Once the- Air Expeditionary Force is employed at its forward operating location, its forces will be at risk because they will have minimal chemical-biological detection systems and incident response assets. During sustained operations, expeditionary force performance will be degraded by the mere threat of a chemical-biological attack, as protective masks and clothing limit performance significantly.[83]

Specifically, mission sortie rates are expected to drop by 50 percent after five days of wearing full protective gear.[84] This decline in performance will be worsened by the fact the USAF has insufficient and unsupportable collective protection systems (shelters).[85]

Should the Air Expeditionary Force sustain a chemical attack, military operations may cease or be reduced as long as there is no major decontamination capability for aircraft, equipment, or personnel. This would be a particular concern after a persistent chemical agent attack or a continuous chemical-biological attack in which agents may be present for days or weeks. Additionally, after a chemical-biological attack at a remote location, relief personnel and materiel support may not be able to respond for hours or even days. The operational, if not human, consequences of these deficiencies could be significant.

Finally, it should be mentioned that false warnings of biological attack alone may have a significant impact on the Air Expeditionary Force. Numerous examples of anthrax hoaxes throughout the U.S. have documented the real cost such events have on medical and police assets, and their disruption of normal urban activities.[86] To preclude such an effect on the Air Expeditionary Force, rapid biological detection devices must be available to discount such hoaxes and reassure base, allied, and civilian personnel.

Redeployment Vulnerability. Upon the successful completion of its mission, the Air Expeditionary Force and its supporting stateside bases must remain vigilant and prepared to deal with the possibility of chemical-biological attack. Strategists argue such an attack may be executed by the defeated adversary or its surrogates purely for purposes of revenge and terror without any specific tactical objective.

IV. USAF Response: The Air Expeditionary Force Chemical-Biological Threat Team

> *"At present, we do not fully understand the impact WMD will have on our missions, but we know that it will be significant. We must consider the operational requirements, understand our weaknesses, and develop courses of action to make us stronger."*
>
> General Michael E. Ryan[87]
> Chief of Staff, USAF

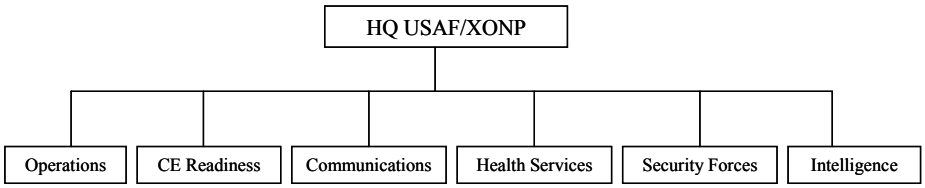
The chemical-biological threat to the Air Expeditionary Force is a complex and evolving problem. Unfortunately, as biologic and chemical technologies become more sophisticated, this threat will only increase in the years to come. To deter the chemical-biological threat, the Air Force and Department of Defense argue that an increased ability to deny or limit the utility of these weapons is essential. At the Joint level, the Counterproliferation Program addresses the chemical-biological threat through efforts in deterrence, counterforce, active defense, passive defense, and capabilities against transnational or paramilitary threats.[88] The program is an aggressive one with $5.9 billion to be expended during Fiscal Year 1999.[89] However, numerous shortcomings remain which must be overcome before the U.S. military achieves a credible deterrent and response capability to these weapons. Expenditures alone will not resolve this threat. Expanding awareness and understanding of the chemical-biological threat should be the first step in addressing this problem.[90] Air Force leaders must focus on the unique issues associated with the threat to the Air Expeditionary Force.

The Air Force is now addressing the chemical-biological threat to all its forces both domestic and overseas. In March 1998, a General Officer Steering Group was established to examine this problem. Subsequently, an October 1998 Threat Response Conference identified, over 40 deficiencies in the Air Force response capability to chemical-biological attack. The conference report concluded "both CONUS [Continental United States] and OCONUS [Outside Continental United States] bases are vulnerable to a Chem-Bio attack with significant implications relative to the base mission, for warfighting organizations and resources."[91]

