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# Is the U.S. Navy prepared to counter biological warfare threats?

Richardson, Scott Nathan

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# NAVAL POSTGRADUATE SCHOOL
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# THESIS

**IS THE U.S. NAVY PREPARED TO COUNTER BIOLOGICAL WARFARE THREATS?**

by

Scott Nathan Richardson

December 2001

Thesis Advisor: Peter R. Lavoy
Second Reader: James J. Wirtz

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**IS THE U.S. NAVY PREPARED TO COUNTER BIOLOGICAL WARFARE THREATS?**

Scott Nathan Richardson
Lieutenant, United States Navy
B.A., Columbia College, Columbia, Missouri, 1988

Submitted in partial fulfillment of the
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**December 2001**

Author: ______________________
Scott Nathan Richardson

Approved by: ______________________
Peter R. Lavoy, Thesis Advisor

______________________
James J. Wirtz, Second Reader

______________________
James J. Wirtz, Chairman,
Department of National Security Affairs

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# LIST OF ACRONYMS AND ABBREVIATIONS

**–A–**

| | | |
|---|---|---|
| ACAD | – | Automatic Chemical Agent Detector |
| ACTD | – | Advanced Concept Technology Demonstration |
| AFMAN | – | Air Force Manual |
| AMEDDC&S | – | Army Medical Department Center and School |
| APODS | – | Aerial Port of Debarkation |
| ASD(S&TR) | – | Assistant Secretary of Defense for Strategy and Threat Reduction |
| ATSD(CBD) | – | Assistant to the Secretary of Defense for Chemical and Biological Defense |

**–B–**

| | | |
|---|---|---|
| BD | – | Biological Detector (also, Biological Defense) |
| BIDS | – | Biological Integrated Detection System |
| BW | – | Biological Warfare (also Biological Weapons) |
| BWC | – | Biological Weapons Convention |
| BWD | – | Biological Warfare Defense |
| BWDZ | – | BW Decontamination Zone |

**–C–**

| | | |
|---|---|---|
| C4I | – | Command, control, communication, computer, and intelligence |
| CA | – | Commodity Area |
| CATF | – | Commander Amphibious Task Force |
| CB | – | Chemical and biological (also C/B) |
| CBD | – | Chemical and biological defense |
| CBDP | – | Chemical and Biological Defense Program |
| CBIAC | – | Chemical and Biological Information Analysis Center |
| CBIRF | – | Chemical Biological Incident Response Force |
| CBM&S | – | Chemical/Biological Modeling & Simulation |
| CBU | – | Cluster Bomb Unit |
| CF | – | Counter Force |
| CIA | – | Central Intelligence Agency |
| CINC | – | Commander-in-Chief |
| CJCS | – | Chairman of the Joint Chief of Staff |
| CM | – | Consequence Management |
| CNO | – | Chief of Naval Operations |
| CO | – | Commanding Officer |
| CONUS | – | Continental Untied States |
| CP | – | Chemical protective (also, collective protection, command post, or |
| CP/CBD | – | Counterproliferation/Chemical and Biological Defense |
| CVBG | – | Carrier Battlegroup |
| CW | – | Chemical Warfare |

**–D–**

| | | |
|---|---|---|
| DARPA | – | Defense Advanced Research Projects Agency |
| DATSD (CBD) | – | Deputy Assistant to the Secretary of Defense for Chemical/Biological Defense |
| DOD | – | Department of Defense |
| DP | – | Detection and Protection |
| DTRA | – | Defense Threat Reduction Agency |
| DTRA(CB) | – | Defense Threat Reduction Agency's Chemical and Biological Defense Directorate |

**–E–**

| | | |
|---|---|---|
| EMD | – | Engineering and Manufacturing Development |

**–F–**

| | | |
|---|---|---|
| FBE | – | Fleet Battle Experiment |
| FM | – | Field Manual |

**–G–**

| | | |
|---|---|---|
| GAO | – | General Accounting Office |

**–H–**

| | | |
|---|---|---|
| HAZWARN | – | NBC Hazardous Warning System |
| HHA | – | Hand Held Immunochromatographic Assays |
| HQ | – | Headquarters |
| HMMWV | – | High Mobility Multipurpose Wheeled Vehicle |
| HSS | – | Health Service Support |

**–I–**

| | | |
|---|---|---|
| IBAD | – | Interim Biological Agent Detector |

**–J–**

| | | |
|---|---|---|
| JBPDS | – | Joint Biological Point Detection System |
| JBSDS | – | Joint Biological Standoff Detection System |
| JMCBDRP | – | Joint Medical Chemical and Biological Defense Research Program |
| JPO-BD | – | Joint Program Office for Biological Defense |
| JSGPM | – | Joint Service General Purpose Mask |
| JSIG | – | Joint Service Integration Group |
| JSLIST | – | Joint Service Lightweight Integrated Technology (individual protection) |
| JTTP | – | Joint Tactics, Techniques, and Procedures |
| JWARN | – | Joint Warning and Reporting Network |

**–L–**

| | | |
|---|---|---|
| LCBPG | – | Lightweight CB Protective Garment |
| LOE | – | Limited Objective Experiment |
| LP | – | Local Unit Practices |
| LRBSDS | – | Long-Range Biological Stand-off Detection System |
| LWZ | – | Littoral Warfare Zones |

**–M–**

| | | |
|---|---|---|
| M&S R&D | – | Modeling and Simulation Research and Development |
| MOE | – | Measure of Effectiveness |
| MRCP | – | Marine Corps Reference Publication |
| MOPP | – | Mission Oriented Protective Posture |
| MTF | – | Medical Treatment Facility |
| MTW | – | Major Theater War |
| MWCP | – | Marine Corps Warfighting Publications |

**–N–**

| | | |
|---|---|---|
| NATO | – | North Atlantic Treaty Organization |
| NAVMED | – | Naval Medical |
| NBC | – | Nuclear, Biological, and Chemical |
| NDDA | – | National Defense Authorization Act of FY 1994 |
| NSF | – | Naval Surface Forces |
| NTTP | – | Naval Tactics, Techniques, and Procedures |
| NWDC | – | Naval Warfare Development Command |

**–O–**

| | | |
|---|---|---|
| OPGEN | – | General Operating Instructions |
| OPNAV | – | Chief of Naval Operations |
| OPTASK | – | Operational Tasking |
| OSD | – | Office of the Secretary of Defense |
| OTC | – | Officer in Tactical Command |

**–Q–**

| | | |
|---|---|---|
| QDR | – | Quadrennial Defense Review Report |

**–R–**

| | | |
|---|---|---|
| RDA | – | Research, Development, and Acquisition |
| RDT&E | – | Research, Development, Test and Evaluation |
| RMA | – | Revolution in Military Affairs |

**–S–**

| | | |
|---|---|---|
| SALAD | – | Shipboard Automatic Liquid Agent Detector |
| SORTS | – | Status of Readiness and Training Reporting System |

**–T–**

| | | |
|---|---|---|
| TTP | – | Tactics, Techniques, and Procedures |

**–U–**

| | | |
|---|---|---|
| UAV | – | Unmanned Aerial Vehicle |
| USAMRIID | – | U.S. Army Medical Research Institute of Infectious Diseases |
| USG | – | United States Government |
| USMC | – | United States Marines Corps |
| USN | – | United States Navy |

**–V–**

| | | |
|---|---|---|
| VEE | – | Venezuelan equine encephalomyelitis |

**–W–**

| | | |
|---|---|---|
| WMD | – | Weapons of Mass Destruction |

**–Y–**

| | | |
|---|---|---|
| *Y. pestis* | – | *Yersinia Pestis* (Plague) |

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# EXECUTIVE SUMMARY


The biological warfare (BW) threat to U.S. Naval Surface Forces (NSF) is real but not well understood. Greater awareness about the threat is essential for U.S. NSF to establish key competencies to counter its effects. Commanding Officers (COs) and Officers in Tactical Command (OTCs) will be placed in positions where they must combat challenges from adversaries who will seek to use BW. This thesis identifies what can be done to enhance NSF capabilities to counter BW.

Having neglected the BW threat, the U.S. Navy seeks to improve its preparedness by exploiting the development of key bio-defense systems. While some of these systems including Joint Portal Shield and the Joint Biological Point Detection System will soon be deployed, the Navy still lacks doctrine, organizational modifications, training and education, and leadership to take advantage of these new technological systems.

This thesis suggests that *Local Unit Practices* (LPs) prescribed by COs and OTCs should be established to match each unit's capability and sustainability to the threat. To do so, requires an institutional revolution that maximizes NSF doctrine and Tactics, Techniques, and Procedures (TTPs) which tie directly into LPs to provide the means for BW defense and protection.

An adversary will not seek to engage the U.S. Navy on the high seas, where the United States holds absolute dominance. Rather, it would seek to prevent U.S. NSF from entering littorals and foreign ports by massive attrition, and small-scale, asymmetric attacks. By targeting ports and airfields, an adversary could block U.S. entry into a region and cut off logistics needed to support U.S. and allied forces in theater.

Currently training and doctrine represent less than two percent of appropriations in FY 2001. Additionally, training and doctrine programs for BW defense rank at the bottom of a priority list of 135 items. This thesis recommends *institutionalization* of training and education, doctrine, leadership organizations, and humans who possess the right capabilities, to take advantage of technology to counter the threat.

There are three reasons why the U.S. Navy should be investing more in BW defense. First, adversaries may wish to deny or deter U.S. access into a region or theater. Second, BW are relatively inexpensive, easily camouflaged within commercial ventures, potentially as devastating as nuclear weapons, and are becoming the "poor man's nuclear weapons." Third, BW agents can be used in different scenarios with varying effects against substantial U.S. NSF vulnerabilities.