To resolve this problem attention should also be placed on the unique chemical-biological defensive needs of the Air Expeditionary Force. To

respond to the threat, an Air Expeditionary Force Chemical-Biological Threat Team should be established. The team's charter should be to define the unique challenges posed by the chemical-biological threat to the expeditionary force and champion viable solutions to those challenges. Optimally, this team would be formed and coordinated by the Air Force Nuclear and Counterproliferation Policy Directorate (HQ USAF/XONP). It would be comprised of representatives from Operations, Civil Engineering Readiness, Communications, Health Services, Security Forces, and Intelligence. Additionally, action officers from the Force Protection and Air Expeditionary Force Battlelabs and the Directorate for Expeditionary Aerospace Force Implementation should be active participants.[92]

Air Expeditionary Force Chemical-Biological Threat Team



The work of the "Air Mobility in a CB Environment" and the "Fighting the Base in a CB Environment" study teams should serve as excellent resources for the Chemical-Biological Threat Team, as these studies were aimed at identifying the training, equipment, and procedures for forces that will operate in a chemical-biological environment. Both studies completed their recommendations for a chemical-biological warfare concept of operations in early 1999.[93] This concept of operations should now be evaluated and modified for the distinct needs of the expeditionary forces.

Through coordinated and in-depth analysis, the Air Expeditionary Force Chemical-Biological Threat Team would advise the Air Force on the ways and means to better *plan, organize, train, and equip* its expeditionary forces to successfully meet the danger posed by chemical and biological weapons. The following are representative examples of recommendations such a team might present. The examples are limited and do not address all areas worthy of evaluation and change. However, they are areas critical to the expeditionary force and warrant immediate attention. Once the threat team

is formalized, its broad expertise and insight will provide a process for offering viable solutions to the chemical-biological threat in the future.

Planning

Organizationally, many in the Department of Defense and the respective Services already recognize the potential severity of the chemical-biological threat to U.S. and allied security.[94] These weapons have the potential to limit the U.S. ability to rapidly project its power or defeat U.S. forces in a theater of operation. The President's *National Security Strategy for a New Century* recognizes the chemical-biological threat, and indicates the United States is "enhancing the preparedness of the Armed Forces to effectively conduct sustained operations despite the presence, threat or use of WMD [Weapons of Mass Destruction]."[95] Because the threat affects all the Military Services, public law mandates all chemical-biological defense programs be integrated at the Joint level to create greater operational and economical efficiencies. The Department of Defense program seeks to "enable our forces to survive, fight and win in NBC [Nuclear, Biological, Chemical] warfare environments."[96] The Air Staff has recently stated that their objective is to "continue near-normal full spectrum operations in a CBW [Chemical Biological Weapons] environment."[97] The Air Force response to this threat has been multifaceted and is now gaining momentum.

Many documents, which address the chemical-biological threat to U.S. forces, have been recently published or are currently in draft or revision. *Joint Pub 3-11, "Joint Doctrine for Nuclear, Biological, and Chemical Defense"* has been in draft since May 1998. HQ USAF/XON has released a classified Counterproliferation Master Plan, which requires all levels of Air Force operations from the Major Commands to the operational level formulate their own master plans to further define their planned response to the chemical-biological threat.[98]

The foundation for all planning is doctrine. While the above documents reflect a growing awareness of the chemical-biological threat, the Air Force presently has no distinct doctrine for chemical-biological defense that will provide a focus for tactical planners. Given the complexity and level of the threat posed by chemical-biological agents to U.S. forces, it is essential the Air Force develop specific chemical-biological operational doctrine. The Department of Defense in the 1998 *Annual Report to Congress on NBC Defense* concluded, "the unique physical, toxicological, destructive properties of the CB [chemical-biological] threats warrant unique operational

and technological responses."[99] To provide consistent operational response across all Air Force functional areas, a well-defined chemical-biological defense doctrine must be formed.

The need for this doctrine was raised at a 1995 National Defense University workshop entitled, "The Impact of the Proliferation of Nuclear, Biological, and Chemical (NBC) Weapons on U.S. Air Force Doctrine, Operating Principles, and Capabilities."[100] The need was also articulated at the October 1998 USAF Chemical-Biological Threat Response Conference. The conference report stated that Air Force "doctrine and training do not address the protection and response of CONUS and OCONUS installations across the full-spectrum of incidents."[101] To respond to this deficiency, a well-formulated chemical-biological defense doctrine must be written and then put into practice. This doctrinal guidance will define the basic principles to direct the Air Force in military action and provide a strong foundation for its personnel as they "plan, employ, organize, train, equip, and sustain" their forces.[102]

The Directorate for Nuclear and Counterproliferation Policy, HQ USAF/XONP, as the focal point for all Air Force counterproliferation matters, has proposed the creation of doctrine for "Counter-NBC [Nuclear, Biological, Chemical] Operations." This request was approved by the Air Force Doctrine Working Group on March 3, 1999. The Air Force Doctrine Center has initiated a one-year process for formulating a coherent chemical-biological defense doctrine.[103]

Air Force doctrine is written in a hierarchy of three levels: basic, operational, and tactical.[104] Current Air Force Basic Doctrine refers to the National Security Strategy which requires military forces "cope rapidly and decisively" with weapons of mass destruction.[105] Air Force Basic Doctrine also clearly states that "airpower is most vulnerable on the ground" and that "air base defense is an integral part of airpower deployments."[106] This basic doctrine must be expanded if it is to articulate the chemical-biological threat to the Air Force, and emphasize a resolve to effectively conduct sustained operations despite the presence, threat, or use of these agents.

In addition to modifications to basic doctrine, the new Counter-NBC Operations doctrine should be written at the "operational" level. This level of doctrine defines how the Air Force fights by anticipating the changes which may affect military operations, such as technological advances.[107] Operational doctrine also guides forces as they fight in distinct environments.[108] The distinct and complex characteristics of a battlespace that includes chemical-biological weapons mandates a sound doctrine to

successfully execute Air Force core competencies. The proliferation of chemical-biological weapons and their increasing lethality will affect the conduct of operations in the future. Air Force doctrine must address this emerging threat in succinct terms.

This doctrine should further define the broader Joint Nuclear, Biological and Chemical Defense Operations guidance detailed in Joint Pub 3-11. (Currently in draft) First and foremost, it should clearly reaffirm the Air Force commitment to fight and win in a chemical-biological environment. This resolve, when coupled with well-developed operational concepts, adequate equipment, and sufficient training of USAF units, will signal potential adversaries that the Air Force recognizes the threat, and has a broad and long-term focus to overcome its challenges. As a consequence, the doctrine itself may have a deterrent effect.

As in JP 3-11, Air Force doctrine should also include sections on fundamentals of chemical-biological defense, training, logistics and medical support. Additionally, it must address specific Air Force concerns. For example, in a chemical-biological environment, the conduct of flight operations (to include the Civil Reserve Air Fleet), decontamination of personnel, equipment, and aircraft, and air evacuation of casualties should be detailed. Furthermore, USAF doctrine should clearly define functional responsibilities within the active Air Force, Air National Guard, and Air Force Reserve and interface with the Army, Navy, and Marine Corps. As the Air Expeditionary Force will be a key element in future Air Force operations, the specific requirements and concerns of this entity must be defined. In a broader sense, the doctrine should outline the relationship between U.S. bases, their surrounding communities, and the federal agencies that will respond to a domestic chemical-biological attack. Finally, this doctrine must address how the Air Force will deal with the chemical-biological threat during the conduct of coalition operations, and when civilian personnel are actively supporting U.S. forces.

Once an Air Force chemical-biological doctrine is established, it can be used in conjunction with the applicable "Tactics, Techniques, and Procedures" as planning guidance. With these tools, the regional Commanders in Chief will have a firmer foundation on which to build their war plans.[109] Chemical-biological doctrinal principles will thus be interwoven into the air component commander's supporting war plans and flexible deterrent options. Once the doctrinal gap is closed relating to air operations in a chemical-biological environment, the Air Expeditionary Force could enter a theater based on plans that give its commanders