U.S. NSF often are first to arrive on the scene of some crisis. The question is not *whether* attacks on American forces will take place in the future, but when and where they will occur. The terrorist attack on USS COLE (DDG-67) highlighted the constant dangers confronting NSF. Protection should include measures that enable warriors to survive and operate in a BW environment; with current capabilities they cannot in "total" without unifying under the rubric of Consequence Management (CM).

The thesis reports on *comprehensive,* fleet wide understanding of BW threats and addresses the need for codified warfighting doctrine, relevant TTPs, and sound LPs to revolutionize U.S. NSF power against BW aggressors. It consists of five chapters. Chapter one introduces the author's research statement, a description of threats and an examination of motives for using BW. Chapter two describes the BW threat to U.S. NSF and defines state and non-state actors through case assessment, and provides a categorization of BW agents and possible delivery systems. Chapter three evaluates Fleet detection capabilities, highlighting the Navy's BW Executive Agent, detection and protection technologies, and means for sustaining the mission in contaminated environments. Chapter four presents options for sustaining the mission through Consequence Management (CM), and Health Service Support (HSS). Chapter five summarizes the main findings of this thesis and provides recommendations for a "Way Ahead".

# I. INTRODUCTION

## A. BACKGROUND

U.S. Naval Surface forces (NSF) must possess the capability to counter biological warfare (BW) threats, and be prepared to survive, fight, and prevail in contaminated environments. Integrated on the Fleet level, leaders and operators should be prepared, across the spectrum, to operate in contaminated environments unencumbered by the BW threat. To date there exists no single doctrine against a biological weapons (BW) threat to NSF.

DoD coordinates the integration of biological programs and directs improvements in readiness to survive, fight and win in contaminated environments. It provides policy to eliminate unnecessarily redundant programs, and funds program priorities and overall readiness.[1] To date, the U.S. Navy has taken delivery of numerous technological systems but has not produced fleet wide doctrine and TTPs that will fully enable NSF to deter or thwart the BW threat.

The United States now faces what could be called a superpower paradox. The unrivaled supremacy of the United States in the conventional military arena is prompting adversaries to seek asymmetric means to strike what is perceived as the Achilles heel of the United States.[2] The May 1997 *Report of the Quadrennial Defense Review* concluded that U.S. defense planners must assume that use of BW is a "likely condition of future warfare" and that these are likely to be used "early in the conflict to disrupt U.S. operations and logistics."[3]

Commanding Officer (COs) and Officers in Tactical Command (OTCs) require *revolutionary* mechanisms for combating challenges from adversaries armed with Weapons of Mass Destruction (WMD). Joint doctrine and joint tactical requirements

---

1 Department of Defense Chemical and Biological Defense Program, Annual Report to Congress (Washington, D.C.: Defense Technical Information Center (DTIC), U.S. GPO, March 2000), 5. Available at: http://www.defenselink.mil/pubs/chembio02012000.pdf.

2 Secretary of Defense William S. Cohen, Proliferation: Threat and Response (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], January 2001), i.

3 Secretary of Defense William S. Cohen, Quadrennial Defense Review Report, (Washington, D.C.: U.S. GPO, May 1997), 13.

necessitate development of naval doctrine, and Tactics, Techniques, and Procedures (TTPs) that enable NSF to decrease vulnerabilities and defeat the threat.

Joint Publication 3-11 sets forth basic principles to assist commanders and staffs plan and conduct operations in which their forces may encounter BW, provides guidance for exercise of authority by combatant commanders, and prescribes doctrine for joint operations and training. It directs that "all organizations of the Armed Forces of the United States subject to joint doctrine" be responsible for ensuring that their forces and facilities be prepared and trained to operate in BW environments.[4]

The September 2001 *Quadrennial Defense Review Report* stated that "the United States is likely to be challenged by adversaries with Weapons of Mass Destruction (WMD), and that geopolitical and military trends will profoundly shape future security environments."[5] Future adversaries will seek to counter U.S. strengths and exploit its weaknesses. They will reap political and military benefits if they can limit the freedom of action on the part of U.S. armed forces by threatening high-value targets.

Nation-states may view BW as means to become a regional power, reduce Western influence, or deter U.S. intervention in regional conflicts. By targeting points of debarkation such as ports and airfields, an adversary could block NSF entry into a region and cut off logistics needed to support U.S. and allied forces in the theater. Some actors may acquire BW to offset U.S. conventional superiority by threatening use against forward deployed U.S. NSF, airbases, or seaports.[6]

The breakup of the Soviet Union, the dominance of the United States as a conventional power, and the rise of radical groups have raised concern regarding the use of BW against military forces in combat.[7] According to DoD, at least 25 countries now

4 Joint Publication 3-11 is the Chairman, Joint Chiefs, Joint Doctrine for Operations in Nuclear, Biological, and Chemical (NBC) Environments, (Washington, D.C.: CJCS, 11 July 2000), i – I-8.

5 Secretary of Defense Donald H. Rumsfeld, Quadrennial Defense Review Report (Washington, D.C.: U.S. GPO, September 2001), 3.

6 Steven Metz, Armed Conflict in the 21st Century: The Information Revolution and Post-Modern Warfare (Carlisle: Strategic Studies Institute, Army War College, April 2000), 40-45.

7 Franz, Jahrling, Friedlander, and others, "Clinical Recognition and Management of Patients Exposed to Biological Warfare Agents", in Joshua Lederberg, Biological Weapons: Limiting the Threat, (Cambridge, MA: BCSIA Studies International Security, MIT Press, 1999), 37.

possess, or are acquiring or developing, BW or the means to deliver them. BW also has found its way into the hands of non-state actors.[8]

Ships, fixed and rotary wing aircraft, small boats and Marine Corps vehicles ─ all NSF platforms involved in power projection─, require protection from BW and should be prepared through doctrine, institutionalized TTPs, fleet-wide use of LPs, and effective training programs that harness current and emerging technologies as means for detecting, identifying, and protecting U.S. NSF against the BW threat.

In the logic of the anti-access approach, an opponent would not seek to engage the U.S. Navy on the high seas, where the United States holds absolute dominance. Rather, it would seek to prevent U.S. NSF forces from entering littorals and foreign ports by massive attrition, and small-scale, asymmetric attacks.[9] State and non-state actors might now have the capability to deter or deny U.S. national interests.

## B. ARGUMENT

This thesis examines the effects BW use by state and non-state actors could have against U.S. NSF. It explores the U.S. Navy's ability to counter the threat in the areas of doctrine, TTPs, detection and protection technologies, Consequence Management (CM), and Health Services Support (HSS). It recognizes a lack of current doctrine and TTPs, and proposes the development of *Local Unit Practices* (LPs) as a means to protect forces and sustain the mission.[10]

It poses, among others, the following questions: How could BW be used to effectively deter U.S. NSF power projection? Could BW use against maritime ports and air facilities slow, or negate, capabilities to position NSF during a crisis or major conflict? Could an aggressor employ BW to cripple on-going U.S. Navy operations? For example, might an aggressor launch BW strikes against main seaports or airfields of debarkation to disrupt the flow of U.S. combat aircraft, troops, heavy military hardware, munitions, and other supplies into theater?

8 Office of Secretary of Defense, Proliferation: Threat and Response, i.

9 Sam J. Tangredi, "The Future Security Environment, 2001-2025: Toward a Consensus View," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 38.

10 For more clarity on military doctrine see Scott D. Sagan, "The Origins of Military Doctrine and Command and Control Systems," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons (Ithaca: Cornell University Press, 2000), 16-46.

If BW attacks were launched during of a short-warning invasion, could such an attack buy sufficient time to achieve military objectives, or to disperse an adversary's forces, thereby forcing the United States to consider conceding or accepting much larger costs? And, by what means is the U.S. Navy enhancing (1) detection and protection capabilities, (2) changes in doctrinal responses, (3) TTPs, and (4) assessments of ships, amphibious landing forces, and force-wide LPs necessary to counter the BW threat, now and in the future?

Fundamentally, the U.S. Navy needs means to win or avoid engagements with evolving BW threats, and to do so in stride while projecting power from the Sea. Navy platforms encounter threats from weapons, sensors, countermeasures, and stealthy systems and must overcome them with organic means of self-defense, without diversion from their mission.

The former Secretary of the Navy Richard Danzig stated: "there is a regrettable tendency to think about defense against biological warfare either as unnecessary or as 'too hard.'" He went on to say: "vulnerabilities to BW attacks are substantial…many blind spots are beyond our control…many, however, are self inflicted -- they are a result of our under-investment and lack of attention. In short, by our neglect we are ourselves creating incentives (for adversaries) to use BW."[11]

How might a BW attack on naval forces compare to the attack on USS COLE (DDG-67) on 12 October 2000?[12] Terror tactics threaten to undermine U.S. strengths by attacking political will. The COLE attack dramatically demonstrates the vulnerability of deployed naval forces. It spotlighted vulnerabilities surface ships face during in-port operations, or operating within the confines of a harbor or anchorage environment. The advantages of a modern warship are largely erased when deprived of the ability to maneuver or use its primary weapons. A ship might find itself in the unenviable position of being vulnerable to an assailant who takes advantage of a ship's close proximity to land and the availability of low-cost, short-range delivery methods.[13]

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11 Secretary of the Navy Richard Danzig, "Biological Warfare: A Nation at Risk -- A Time to Act," (Washington, D.C.: National Defense University, Institute for National Strategic Studies Press, No. 58, January 1996).

12 Kristin S. Kolet, "Asymmetric Threats to the United States," National Institute for Public Policy, (Fall 2001), 286-287.

13 Department of the Navy (DoN) Surface Warfare Development Group (SWDG). Tactical Memo (TACMEMO) SWDG 3-20.4-01 (Little Creek: Department of the Navy Printing Office [NPO], February 2001), 1-1(U).