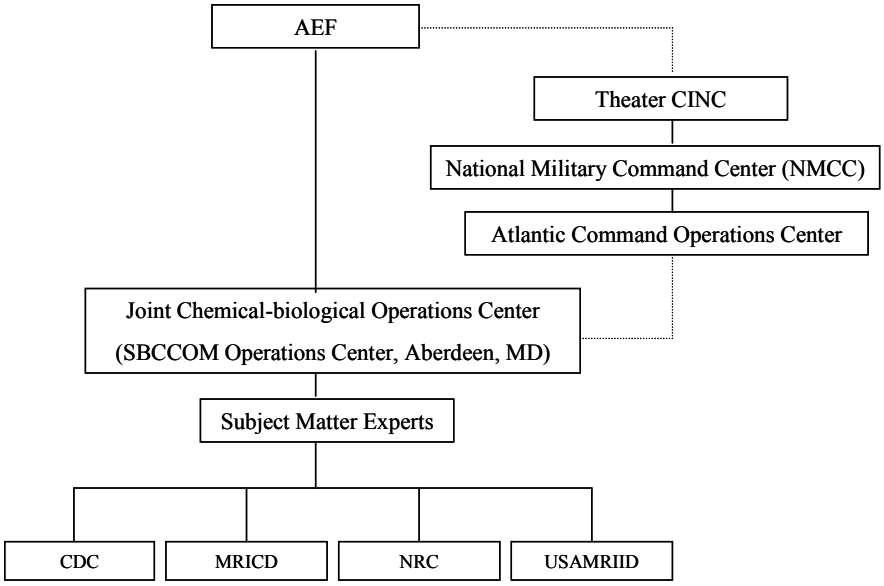
confidence that the chemical-biological threat has been systematically and thoughtfully addressed.

Organization

The Quadrennial Defense Review indicates that managing the response to the threat posed by the proliferation of weapons of mass destruction must be an "organizing principle in every facet of military activity."[110] This will certainly be the case for Air Expeditionary Force operations. New chemical-biological defense doctrine and related contingency planning will create the need to modify present and to form new organizational structures. As the Air Expeditionary Force will be forward deployed with minimal materiel and personnel resources, a robust command and control system will be essential. This system must integrate medical and non-medical means to immediately detect and warn the force of any chemical-biological strike. The detection and identification of a strike by a chemical agent dispersed by a conventional munition may be accomplished with available equipment. However, covert attack with a biological agent whose human effects may evolve over hours or days and will require the use of new information systems to track patient symptoms. These information systems must then have the ability to analyze this data and warn the medical and operational leadership of a probable attack.

The Enhanced Consequence Management Planning and Support System. Currently, there is a prototype disease tracking system, Desert Care II, is being tested by U.S. forces in South-West Asia. While this system holds promise, additional systems are being developed. The Defense Advanced Research Projects Agency is now developing a more comprehensive system for chemical-biological attack response which is known as the Enhanced Consequence Management Planning and Support System (ENCOMPASS). This system is an integrated grouping of computer-based programs, which will provide many critical functions to a force responding to a chemical-biological attack.[111] This system will enable expeditionary forces to manage such an attack, as opposed to merely reacting to it in a "crises" mode and possibly being overwhelmed by it. While the current program is being developed to support the U.S. Marine Corps Chemical-Biological Emergency Response Force, the system holds great promise Tor use by the Air Expeditionary Force. There is a current proposal to test this system during Expeditionary Force Experiment 1999 in order to validate and refine the system's effectiveness.[112]

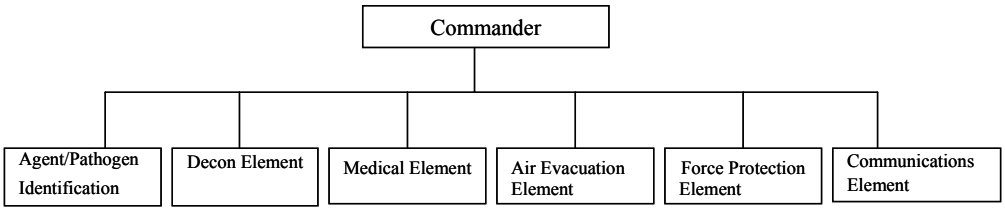
Joint Chemical-Biological Operations Center. After an attack, Air Expeditionary Force personnel will need real-time access to information to optimize the military and medical response. Ideally much of this information will be immediately available as hard copy texts or on digitalized databases. However, should additional subject matter expertise be required from rear echelon areas or the United States, reach-back data systems need to be structured to facilitate that access. As an example, medical personnel may need timely consultation with the Centers for Disease Control (CDC) in Atlanta, Georgia or the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) at Fort Detrick, Maryland. This organizational response capability must be formalized, funded, and staffed to provide critically needed information on a 24-hour-a-day basis. To facilitate that coordination, a Joint Chemical-Biological Operations Center should be established. One possibility would be to expand the function of the current U.S. Army Soldier and Biological Chemical Command (SBCCOM) Operations Center to include support for overseas forces. This should be a Joint asset that would provide the Air Expeditionary Force and other forces with a "reach back" capability to obtain expert guidance in various functional areas (i.e., agent identification, decontamination, and treatment). These requirements would be coordinated and channeled through the Operations Center in order to provide timely coordination with other military, federal, and civilian organizations. Ideally this communication would be direct from the expeditionary force to the Operations Center via secure Internet or satellite telecommunications. Other operations centers in the chain of command would monitor these communications and provide input on an as needed basis. Information flow from an Air Expeditionary Force to the Operations Center could proceed as follows:



Theater Chemical-Biological Emergency Response Forces. The Chairman of the Joint Chiefs of Staff has recently directed the regional combatant commands to "develop plans, identify and exercise forces for, and when directed, respond to foreign WMD [Weapons of Mass Destruction] within their assigned areas of responsibility.[113] Additionally, the Chairman has directed that U.S. Atlantic Command will deploy follow-on specialized assets from the United States to augment forces in need overseas.

To fulfill the requirement for an initial theater response capability, the geographic Commanders in Chief, with the assistance of Atlantic Command, should provide Theater Chemical-Biological Emergency Response Forces. These tailored response forces will provide the needed personnel, equipment, and treatment to support an Air Expeditionary Force whose intrinsic assets are overwhelmed. Their function will be to validate the nature of the attack, provide initial consequence assistance to mitigate the effects of the attack, and assist in the quick restoration of normal operations. While the response force's task list and concept of operations would need to be clearly defined, it must be emphasized that the organization must be a professional unit that can operate in a potentially chaotic and lethal environment. The unit should be geographically positioned to provide timely support to a deployed force after an attack. This location might optimally be the main operating base that is supporting the Air Expeditionary Force.[114] For instance, an air base in Germany might be the response force location for an Air Expeditionary

THEATER CHEMICAL-BIOLOGICAL EMERGENCY RESPONSE FORCE



Force deployed to Africa. The response force should be composed of a number of specialties, including security, civil engineering, communications, and medical. It must have its own equipment aid logistics packages to rapidly assist a force in need. It is essential that their materiel assets, including diagnostic tools, decontamination equipment, medicines, and vaccines, be stockpiled in theater for timely movement.

From a personnel standpoint, the core of the unit should be trained and equipped as a fixed team to optimize its effectiveness. However, additional assets and personnel should be added to, or subtracted from, the response force based on the nature of the attack. For instance, Special Operations Forces may be needed to assist in the execution of this emergency response. Their fixed and rotary wing aircraft may be needed to access an Air Expeditionary Force during or after an attack. Additionally, their organic force protection and communications capability could prove essential to the success of the mission.

The Air Expeditionary Force planners may learn much regarding doctrine, training, and equipping the response force from the National Guard's Rapid Assessment and Initial Detection teams, the Army's Technical Escort Unit, and the Marine Corps' Chemical/Biological Incident Response Force. The latter is a "national asset, globally sourced to Marine Force Commanders and National Command Authority for duties as the President may direct." It is equipped with state-of-the-art detection, monitoring, and decontamination equipment and is prepared for operations in a wide range of contingencies.[115] Additionally, the Marine Corps presently is staffing a concept for an integrated response team for overseas crises.[116] This concept could evolve in the Joint arena and ultimately lead to a Marine component to the Theater Chemical-Biological Emergency Response Forces.

Education and Training

To adequately prepare the Air Expeditionary Force to meet the chemical-biological threat, new education and training programs should evolve at the individual, unit, group, and ultimately Joint, and coalition levels. Training and exercises are the "best means for evaluating operational concepts and doctrine, assessing readiness, and fostering innovation and adaptation."[117] Chemical-biological defense training and exercises will increase awareness and understanding of the threat among U.S. forces and allies and will increase their level of confidence to deal with a threat environment or actual attack. Most importantly, once educated and trained, personnel at all levels will begin to offer solutions to the complex problems presented by chemical-biological weapons.