## C. THE THREAT

The United States relies heavily on its navy for global power projection. Adversaries respect the power and technological sophistication of the U.S. Navy and recognize that the potential for parity on the high seas is impossible. Attacking the U.S. Navy asymmetrically using BW is a viable strategy to marginalize the technological superiority of U.S. NSF.

There are three compelling reasons why the U.S. Navy should be investing more in BW defense. First, adversaries whose strategies perceive American reluctance to accept high mortality rates may wish to challenge U.S. NSF in attempts to deny or deter U.S. access into a region or theater.[14] Second, because BW are relatively inexpensive, easy to camouflage within commercial ventures, and potentially as devastating as nuclear weapons, they hold promise for becoming the "poor man's nuclear weapons."[15] Third, current U.S. NSF vulnerabilities are substantial.[16] BW agents can be used in different scenarios with varying effects. The target and nature of the attack determine which agent is used and how it is delivered.[17]

A BW attack might cause widespread infection and death, resulting in the failure of U.S. military action. While precision with BW is difficult, an attack would seek to employ weapons directly against ships and amphibious landing forces. The preferred agents for such an attack may not result in death, but, rather, cause severe disability and disorientation.[18]

### 1. Motivations of State and Non-State Actors

Despite international attempts to combat BW proliferation by enacting and strengthening the Biological Weapons Convention (BWC), many countries are pursuing offensive BW capabilities.[19] Non-state actors also have already turned to BW. Heightened awareness of state BW threats and military adaptations may have the

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14 Under Secretary of the Navy Richard Danzig, "Why Defense against Biological Warfare Should be a Priority," Surface Warfare Magazine (November/December 1996), 10.

15 United States Government (USG), The Worldwide Biological Warfare Threat (Washington, D.C.: U.S. GPO), 16.

16 Danzig, "Why Defense Against Biological Warfare Should be a Priority," 11.

17 USG, The Worldwide Biological Warfare Threat, 16. Basic Operational-Use-Scenarios include those for strategic, tactical, and special operations forces, as well as for state sponsored terrorism purposes.

18 Ibid., 16.

19 Vernon Loeb, "U.S. Won't Back Plan to Enforce Germ Pact: Draft 'Unworkable,' Bush official says," Washington Post, (21 July 2001), 1. More than 140 countries, including the United States, have ratified the BWC. The Treaty lacks any effective means of enforcement. Negotiations on a protocol for verifying compliance have been underway since 1995.

unintended effect of inspiring non-state actors, or they may act as proxies for state actors.[20]

Many more countries are now capable of attacking U.S. NSF with BW than with nuclear weapons. BW is sometimes dismissed as dangerous and ineffective by those who do not know that such weapons can achieve lethality levels consistent with low-yield nuclear weapons or that biotechnology makes their production and controlled use easier than in times past.[21]

Iraq, Iran, North Korea, China, Russia, Syria, and Libya are all thought to possess deliverable BW capabilities.[22] BW programs are all conducted in secret. Except for Iraq and Russia, no state openly admits to having built deliverable weapons. Under this cloak of secrecy, BW have accumulated in the arsenals of states that are willing to violate their own sovereign commitments not to break taboos against such weapons, to not support terrorism, and not to use BW against enemies.[23]

### 2. Why BW Presents the Greatest Danger

The process of developing BW is complex but not too difficult. Three steps are required: (1) development of a stock culture of the desired agent, (2) acquisition of the appropriate equipment for production of the biological agent and manufacture of munitions, and (3) qualified technicians for production, testing, and evaluation, creation of delivery systems, and fitting agents to those systems. The ease in obtaining a stock culture of a desired organism is one of the *greatest* dangers of BW.[24]

According to OSD, the availability of technologies, expertise, and information stems from the willingness of various state suppliers to sell BW materials and technologies, and a veritable information explosion from academic and commercial sources. It also may be fueled by weakened security at some key nuclear, biological and chemical (NBC) facilities in Russia, the search for employment by unemployed scientists

20 Non-state actors will not necessarily follow the strategies or tactics of state directed military-style attacks. In fact, they could use weapons that do not have the same requirements for dependability, ruggedness, or sophistication, and that do not resemble state actor capabilities at all.

21 Brad Roberts, "Rethinking the Proliferation Debate: A Commentary," Security Studies, Vol. 4, No. 4, (Summer 1995), 793.

22 Ibid., 800.

23 Ibid.

24 Office of Secretary of Defense, Proliferation: Threat and Response, 4.

and technicians (the "brain drain), and the transfer or sharing of technology among states trying to develop programs.[25]

Medical developments are particularly troubling because virtually all the equipment, technology, and materials needed for BW agent research and development and production are dual-use. Any state or non-state actor with the political will and a competent scientific base available in civilian industrial or scientific enterprises can produce toxins or infectious agents, which include viruses, bacteria, and rickettsiae.[26]

BW use against theater-level targets offers the most lucrative and cost-effective employment option of all forms of WMD. BW enjoy the same deterring effect as CW on the battlefield, but can be far more potent in effect.[27] While all WMD are lethal, it is clear that, on a bomb-for-bomb basis, BW could rival or exceed the killing power of nuclear weapons in the sense that BW also possess the potential to begin epidemics that could cause fatalities far beyond the point of contact.[28]

## D. IMPLICATIONS

### 1. U.S. Naval Surface Forces

COs and OTCs must understand NSF vulnerabilities to BW attacks that could employ very small amounts of agent with catastrophic results. What specific systems and capabilities will enable U.S. NSF to sustain the mission and prevail in a contaminated environment? More specifically, what are the TTPs for countering BW, and what doctrine will the U.S. Navy follow? Those accountable should have the means to answer the threat just as with any other warfare area. Those in command *require* institutional guidance from which to develop and disseminate LPs for those they lead.

CBDP invests heavily in battlefield reconnaissance vehicles, sensor networks for detecting large area attacks, theater warning and reporting for multiple attacks, and protective ensembles to enable combat operations in BW environments. In August 2001,

25 Ibid., 3. An offensive program must have people with the technical skills and knowledge of production and weaponization of agents. Subsequent to the Cold War, the Russians are committed to the security of weapons-useable materials, but continuing turmoil in society, corruption, and resource shortages complicate the ability of Russian officials to safeguard BW advances. Other states and non-state actors, including terrorist groups, seek to acquire these materials and employ extreme means to buttress this security shortfall against Russia's societal bent towards corruption.

26 Ibid., 4.

27 Kenneth F. McKenzie, Jr., "The Rise of Asymmetric Threats: Priorities for Defense Planning," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 84.

28 Barry R. Scheider, Future War and Counterproliferation; U.S. Military Response to NBC Proliferation Threats, (Westport: Praeger, 1999), 93.

initial testing began onboard U.S. Navy ships introducing the Joint Biological Point Detection System (JBPDS).[29] What remains *missing* is codified doctrine, TTPs, and LPs.

There is no evidence to suggest that operators could adopt a common posture in the case of a BW attack, or incident.[30] While the manageability of a BW attack can be debated, operational and tactical preparation will serve both deterrent and counter-proliferation strategies.

### 2. The Road Ahead

The U.S. Navy possess a wide range of detection technologies that represent good first steps in meeting CBDP requirements; however, current training and doctrine appropriations represent less than two percent of CBDP appropriations in FY 2001. Additionally, training and doctrine programs rank numbers 128, 132, 133, and 135 respectively in the priority list of 135 programs in the Joint Service Nuclear, Biological and Chemical (NBC) Defense Modernization Plan (JSNDMP).[31] These and many other issues should be addressed in the development of future BW defense strategies.

New technologies for detection and protection, health services support and consequence management are being evaluated. Chief among them is the Joint Biological Point Detection System (JBPDS), which includes the Joint Point - Man-Portable XM96, and the Joint Point - Shelter XM97, designed for detection, warning, collection, and identification of BW agents.[32] Procurement of decontamination development systems is underway, for a lightweight, modular, decontamination system that will reduce the logistics burden compared to existing systems.[33] New concepts and technologies are being fielded to network joint systems for decontamination of ports and airfields, and efforts are being pursued to develop a decontaminant for sensitive equipment (e.g.,

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29 Obtained through personal interview with George W. (Bill) Gates. NSWC Crane Division, Code 805D, 6 September 2001. JBPDS is the initial stage for providing "network" point detection protection to forces in BW environments.

30 Mr. Christopher J. Vogt and Mr. Peter Novick writing for the Navy Warfare Development Command, Maritime Battle Center, in Newport, Rhode Island, assert: "the current approach is a holdover from the Cold War, against an adversary who planned to saturate the northern German plain with VX before driving its tank divisions to the Rhine." Chris Vogt, is Naval Scientific Advisor to COMSEVENTH Fleet. Most of his efforts have been leading CP-related experiments in the Navy's FBE program. Mr. Pete Novick, a retired Surface Warfare Commander, is Emergency Management/CBR-D Officer for U.S. Naval Forces Japan, with shore installation management responsibility for Japan and Diego Garcia.

31 Joint Service Integration Group. "Joint Service Nuclear, Biological, and Chemical (NBC) Defense Modernization Plan," (DRAFT, November 2000).

32 Once operationally tested and fielded throughout all services, it will possess the capability of providing a detection network throughout BW threat areas.

33 Critical shortfalls remain to replace the current decontamination solution with one that is non-aqueous, non-corrosive, and environmentally safe.

electronics); however, technologies alone will not provide adequate means for effective BW defense.