Joint Training. Ultimately, joint level exercises should include *realistic* chemical-biological attack scenarios as part of the overall training. Exercises, such as the Pacific Command's Tandem Thrust, should have a chemical-biological attack component to validate and refine theater response capabilities. Ideally, the U.S. Atlantic Command should also develop scenarios to simulate an Air Expeditionary Force chemical-biological attack. These scenarios should be joint in composition and include Air Force, Army, Navy, and/or Marine assets. While this would require a considerable commitment and expense, such exercises would provide invaluable experience for all U.S. forces.

Air Force Chemical-Biological Defense Training. The preparation of an Air Expeditionary Force comprised of different active, reserve, guard, and civilian personnel to respond to the chemical-biological threat will be a significant undertaking. Personnel drawn together from disparate units must aggressively train prior to deployment and in theater to survive a chemical-biological attack. Air Force training programs must be developed to effect a unified response to such an attack. Intelligent Computer-Aided Instruction and distributed training technologies, should be integrated in this process.[118] Furthermore, initial and recurring readiness training must place an increased emphasis on biological threats compared to the past where they have been neglected. Low probability threats, as biological weapons attacks are often considered to be, should be addressed because of their potential for extreme costliness should they occur.

USAF Health Services Training. For medical personnel, aggressive chemical-biological defense training must begin at entry into the Air Force and continued on a recurrent basis. Today, the overwhelming majority of

U.S. health care providers have never diagnosed or treated patients ill from chemical-biological weapons effects. While some physicians may recognize the presence of a nerve agent attack, as its effects are similar to those of some agricultural chemicals, most would not. Furthermore, most of the infectious diseases produced by the common biological weapons are not prevalent in the United States. Standardized training for recognition and treatment of all these entities is essential.

At present, the Air Combat Command is developing a three-phased training program for its medical staff. This program uses the "Management of Chemical and Biological Casualties Course" produced by the U.S. Army Medical Research Institute of Infectious Disease and the U.S. Army Medical Research Institute of Chemical Defense.[119] This training will provide an excellent foundation for the medical personnel who will support the initial Air Expeditionary Forces.

The Air Combat Command concept should be expanded upon and provided to all Air Force medical service facilities. Ideally, a medical response course would be established at the Joint level to provide consistency across Service lines. This Advanced Biological Chemical Life Support program could be developed from the "Management of Chemical and Biological Casualties Course" and administered by the Military Training Network at the Uniformed Services University of the Health Sciences. The program should be mandatory for all military physicians, nurses, and physician assistants and repeated on a two-year cycle. Information and skills learned during biannual Advanced Biological Chemical Life Support training should be reinforced during Continuing Medical Readiness Training and through the use of computer accessed updates.

Equipment

Just as new educational and training programs must evolve to respond to the chemical-biological threat, new defensive equipment with unique qualities must also be developed to support the Air Expeditionary Force. As the force concept of operation requires the flexibility to rapidly deploy. to any location on the globe, equipment must be light and compact to minimize airlift requirements. As the equipment must function in austere environments with minimal support, it must be rugged, essentially maintenance free, and have minimal power requirements. Ideally, to reduce personnel requirements, this defensive equipment should operate autonomously without the need for human input. Should operators be

required, the equipment function should be simplified to the maximum extent possible. This again will facilitate reduced training and personnel requirements.

Presently, many of the chemical-biological defense systems are suboptimal for an Air Expeditionary Force. Adequate wide-area or early detection capabilities versus biological weapons attacks have not yet been developed. Moreover, present detection devices, decontamination chemicals and equipment all pose significant logistical burdens. They are often quite large, require specially trained personnel to operate and maintain, and in many cases are still in development. Individual protective masks and clothing restrict communication, vision, mobility, and impose heat stress. All these factors degrade operational performance significantly. At temperatures of 90 F, estimated continuous work time is only 0.6 hours while in protective ensembles.[120] Additionally, due to the physiological stress and limitations of operation in individual protective ensembles, collective protection shelters will be needed to allow personnel to eat, drink, and rest. At present, the Air Expeditionary Force will have very limited collective protection capabilities. This could be a major problem in a chemical-biological environment. Without a place to rest, change suits, discharge bodily functions, and decontaminate individuals, the Air Expeditionary Force would have extreme difficulty in functioning for any prolonged period in a CB environment. Finally, effective and robust chemical-biological agent detection and identification systems must be developed and integrated into airbase warning and command and control systems for the force to sustain and overcome a chemical-biological weapons attack.