## E. ORGANIZATION

This thesis consists of five chapters. Chapter one introduces the author's research statement and questions to be addressed, a background of threats from actors and an examination of motives for using BW and implications for NSF, and entering precepts. Chapter two describes the BW threat, defines state and non-state actors through case assessment, and provides a categorization of BW agents, and delivery systems. Chapter three evaluates Fleet capabilities, highlighting the Navy's BW Executive Agent, considers methods for protecting the force, and covers detection and protection technologies, and the means for sustaining the mission in BW contaminated environments. Chapter four presents options for sustaining the mission through CM, and HSS, and concludes that adapting a "collective protection" approach using all of the capabilities DoD forces can provide is the most lucrative solution for BW defense. Chapter five summarizes the main findings of this thesis and plots a "Way Ahead" in the realm of biological warfare.

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## II. THE BW THREAT TO U.S. NAVAL FORCES

### A. INTRODUCTION

How could biological weapons (BW) be used to thwart U.S. Naval Surface forces (NSF) ability to project power? Although they are usually seen as less threatening than nuclear weapons, biological agents can inflict massive casualties.[34] BW can be used in a limited fashion, for example, against amphibious landing forces, materials, and equipment, and for point attacks against ships and naval task forces. BW use against airfields, once considered unlikely because of the time for BW to work and their susceptibility to meteorological and prophylactic factors, has become a significant threat due to enhanced bio-technology.[35]

The Department of Defense (DoD) report, *Proliferation: Threat and Response, 2001*, presents a troubling vision of the threat.[36] Regional actors may employ anti-access strategies using BW to thwart U.S. power projection. Experts agree that BW technologies and associated delivery systems will continue to be diffused to state and non-state actors through sales, modification of dual-use systems and material, and through indigenous development programs.[37]

Adversaries armed with ballistic or cruise missiles could use these systems to deliver BW. They could delay or deny U.S. access to a theater of operations causing U.S. NSF to fail to accomplish their mission.[38] In December 2000, *Global Trends 2015* noted that "the continuing diffusion of bio-technology will be the crest of the wave," and goes on to state that the United States will face "strategic WMD threats…and the potential for unconventional delivery of BW by both state and non-state actors also will grow."[39]

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34 Robert G. Joseph and John F. Reichart, "Deterrence and Defense in a Nuclear, Biological and Chemical Environment," (Washington, D.C.: National Defense University Press, 1999), 1.

35 Ibid., 4.

36 Ibid.

37 Sam J. Tangredi, "The Future Security Environment, 2001-2025: Toward a Consensus View," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 34-35.

38 Michele A. Flournoy, "Introduction: Twelve Strategy Decisions," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 12.

39 Central Intelligence Agency National Intelligence Council, Global Trends 2015: A Dialogue with Non-Government Experts, (Washington, D.C.: National Foreign Intelligence Board), NIC Report No. 2000-02, (December 2000). Available at: http://www.cia.gov/publications/globaltrends2015/index.html - link.9b.

Given uncertainties in regard to science and technology, the report stated that the "rapid advances and diffusion of bio-technology, nano-technology, and the material sciences, will add to adversaries' capabilities to engage in BW and bio-terrorism."[40] To counter this BW trend the U.S. Navy will need to enhance its operational concepts or face constraints to its ability to project U.S. national interests.[41]

The BW threat relies on deterrence and deniability and is based on the fear that biological agents could create large numbers of casualties. The question is, what operational concepts will the U.S. Navy use to counter the threat and how will it get there? American dominance of sea and air is largely irrelevant in dealing with the more likely future threat of BW from state and non-state actors, as well as against the prepared anti-access or area denial strategies of regional opponents.[42]

The Biological and Toxins Agreement disallows states to possess and weaponize biological agents? How do states get away with it? And, what can U.S. NSF do to counter BW proliferator's capabilities? The weaponization and delivery of BW agents entails field-testing of biological aerosols, munitions, and delivery systems, as well as troop exercises and could be conceded or carried out at night or under the cover of legitimate dual-use activities by both state and non-state actors.[43]

The United States and most allies cannot respond in kind if BW were used, and adversaries are well aware of this fact.[44] Actors seeking BW capabilities likely will begin with the development of standard agents that have previously been weaponized such as anthrax, tularemia, and botulinum toxin.[45] Possible delivery systems range in complexity and effectiveness from an agricultural sprayer to specialized cluster warheads

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40 Ibid.

41 Elizabeth Kier and Jonathan Mercer, "Setting Precedents in Anarchy: Military Intervention and Weapons of Mass Destruction," International Security, Vol. 20, No. 4 (Spring 1996), 77-106. The authors argue that setting precedent may be particularly important in today's post cold war environment where the rules of the road are under negotiation. For further discussion on international reputations see Jonathan Mercer, Reputation and International Politics (Ithaca: Cornell University Press, 1996).

42 In the logic of the anti-access approach, a potential opponent would not seek to engage the Navy at sea, where the United States holds absolute dominance. Rather, it would seek to prevent U.S. NSF from entering its littoral waters by massive attrition attacks using biological weapons.

43 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 76.

44 Barry R. Schneider, Future War and Counter Proliferation: U.S. Responses to NBC Proliferation, (Westport: Praeger Publishing, 1999), 70.

45 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 84.

carried on a ballistic missile.[46] Ultimately the political question of BW proliferation becomes a political and diplomatic issue beyond the scope of this research.

This chapter ties state and non-state actors directly to means for maximizing the BW threat to NSF and capabilities for their delivery. Incentives and disincentives are contrasted with countries capabilities for BW production of different types of biological agents to illustrate how actors might thwart U.S. NSF ability to project power.

## B. WORLD ACTORS (CASE ASSESSMENTS)

It is estimated that more than 100 countries have the capacity, if not the intent, to develop at least crude BW based on standard microbial and toxin agents; in addition to the United States, Russia, Western Europe, and Japan, countries with an advanced biotechnology infrastructure include, Argentina, Brazil, Chile, Cuba, India, Israel, China, Iran, Iraq, Egypt, Syria, North Korea, Taiwan, and Thailand.[47]

### 1. State Actors and Threat Environments

The devastation that could be caused by use of BW agents is suggested by the fact that throughout history, the inadvertent spread of infectious disease during wartime has caused far more casualties than actual combat.[48] Even though BW arouses general repugnance, has never been conducted on a large scale, and is banned by an international treaty, BW agents were stockpiled during both the Great War and the Second World War and continue to be developed as strategic weapons—"the poor man's atomic bomb''—by a growing number of countries.[49]

Evidence suggests that states are acquiring BW for multiple reasons. Incentives and disincentives acting in combination have the net effect of motivating countries to seek an offensive BW program, or to refrain from doing so. States suspected of having ongoing BW programs are clustered in two conflict-ridden regions of the world. Six are located in North Africa and the Middle East (Egypt, Iraq, Iran, Israel, Libya, and Syria), and another five are concentrated in East Asia (Burma, China, North Korea, South Korea,

46 Ibid., 94.

47 Raymond A. Zilinska, "Biological Warfare and the World" Politics and the Life Sciences, Vol. 9, No. 1, (August 1990), 61. Also see Deputy Assistant Secretary of Defense Thomas Welch, "Testimony before the U.S. Congress" reported in Defense Week (May 1998).

48 John P. Heggers, "Microbial Invasion-The Major Ally of War (Natural Biological Warfare)," Military Medicine, Vol. 143, No. 6, (June 1978), 390-394.

49 For a more detailed discussion of terrorism, see OTA, U.S. Congress, Technology Against Terrorism, (Washington D.C.: U.S. GPO, July 1991), 21-22. See also Jessica Eve Stem, "Will Terrorists Turn to Poison?" Orbis, Vol. 37, No. 3, (Summer 1993).

and Taiwan). Other alleged BW proliferators include Russia, which may not have fully eliminated the vast program inherited from Soviet Union, and South Africa, which during the Apartheid era had an active BW program that was reportedly dismantled in 1993.[50] Cuba, India, Laos, Pakistan, and Vietnam also appear on some lists of suspected BW proliferators.[51]

What are the primary motivations for state actors acquiring BW? According to Jonathan B. Tucker, the veil of secrecy surrounding BW programs suggests that BW do not have the same prestige value as nuclear weapons. This suggests that the decision to acquire a BW capability is often based on the perception of an acute security threat, accompanied by a deficit in the ability of the state to counter that threat with conventional weapons.[52] Security-related incentives and disincentives for the acquisition of BW are summarized in Table 2.1.

The list of suspected BW proliferators can be divided into two general categories based on the technical and financial resources at their disposal. More developed states, such as China, Russia, Iran, and Iraq, have pursued the full panoply of WMD, with a primary emphasis on nuclear arms. In contrast, less-developed states such as Libya, for whom the nuclear option remains technically and financially inaccessible, have focused their efforts on the acquisition of BW.[53] Countries that seek nuclear weapons also may pursue BW as an interim strategic deterrent until they can build and deploy secure nuclear forces. An apparent paradox concerning the value of BW for deterrence is that countries generally do not admit to possessing them.

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50 P. Taylor, "Toxic South African Arms Raise Concern," Washington Post, (28 February 1995), A-14. In Zilinskas, "Biological Warfare and the World," 27.

51 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 82; J. M. Collins, Z. S. Davis, and S. R. Bowman, Nuclear, Biological and Chemical Weapon Proliferation: Potential Military Countermeasures, (Washington, D.C.: Congressional Research Service, Report No. 1994-528S, 1994), 2; W. S. Carus. "The Poor Man's Atomic Bomb?" "Biological Weapons in the Middle East," Policy Paper No. 23, (Washington, D.C.: Washington Institute for Near East Policy, 1991) in Raymond A. Zilinskas, Biological Warfare: Modern Offense and Defense, (Boulder: Lynne Rienner Publishers, 2000).

52 Jonathan B. Tucker, "Motivations For and Against Proliferation: The Case of the Middle East" in Zilinskas, Biological Warfare: Modern Offense and Defense, 27-52.