Air Expeditionary Force Chemical-Biological Detection Systems. Optimally, the Air Expeditionary Force should be equipped with an integrated chemical-biological detection and warning system. As such a system does not currently exist, complementary systems will be used to provide a basic detection capability. The force will have chemical threat detection capability via M8 liquid agent detection paper and M9 adhesive detection tape for equipment and personnel protective ensembles. It will also have the hand-held Chemical Agent Monitor (CAM) and the Chemical Agent Detector Kit (M256/A 1) for point detection.[121] These systems allow for the rapid detection and identification of both nerve and blister agents. Most likely the expeditionary force will also have the M221 Automatic Chemical Agent Detector Alarm (ACADA) system. These units will be positioned around the base to provide continuous monitoring for possible chemical

attack.[122] Finally, strong consideration should also be given to the use of U.S. Army detection capabilities on an as needed basis.

In the near term, the Air Expeditionary Force will have no significant capability to rapidly detect and identify biological pathogens. The Department of Defense is aware of this shortfall and is developing an Air Base/Port Biological Detection Advanced Concept Technology Demonstration. This system, Portal Shield, will provide rapid automated biological attack detection, identification, and warning for high value fixed sites such as ports and airfields. It will be based on the U.S. Navy Interim Biological Agent Detector prototype and should soon begin, field- testing.[123] This system holds great promise for future use with the Air Expeditionary Force and ideally will be refined for Air Force operational needs. The Portal Shield concept, however, still necessitates the capability to perform quick confirmatory biological agent testing. This confirmatory analysis can be accomplished by another system, the Rapid Pathogen Identification System.

The Rapid Pathogen Identification System. The Rapid Pathogen Identification System (RAPIDS) is a state-of-the-art biological agent identification device that is being evaluated by the Modernization Cell of the Air Combat Command's Surgeon's office. The system, still in development, is designed to support an "immediate and urgent need to support the Warfighting CINCs with a diagnostic system which will provide rapid, specific, and sensitive detection and identification of biological warfare agents and infectious pathogens in clinical specimens."[124] It should be emphasized that as the Air Expeditionary Force deploys around the globe its personnel will potentially be exposed to outbreaks of endemic and emerging infectious diseases (such as Ebola).[125] RAPIDS, once perfected and. deployed, should enable the expeditionary force to identify those natural pathogens as well as biological warfare agents. This dual capability, if and when validated, will be critical to the good health of the force.

RAPIDS will identify biological pathogens that are present in clinical specimens, food and water samples, air and surface swipes. The device is a lightweight backpack system, is operable by one person with minimal training, and can evaluate 30 samples within 25 minutes. The unit is portable and will use an advanced molecular biology technique called Polymerase Chain Reaction (PCR) to identify the biological agent. This technique confirms the presence of a biological pathogen through the identification of specific segments of genetic material.[126] Once the pathogen has been identified, medical personnel will be able to institute effective preventive measures, administer prophylaxis, and treatments. When deployed, Air

Expeditionary Force personnel will monitor the results derived from RAPIDS through epidemiological tracking modalities such as the previously described ENCOMPASS system. With such a quick diagnostic tool tied to an effective consequence management system, the Air Expeditionary Force will have increased resiliency against biological attacks. In sum, it is expected that RAPIDS will be an outstanding addition to the biological defense capability and will have little impact on support requirements. It will also offer the added benefit to the Air Expeditionary Force of providing pathogen detection in food, water, and medical specimens.

To accelerate acquisition of this system, several prototypes should be purchased and evaluated. If the results of lab and field testing are favorable, Air Force leadership should champion the technology at the Joint level. The device should then be put on a "fast track," 18-month acquisition cycle and effectively deployed with our Air Expeditionary Forces. Furthermore, once approved in the Joint arena, RAPIDS holds great promise for use by the other Services and as a component of other chemical-biological detection systems.

V. Conclusion

The Air Expeditionary Force will be the primary mode of Air Force operational employment in the very near future. This force will, have minimal redundancy in personnel and equipment, and be supported over extended distances by airlift. Additionally, the force will be geographically concentrated to minimize support requirements. While these qualities make the force more efficient, they also make it particularly vulnerable to an increasing chemical-biological threat. Recent reports by the Defense Science Board and the Air Force Scientific Advisory Board have confirmed this threat in very succinct terms.[127]

The specter of chemical-biological attack poses- a very real threat to the Air Expeditionary Force. Recent and past history has shown that despite legal prohibitions, these agents have been used with significant consequences against civilians and military personnel. Continued scientific advances have produced chemical-biological weapons that have utility across the spectrum of conflict. Agents can be selected to produce varied physiologic effects from transient incapacitation to death. The area of impact can be restricted to a specific individual or broadened to an entire theater of operation and their persistence can be minutes to years. Finally, the global proliferation of these agents exacerbates the threat. As noted previously, at least 25 nations are presumed to have chemical and/or biological weapons. Experts believe that these weapons may also be in the hands of non-state actors, such as terrorist groups.[128]

To respond to this threat, the Air Force's greatest challenge may be an intellectual one. Historically, the Air Force has always presumed its air bases would operate in a relatively secure environment. With the chemical-biological threat, particularly an evolving biological threat, that presumption is no longer valid. No base is secure from attack. Furthermore, as the chemical-biological threat is complex, it was previously been viewed as "too hard" to solve and therefore dealt with only modestly. While the threat is a difficult one, it can be effectively addressed over the long-term in a focused incremental manner.[129]

For the Air Force to prevail against future chemical and biological warfare threats, all personnel must first gain an objective understanding of the capabilities of chemical and biological agents, their alternate means of delivery, the vulnerabilities of U.S. and allied forces, and the means of effective defense. Once this understanding is achieved, an aggressive and

thorough organizational response must follow. With a sustained commitment, the Air Expeditionary Force can have an increased resiliency to chemical-biological attack and prove to be a formidable operational entity well into the 21st century. Without such a commitment, the Air Expeditionary Force may be approaching a future chemical-biological catastrophe. This can and must be avoided.

VI. Recommendations

To respond to the chemical-biological threat to the Air Expeditionary Force new doctrine, organizational structures, training programs, and equipment must be developed. The vehicle for this change should be through an Air Expeditionary Force Chemical-Biological Threat Team coordinated by HQ USAF/XONP. With a synergistic cross-functional approach to the threat, practicable solutions to the challenge will emerge and be put into operation. To initiate this process, the author advocates the following:

1) *USAF formulate doctrine for Chemical and Biological Defense Operations.* The Air Force Doctrine Center has initiated the formal process to develop such a doctrine. This doctrinal guidance will provide a strong foundation for Air Force personnel as they plan, organize, train, and equip to fight and win in a chemical-biological environment.

2) *Evaluate the ENCOMPASS command and control system for chemical-biological attack consequence management.* The Defense Advanced Research Projects Agency is developing a comprehensive system for chemical-biological attack response known as the Enhanced Consequence Management Planning and Support System. This system should be evaluated and refined to provide our forces with the ability to effectively manage such an attack.

3) *Expand the charter of the U.S. Army Soldier Biological Chemical Command Operations Center to include support for U.S. forces overseas.* Expeditionary forces will need real-time access to vital information to optimize the military and medical response to a chemical-biological attack. A Joint Chemical-Biological Operations Center should be created to facilitate that informational flow.

4) *Establish Theater Chemical-Biological Emergency Response Forces.* The geographic Commanders in Chief should develop emergency response forces to provide rapid assistance to a deployed force post chemical-biological attack. These tailored forces will provide the needed personnel, equipment, and treatment to support an Air Expeditionary Force whose intrinsic assets are overwhelmed.

5) *Create a joint Advanced Biological Chemical Life Support course for all U.S. military health care providers.* The "Management of Chemical and Biological Casualties Course" produced by the U.S. Army Medical Research Institute of Infectious Disease and the U.S. Army Medical Research Institute of Chemical Defense should be modified and made mandatory for all military physicians, nurses, and physician assistants.

5) *Accelerate evaluation and acquisition of the RAPIDS biological detection system.* There is currently an urgent need for our forces to quickly identify biological warfare agents. A state-of-the-art device, the Rapid Pathogen Identification System, is now being tested to address this need. This system should be perfected and deployed to enable the expeditionary force to identify natural pathogens as well as biological warfare agents.

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USAF Counterproliferation Center

The USAF Counterproliferation Center was established in 1998 to provide education and research to the present and future leaders of the USAF, to assist them in their activities to counter the threats posed by adversaries equipped with weapons of mass destruction.

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