53 Tucker, "Motivations For and Against Proliferation: The Case of the Middle East" in Zilinskas, Biological Warfare: Modern Offense and Defense, 29-30.

| Incentives | |
|---|---|
| 1. | To deter chemical, biological, or nuclear attack by regional or extraregional powers |
| 2. | As a force-multiplier against regional or extraregional powers possessing superior conventional capabilities (e.g. U.S. capabilities) |
| 3. | To achieve regional hegemony by intimidating neighboring states |
| 4. | As a tactical weapon for battlefield use |
| 5. | For covert warfare or economic sabotage against enemy states |
| 6. | For State-supported terrorism |
| 7. | For Counterinsurgency warfare against internal groups |
| 8. | For assassination and harassment of political opponents |
| **Disincentives** | |
| 1. | Absence of a perceived security deficit or the existence of a credible security guarantee |
| 2. | Limited deterrent value compared with nuclear arms or the perception that BW lacks military utility |
| 3. | Risk of provoking offsetting weapons programs by other states or presumptive military action |
| 4. | Security problems associated with maintaining a BW capability |
| 5. | International norms against acquisition and use |
| 6. | Global and regional arms control regimes, if backed up with political or economic sanctions |
| 7. | Availability of effective defenses |
| 8. | Opportunity costs and resources trade offs with conventional arms |

Table 2.1. Security Incentives and Disincentives for Acquiring Biological Weapons.[54]

How long will U.S. NSF strength remain superior to undeveloped countries possessing BW? Some developing countries, having learned the lessons of Iraq's defeat in the 1991 Gulf War and Serbia's debacle in Kosovo in 1999, may pursue an asymmetric strategy in which they seek to pit their strengths against the vulnerabilities of advanced industrialized states that are superior in conventional military power.[55]

54 Ibid., 30.

55 Ivan Arreguin-Toft, "How the Weak Win Wars: A Theory of Asymmetric Conflict," International Security, Vol. 26, No. 1 (Summer 2001), 93-128.

Since BW can inflict mass casualties yet are far cheaper than conventional bombs and delivery systems, they offer potential means for poor countries to offset the advantage provided by high-technology conventional weapons. The goal of this strategy would be to deter outside intervention altogether or to prevent the stronger side from bringing to bear the full weight of its conventional military power.[56]

An assessment of selected countries BW capabilities is provided in Table 2.2.

| | |
|---|---|
| **Iraq** | *Iraq* produced and weaponized significant quantities of BW agents prior to the 1991 Gulf War. While it admitted BW efforts in 1995, it claimed to have destroyed all agents, but offered no credible proof and may have begun program reconstitution in absence of UN inspections and monitoring. |
| **North Korea** | *North Korea* has pursued BW capabilities since the 1960s and possesses the infrastructure that can be used to produce BW agents. It may already have BW available for use. |
| **China** | *China* possesses the necessary capability and infrastructure adequate to develop and produce BW agents. It reaffirmed commitments not to develop BW, but likely retains some elements of an offensive program. |
| **Russia** | *Russia* may have many elements of its FSU BW program still intact and could support future agent production. Some offensive BW activities may still be continuing. |
| **Iran** | *Iran* possesses the overall infrastructure and expertise to support a BW program. It pursues contracts with Russian agencies and other sources to acquire dual-use equipment and technology and is believed to be actively pursuing offensive BW capabilities to thwart Iraqi aggression and regional tensions, and may even currently possess small levels of usable agent. |
| **Syria** | *Syria* possesses an adequate bio-technical infrastructure to support a limited BW program and is probably pursuing biological agent development, but is not believed to have a major agent production effort underway. |
| **Libya** | *Libya* remains in the research and development stage, but may be capable of producing small quantities of agent in the near future. |
| **India** | *India* has a substantial bio-technical infrastructure and the necessary expertise, some of which is assumed as being used for BW defense research. |
| **Pakistan** | *Pakistan* is believed to possess the capability to support a limited BW research effort. |

Table 2.2. Selected Countries BW Capabilities.[57]

### 2. Non-State Actors

How can U.S. NSF counter BW threats from non-state actors? The non-state asymmetric strategy is difficult to anticipate. The United States normally considers other *states* as potential enemies, however, given the wide distribution of technology and

56 Tucker, "Motivations For and Against Proliferation: The Case of the Middle East" in Zilinskas, Biological Warfare: Modern Offense and Defense, 31.

57 Office of Secretary of Defense (OSD), 2001 in United States Government (USG), The Worldwide Biological Warfare Threat (Washington, D.C.: U.S. GPO), 2.

knowledge, and the capabilities of well-honed terrorist and smuggling organizations, future adversaries may not be other states at all.

Troublesome questions arise: Can a state declare war against a non-state? What if the non-state actor is sheltered within the territory of a state?[58] The war on terrorism waged against the Taliban and other Al Queada organizations in Afghanistan beginning in October 2001 is an example of this problem. The rise of sophisticated, powerful, and hostile non-state actors suggests that finding answers to these questions should become paramount to national priority.[59]

Should the U.S. Navy concentrate solely on "state actors"? How could a non-state actor compete with superior military forces? The Director of Central Intelligence in February 2001 said that "[T]errorists groups are actively searching the internet to acquire information and capabilities for chemical and biological attacks. Many of the 29 officially designated terrorists organizations have an interest in unconventional weapons, and Usama bin Laden in 1998 even declared their acquisition 'a religious duty'."[60]

The consensus is that non-state threats will increase in number and intensity in the future.[61] Non-state threats may seem more potent due to the advantages modern technologies may bring to the perpetrator. The same technologies can be used; however, to strengthen defenses. But this will not solve the immediate problem of terrorism, particularly if terrorist groups obtain WMD.

There is concern about near-term potential for incidents, but the level of current and future vulnerability of NSF using BW is still hotly debated. No sources maintain that non-state threats will *not* increase in the 2001-2025 timeframe, but some sources do view the rise of these threats as exponential rather than gradual, with more alarm than the

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58 Newport Paper No. 13 – Part One, "Where we Are, and Whither we are Tending…," 1998.

59 Ibid.

60 Director of Central Intelligence George J. Tenet, Worldwide Threat 2001: National Security in a Changing World, testimony before the Senate Select Committee on Intelligence, (7 February 2001). Available at: http://www.cia.gov/.

61 National Intelligence Council Chairman John C. Gannon, remarks at the Hoover Institute Conference on Biological and Chemical Weapons, (1999). He stated, "the BW threat is real and growing, the number of potential perpetrators is increasing, particularly non-state actors, agents of increasing lethality are being developed, and that the Intelligence Community alone cannot eliminate this threat, nor can any other single institution or sector." Available at: http://www-hoover.stanford.edu/research/conferences/bcw/gannon1.html.

consensus view might imply. Of particular concern, is the possibility of terrorism by non-state actors with BW capabilities, also known as *catastrophic terrorism.*[62]

**C. TYPES OF BIOLOGICAL AGENTS**

Although BW often is grouped together with chemical weapons (CW), they differ in important ways. CW agents are man-made, non-living poisons, biological agents are infectious microorganisms that reproduce with the host to cause an incapacitating or fatal illness. Small quantities of a biological agent – if widely disseminated through the air – could inflict casualties over a large area. Weight for weight, BW agents are hundreds to thousands of times more potent than the most lethal CW agents, making them the true WMD with a potential for lethal mayhem that can exceed that of nuclear weapons.[63]

Biological agents are infectious microorganisms that generally fall into three categories; bacteria, viruses, and biological toxins. They reproduce within the host to cause an incapacitating or fatal illness. Poisonous chemicals manufactured by living organisms, toxins have characteristics of both chemical and biological agents. Because of the ability of pathogenic microorganisms to multiply rapidly within the host, small quantities of a biological agent, if widely disseminated, could inflict casualties over a very large area.[64]

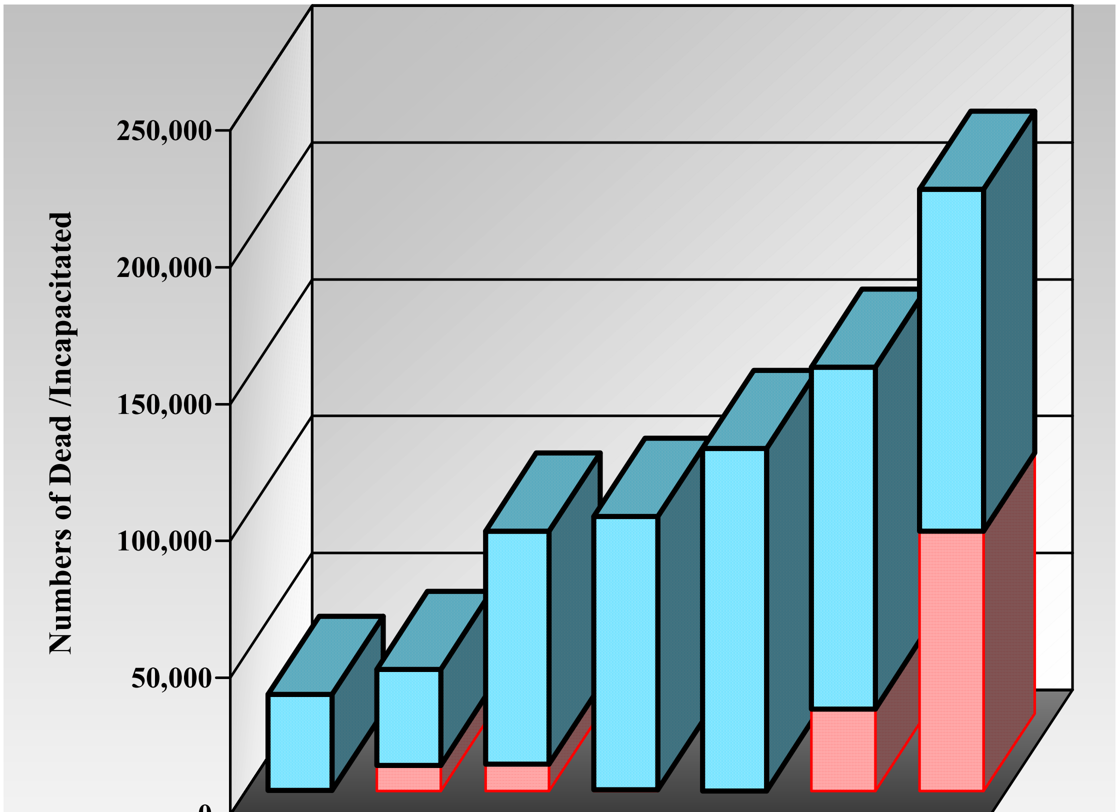
BW developed for military use can infect reliably in small doses. It also has a high capacity to cause acute illness resulting in incapacitation or death (see Figure 2.1). It has a limited loss of potency during production, storage, and transport; a short incubation period between infection and onset of symptoms, and an insusceptibility to common medical treatments. It is easy to transport, and is stable under wartime field conditions of storage and delivery. It is easy to disseminate and can survive environmental stresses during dissemination (e.g. heat, sunlight, desiccation, and shear

62 Sam J. Tangredi, "The Future Security Environment, 2001-2025: Toward a Consensus View," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 34.

63 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 73.

64 Office of Technology Assessment [OTA], U.S. Congress. Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], 1993), 73.

force) long enough to infect. Attacking troops can also be protected against the agent (e.g. vaccines, antibiotics, and/or protective clothing and respirators).[65]




| | Rift Valley Fever | Encephalitis | Typhus | Brucellosis | Q-Fever | Tularemia | Anthrax |
|---|---|---|---|---|---|---|---|
| Incapacitated | 35,000 | 35,000 | 85,000 | 100,000 | 125,000 | 125,000 | 125,000 |
| Dead | 400 | 9,500 | 10,000 | 500 | 150 | 30,000 | 95,000 |

Figure 2.1. The Nominal Lethality of Different Biological Weapons (Numbers of Dead/Incapacitated from Delivery of 1,000 Kilograms).[66]

Bacterial agents, viral agents, and biological toxins represent a small sample of the general categories and characteristics of agents that are of current concern. Additional information on key biological agents can be found in Table 2.3.

65 Ibid., 77.
66 Ibid., 100.

| Disease | Infectivity | Transmissibility | Incubation Period | Mortality | Therapy |
|---|---|---|---|---|---|
| **Viral** | | | | | |
| Chikungunya Fever | High? | None | 2-6 days | Very low (-1%) | None |
| Dengue fever | High | None | 2-5 days | Very low (-1%) | None |
| Eastern Equine Encephalitis (EEE) | High | None | 5-10 days | High (+60%) | Developmental |
| Tick Borne Encephalitis | High | None | 1-2 weeks | Up to 30% | Developmental |
| VEE | High | None | 2-5 days | Low (-1%) | Developmental |
| Hepatitis A | - | - | 15-40 days | - | - |
| Hepatitis B | - | - | 40-150 days | - | - |
| Influenza | High | None | 1-3 days | Usually low | Available |
| Yellow Fever | High | None | 3-6 days | Up to 40% | Available |
| Smallpox (Variola) | High | High | 7-16 days | Up to 30% | Available |
| **Rickettsial** | | | | | |
| Coxiella Burneti (Q-fever) | High | Negligible | 10-21 day | Low (-1%) | Antibiotic |
| Psittacosis | High | Moderate-high | 4-15 days | Mod-high | Antibiotic |
| Rickettsi (Rocky mountain spotted fever) | High | None | 3-10 days | Up to 80% | Antibiotic |
| Epidemic typhus | High | None | 6-15 days | Up to 70% | Antibiotic |
| **Bacterial** | | | | | |
| Anthrax (pulmonary) | Mod-high | Negligible | 1-5 days | Usually fatal | Antibiotic/vaccine |
| Brucellosis | High | None | 1-3 days | -25% | Antibiotic |
| Cholera | Low | High | 1-5 days | Up to 80% | Antibiotic/vaccine |
| Glanders | High | None | 1-2 days | Usually fatal | Antibiotic |
| Meloidosis | High | None | 1-5 days | Usually fatal | Antibiotic |
| Plague (pneumonic) | High | High | 2-5 days | Usually fatal | Antibiotic/vaccine |
| Tularemia | High | Negligible | 1-10 days | Low to 60% | Antibiotic/vaccine |
| Typhoid Fever | Mod-high | Mod-high | 7-21 days | Up to 10% | Antibiotic/vaccine |
| Dysentery | High | High | 1-4 days | Low to high | Antibiotic/vaccine |
| **Toxins** | | | | | |
| Botulinum Toxin | High | None | 12-72 hrs | High | Vaccine |
| Mycotoxin | High | None | Hours/days | Low to high | ? |
| Staphylococcus | Moderate | None | 24-48 hrs | Incapacitating | ? |

Table 2.3. Key Biological Agents that Could be Used.[67]

67 United Nations Department of Political and Security Affairs, Report of the Secretary General, Department of Political and Security Affairs, Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use, (New York: United Nations, 1969, 26, 29, 37-52, 116-117; Jane's NBC Protection Equipment, 1991-1992; James Smith, “Biological Warfare Developments,” Jane's Intelligence Review (November 1991), 483-487.

### 1. Bacterial and Rickettsiae Agents

Bacterial agents are single-celled microscopic organisms that include anthrax, plague, tularemia, Q-fever and Brucellosis. Bacterial agents can be transformed into spores; the spore is more resistant to cold, heat, drying radiation and chemicals than the bacterium itself (see examples in Table 2.4).

| | |
|---|---|
| **Bacterial and Rickettsiae Agents** | *Anthrax* is a zoonotic disease with cattle, horses, and sheep being the chief hosts. The disease spores are very stable and may be viable for years in soil and water. When stabilized for weaponization, it can be delivered as an aerosol cloud or it can be spread from a point source through a spray device. The hardy anthrax spore can survive explosive dissemination from a bomb or shell and a large area could be covered by dispersal of multiple spray bomblets from a missile warhead. Following an incubation period of one to six days, presumably dependent upon the dose of inhaled anthrax spores, a fever, malaise, and fatigue may be present, followed by a period of improvement ranging from hours to days. Following is the abrupt development of severe respiratory distress; shock and death within twenty-four to thirty-six hours.[68]<br>*Tularemia*, also know as rabbit fever and deer fly fever, is also a zoonotic disease that humans acquire through inoculation of skin, or mucous membranes with blood or tissue fluids of infected animals, bites, infected deer flies, or mosquitoes (referred to as "vectors") and ticks. It occurs after inhalation of infectious aerosols. Pneumonia is most common with the typhoidal form of tularemia. After an incubation period of two to ten days, Ulceroglandular disease usually manifests as regional lymphadenopathy, fever, chills, headaches, and malaise. This agent can be weaponized in either wet or dry form and can be delivered in a manner similar as that described for anthrax.<br>Rickettsiae are microorganisms that resemble bacteria in form and structure but differ in that they are intracellular parasites that can only reproduce inside animal cells. Examples include Rock Mountain spotted fever, Tsutsugamuchi disease, and Q-fever. Used in BW agents, Rickettsiae would likely be disseminated directly through the air.[69] |

Table 2.4. Bacterial and Rickettsiae Agents.

### 2. Viral Agents

Viral agents are extremely small submicroscopic agents (100 times smaller than bacteria) containing genetic material that consist of a strand of genetic material (either RNA or DNA), surrounded by a protective coat that facilitates transmission from one cell to another (see Table 2.5).

68 Ibid., 78-79.

69 Ibid., 80.

| | |
|---|---|
| **Viral Agents** | Examples include Smallpox, Venezuelan Equine Encephalitis (VEE) and Viral Hemorrhagic fevers. Viruses lack a system for their own metabolism and are dependent on host cells: viruses are intercellular parasites which means that a virus requires living cells in order to multiply. *Venezuelan Equine Encephalitis (or VEE)* is characterized by inflammation of the meninges of the brain and of the brain itself. This disease is of short duration and the fatality rate is less than one percent. Onset of VEE is usually sudden after an incubation period of one to five days. A spiking fever, general malaise, vomiting, cough, sore throat and diarrhea, lasting twenty-four to seventy-two hours. It can be weaponized in either wet or dry form and is employed in the same manner as anthrax. Smallpox and other viruses that cause hemorrhagic manifestations fall into this category as well.[70] |

Table 2.5. Viral Agents.

### 3. Biological Toxins

Biological toxins, contrasted to man-made toxins in chemical agents, are products of living organisms that produce adverse clinical effects in human beings via three different routes of exposure, injection, ingestion, and inhalation (see Table 2.6).

| | |
|---|---|
| **Biological Toxins** | This is a group of seven related neurotoxins, "A" through "G", produced by the bacillus clostridium botulinum. When inhaled, they produce a clinical picture similar to food-borne intoxication and could be dispersed by aerosol over amphibious troop concentrations to cause mass sickness and inability to execute operational requirements. The clinical syndrome produced is known as "botulism". From a chemical standpoint, there are two categories of toxins: protein toxins, and non-protein toxins. Botulinum toxin is one of the most toxic compounds know to man, requiring only 0.001 microgram per kilogram of body weight to kill; 15,000 times more toxic than VX and 100,000 times greater than sarin, two well known chemical agents. Compared to microbial pathogens, toxins offer the following tactical advantages: toxins are so small that easily transported quantities would be militarily significant; toxins deteriorate rapidly once released into the environment; and they are well suited for covert warfare…leaving no traces providing little evidence of military use for retaliation.[71] |

Table 2.6. Biological Toxins.

## D. DELIVERY SYSTEMS

It is not enough to mass-produce BW agents. Agents must first be formulated to enhance dissemination efficiency, and then must be incorporated into a satisfactory delivery system. Depending upon the adversary's desired effect, a BW attack can come

70 Ibid., 80-81.

71 Ibid., 82.

in numerous forms.[72] BW agents can be delivered in either a liquid or dry powder form. Dry agents are more stable during storage and shipping and are more suited to widespread dissemination.

A biological agent is of little military utility if it does not produce consistent and reliable effects and cannot be delivered to a target. BW agents are all nonvolatile solids that would be disseminated either as a liquid slurry or dry powder of freeze-dried organisms or toxins.[73] It is not hard to spread BW agents in an indiscriminate way for the purpose of producing large numbers of casualties over a wide area, it requires much more dedication, however, to develop BW munitions that have predictable and controllable military effects against point targets.[74]

A primary challenge in weaponizing BW agents is long-range delivery. The challenge is to keep the agents alive long enough to infect humans. It requires the agent to be capable of withstanding the physical stresses involved in the dissemination process without losing activity.

The particle size of an aerosol is critical to both its atmospheric stability and its military effectiveness. Whereas larger particles tend to settle out of the air, microscopic particles between one and five microns in diameter form a stable aerosol in which the particles remain airborne. Such a cloud could then be transported by the wind over long distances. Moreover, particle losses resulting from fallout and washout are negligible and do not significantly reduce the concentration of an aerosol cloud.[75]

**1. Point Attack Versus Area Attack**

There are two types of aerosol dissemination of BW agents. Area attack and point attack. Area attack involves releasing an aerosol cloud upwind and allowing it to

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72 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 91-96. Delivery systems range in complexity and effectiveness from agricultural sprayers mounted on a truck, to a specialized cluster warhead carried on a ballistic missile. Regardless of the method, the attack can generate a cloud of aerosol particles small enough to allow them to be inhaled deep into the lungs.

73 The disease vector is usually some type of arthropod: mosquitoes transmit yellow fever and dengue fever, fleas transmit plague; and ticks transmit tularemia and Q fever. During 1932-45, the Japanese BW facility known as Unit 731 set up flea "nurseries" for the production of 135 million plague-infested fleas every four months. As a delivery system, porcelain bombs were developed that could contain about 30,000 infected fleas. See Williams and Wallace, op. Citational, footnote 35, 27.

74 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 94.

75 Ibid., 96. Aerosolized BW agents generally do not penetrate the skin and thus do not represent a significant contact hazard; instead, they infect individuals when inhaled into the lungs. Additionally, large particle clouds are "more resistant" to the lethal effects of solar radiation than small particles, but small particles are best suited for "long range" attacks.

drift over the target area. In contrast, point attack involves projecting the agent in a canister that releases the agent immediately over the target. An example of an area attack might be an aircraft or unmanned aerial vehicle flying upwind of intended targets, over the top of ships – inport or underway – or amphibious landing forces, or it can be spread from a point source through a spray device.[76]

A BW designed for area attack would disseminate its payload as an aerosol cloud containing a sufficient concentration of microorganisms to infect the targeted personnel with particles in the one to five micron range. Area attack depends heavily upon atmospheric diffusion and wind currents to dilute and spread the agent over the intended area being attacked.[77]

BW agents are disseminated from a munition using either explosive or pressurized methods. Whereas explosive dissemination produces an almost instantaneous build-up of aerosol concentration over the target, it destroys a large portion of the infectious agents and tends to produce drops that are considerably larger than the optimal droplet size for inhalation. In contrast, pressurized munitions do not disperse agent as rapidly as explosive munitions but provide better control of particle size, are gentler on the microorganisms, and produce an aerosol cloud that is visible for a shorter period of time.[78]

A BW (bomb or warhead) may be filled with bulk agent or with numerous self-dispensing cluster-bomb units (CBUs). A cluster bomb has a casing that breaks open during delivery to "scatter" a large number of smaller sub-munitions over a wide area. The sub-munitions then are triggered to go off at an altitude of about fifteen to twenty

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76 Biological agents can be delivered by various means including, but not limited to, theater ballistic missiles, aerial bombs, artillery shells, mines, spraying devices, hand grenades, low slow flying aircraft, or direct application from ground based aerosol generators, and can be used on the battlefield by state actors, or by non-state actors including terrorists, against military forces both at sea and during inport operations. In his 1995 report to congress, John M. Collins, a senior defense specialist at the Congressional Research Service, argued that regional aggressors could apply BW to great advantage. "Results would be devastating," said Collins, "if they immobilize activities at sea ports, international airfields and supply depots so the United States could neither introduce forces into the theater rapidly nor adequately sustain U.S. ships, and forces already in place."

77 OTA, Technical Aspects of Biological Weapon Proliferation, in Technologies Underlying Weapons of Mass Destruction, 97. This phenomenon, called inversion, is ideal for the delivery of BW because the stable interface of warm and cold air prevents the vertical mixing of the cloud and causes it to hug the ground. The most stable atmospheric conditions occur on cold, clear nights or early in the morning, when the ground and the layer of air above it are cooler then the next higher layer of air.

78 Ibid.

feet off the ground. Each bomblet generates a small aerosol cloud; these multiple point sources are then coalesced by air currents into a single large cloud.[79]

### 2. Possible Attack Scenarios

There is a literal panacea of environments that NSF might find themselves and several different *states* of potential warfare and unit readiness. They routinely may be operating on the high seas, they might be pier-side in foreign ports, conducting operations in Littoral Warfare Zones (LWZ), or pier-side in the continental United States (CONUS). They also could be immersed in a full-scale combat zone with joint operations occurring all around them. In each environment they will be required to manifest different types of responses to different types of threats. They will require different TTPs and doctrine to fight, survive, and prevail.

Given U.S. Navy overwhelming conventional superiority on the high seas, and existing Force Protection programs for naval assets conducting operations or while pier-side within CONUS, the most critical BW threat to U.S. NSF would likely be either conducting inport operations in foreign ports or operations in LWZs.[80]

The question is not *whether* attacks on American forces will take place in the future, but when and where. The terrorist attack on USS COLE (DDG-67) highlighted the constant dangers confronting U.S. armed forces.[81] Being readily identifiable symbols of the United States, American forces are attractive targets. The Navy should invoke the Navy-after-Next warfare requirements and prepare now through development of crucial doctrine and tactics to counter BW.

## E. CONCLUSIONS

This chapter is dedicated to defining BW threats to U.S. NSF and provides a summary assessment of the most likely state and non-state actors, and their possible motivations for use of BW. The emphasis centered on identifying types of BW agents, followed by a discussion of the delivery methods and possible scenarios for BW strikes.

BW is perceived to be attractive to adversarial states and non-state actors for a variety of reasons. Insofar as states are concerned, BW provides a means of waging

79 Ibid., 98-99.

80 Thomas W. Murrey, Jr., "Who's Responsible: Understanding Force Protection," in Joint Force Quarterly: A Professional Military Journal, No. 22 (Summer 1999), 105-108.

81 Editor in Chief Dick Cole, "USS COLE: Where do we go from here?" in Surface Warfare, Vol. 26, No. 1 (January/February 2001), 6-12. Available at: http://surfacewarfare.nswc.navy.mil/.

asymmetric warfare against an adversary with superior military capabilities. Biological agents are easy to acquire because they occur in nature, yet the effects of BW can be comparable to those of nuclear weapons. As for non-state actors, the attraction of BW is far less evident as the skills necessary to produce and disperse biological agents in an effective way are non-trivial. In contrast to the use of high explosives where the effect is instantaneous and the consequences highly predictable, a biological agent will have a delayed effect. The consequences of the BW will depend on the precise meteorological conditions at the instant of release, where and how the agent is dispersed, and whether it reaches the intended target.[82]

The use of BW against theater-level targets offers the most lucrative employment option of all forms of WMD use.[83] Given current TTPs and doctrine for countering BW attacks, U.S. NSF would have great difficulty in retaliating for a BW attack or incident. BW can give the user a potential strategic advantage. The threat or use of anthrax, tularemia, or VEE, for example, against a theater aerial or surface port of debarkation could have a crippling effect on the flow of U.S. forces into the theater, which could be magnified in "surge" situations.[84]

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82 Graham S. Pearson, "Why Biological Weapons Present the Greatest Danger," paper delivered at the Seventh International Symposium on Protection against Chemical and Biological Warfare Agents, Stockholm (15-19 June 2001). Pearson previously was the Director-General and Chief Executive of the Chemical and Biological Defence Establishment, Porton Down, UK.

83 Kenneth F. McKenzie, Jr., "The Rise of Asymmetric Threats: Priorities for Defense Planning," in Michele A. Flournoy, ed., QDR 2001 Strategy-Driven Choices for America's Security, (Washington, D.C.: National Defense University Press, 2001), 84.

84 Ibid., They also have the added advantage over nuclear weapons for the attacker because it would be substantially more difficult for the United States to trace sponsorship on an attack in order to mount retaliation efforts.

# III. FLEET BIO-DEFENSE DETECTION CAPABILITIES

## A. INTRODUCTION

Better understanding of the Biological Warfare (BW) threat by the U.S. Navy is essential to establish key competencies to counter its effects. The current risks shouldered by NSF Commanding Officers (COs) and Officers in Tactical Command (OTCs) make it particularly important that the U.S. Navy employ concepts that can be engineered into naval doctrine and operational TTPs, and further translated into *Local Unit Practices* (LPs).

The BW threat is widely addressed by OSD and among the Services and CINCs. In his report, "Biological Weapons in Major Theater War," Brad Roberts states, "[I]t is still common for senior leaders and decision-makers to cast BW as an emerging threat whose impact will be felt only five to ten years hence; widespread recognition of the BW threat has generated a broad range of activities to improve the ability of U.S. forces to fight and survive in a BW environment." Yet the full spectrum of requirements associated with successfully defeating a well-armed BW aggressor remains poorly understood among military planners and operators.[85]

There are numerous ways for BW to be used against U.S. NSF in a Major Theater War (MTW). An aggressor is likely to perceive many lucrative targets for BW attack, including forces in theater and forces enroute to the theater, targets of campaign significance such as air and seaports of debarkation and embarkation, host nation support assets, and high value point targets. Delivery systems may run the gamut. Some modes of use are aimed principally at gaining an operational advantage, while others are aimed at generating fear to extract a political concession.[86]

## B. U.S. NAVY BW EXECUTIVE AGENT

Realization that BW threats to U.S. NSF exist has prompted the U.S. Navy to reevaluate its primary tenets regarding oversight of BW defense. The threat is typically seen as having relatively low priority, compared to conventional, CW, and nuclear

85 Brad Roberts, "Biological Weapons in Major Theater War," (Washington, D.C.: Institute for Defense Analysis [IDA], November 1998), S-1-S-2.

86 Ibid.

threats, when in fact BW programs are proliferating and are located in every region where MTW is a possibility.[87]

The CNO Executive Agent for CB Defense, Deputy Secretary of the Navy for Resources, Warfare Requirements and Assessments (OPNAV N7) has been instrumental in ushering in new interest in the threat and means for combating BW (See Figure 3.1). As part of its responsibility, it has shared in comprehensive DoD approaches to combating this threat.

Fleet Battle Experiments (FBE), wargaming, fleet operations, and restructured approaches to aligning the "planner" and "executive" as partners in the assessment of threats and emerging force requirements are ways to combat the BW problem.

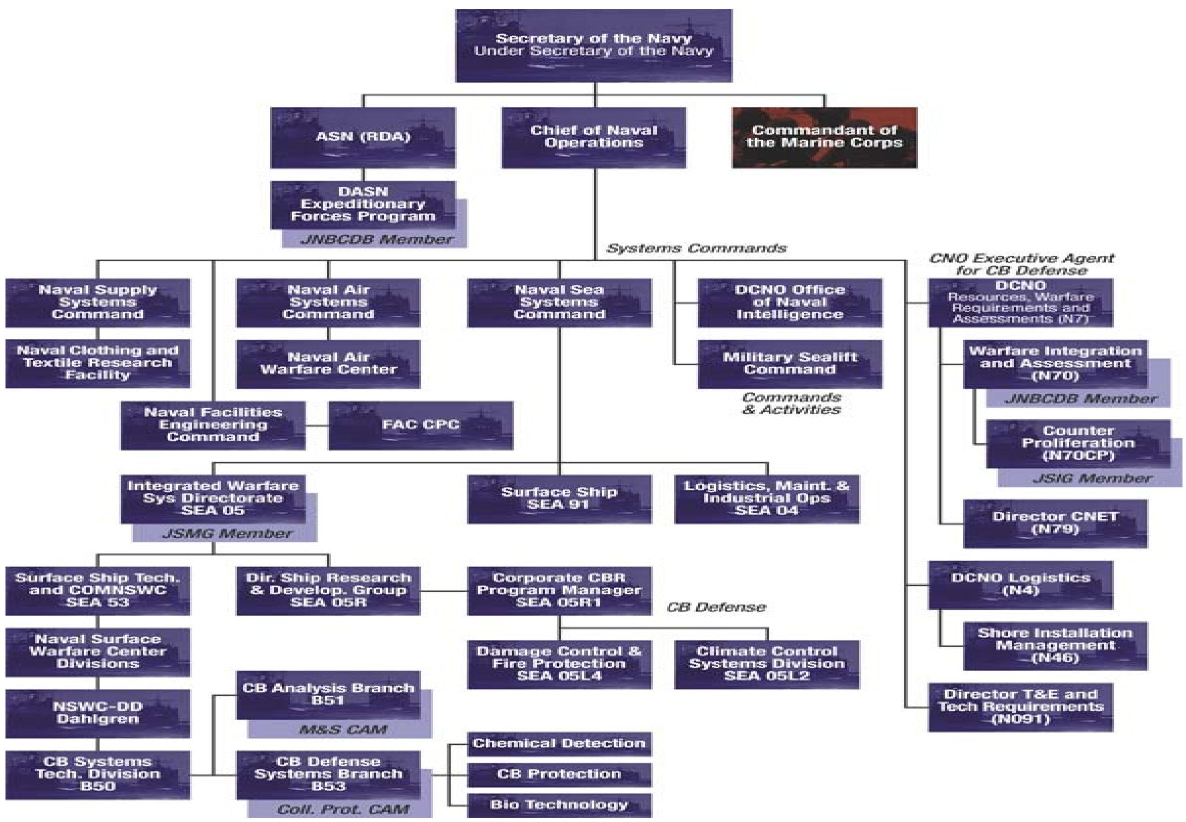


Figure 3.1 U.S Navy Executive Agent for CB Defense (N70CP).[88]

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87 Roberts, "Biological Weapons in Major Theater War." The use of offensive BW is typically seen as "another version of getting slimed, only worse," when in fact the modes and effects of BW use are likely to be distinctive. BW defense is typically seen as comprising CW protection plus vaccination, when in fact a defense-in-depth consisting of both active and passive defenses, counter-force capabilities, medical counter-measures, and other elements is necessary.

88 Joint Publication 3-11. Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense, 10 July 1995.

With the establishment of the Counter Proliferation (N70CP) component of the Warfare Integration and Assessment (N70) Branch, the U.S. Navy has taken important steps to institutionalize experts in the field of counter-proliferation (CP) and BW defense. The mission of N70CP is to:

- Evaluate and assess potential threats against the force
- Identify and counter aggressors who possess BW capabilities
- Provide for emerging technologies and new processes against viable threats
- Streamline doctrinal processes that will allow for establishment of comprehensive TTP and LPs fleet-wide
- Take a "long view" at training strengths and weaknesses and assess the magnitude of its proprieties against realistic needs[89]

## C. PROTECTING THE FORCE

### 1. Fleet Battle Experiments/Limited Objective Experiments

The Navy Warfare Development Command (NWDC) in partnership with the Numbered Fleet commanders designs and executes the Fleet Battle Experiment (FBE) Program as part of the process for collecting and assessing warfighting innovations.[90]

Recent experiments included Biological and Chemical Defense initiatives: FBE-Echo, conducted with THIRD Fleet in March of 1999, FBE-Foxtrot, with FIFTH Fleet in December of 1999, Biological Warfare Defense, Limited Objective Experiment (LOE) with FIFTH Fleet in March of 2000, and FBE-Hotel, conducted with SECOND Fleet in September 2000.[91]

These initiatives included the development of an NBC Defense Battle Management Cell to perform several functions in support of the Naval Component Command/Joint Task Force Command (JTFC) including, readiness and vulnerability assessments, disaster oversight planning, tactical control of defense forces, sensors, local

89 Peter Schwartz, "The Art of the Long View," (Washington, D.C.: Doubleday Bell, 1991), 3-10, 105-123.

90 Department of Defense [DoD] Chemical and Biological Defense Program, Annual Report to Congress and Performance Plan, (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], July 2001), 95. Publications under current revision include NWP 3-11 Multiservice NBC Operations, NTTP 3-11.24 Multiservice Tactics Techniques and Procedures for NBC Aspects of Consequence and NTTP 3-11.25 NBC Contamination Avoidance. Available at: http://www.defenselink.mil/pubs/chem_bio_def_program/2001_CBDP_Annual_Report.pdf.

91 Ed McGrady and Robert Morrow, "Shipboard Biological Contamination Scenarios," (Alexandria: Center for Naval Analysis [CNA], June 2000).

forces and forces deployed for contingencies, warning and reporting, NBC event responses, and coordination of intra-theater support.[92]

The first FBE-F scenario included a hoax event onboard an underway DDG-51 Arleigh Burke Class Destroyer. While underway, a sailor received a package in the mail. Upon opening it, a spring trap mechanism triggered a burst throwing biological agent (dust for the purpose of the experiment) in the air. The experiment analyzed the actions of the crew, the chain of command, and of the Battle Group Commander from that point forward. Findings surrounded around the areas of shipboard detection, medical and psychosomatic symptoms (both simulated and real world), battle management, and the overall impact of the BW attack.[93]

In a second scenario during LOE-00 dubbed Neon Falcon-00, a live agent threat was focused on NAVCENT, and contained to a surface ship.[94] It focused on pressing the information collection and management capability of the battle management cell and the battle group commander to develop an understanding of the nature of the incident and relate it to the ongoing warfighting scenario (i.e. whether it was deliberate or accidental, and who was responsible).[95]

While the full results are classified, shortfalls currently exist in BW defense. Chief among them is a lack of comprehensive TTPs that make operations transparent between units, and existing LPs effectively *operationalized* by U.S. NSF positioned in BW regions. Another shortfall is the lack of comprehensive naval doctrine that stipulates commanders' intention, objective, and permissives for responding to BW situations. The general lack of permissives and doctrine ultimately leads to an assumption that NSF are not ready nor capable to sustain the mission in the face of BW attack or incident.

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92 Gallup, Schacher, Sovereign, Irvine and Kimmel, FBE-Foxtrot Final Report (Monterey: Naval Postgraduate School, Institute for Joint Warfare Analysis [IJWA], April 2000). 92 FBE Foxtrot was conducted in Bahrain at Headquarters, Commander, U.S. Naval Forces Central Command (COMUSNAVCENT) and Commander, FIFTH Fleet and included initiatives involving technology insertions for Nuclear, Biological, and Chemical (NBC) defense.

93 Ibid.

94 Unlike the hoax in FBE-F, the live agent threat in Neon Falcon simulated a real outbreak of an infectious biological agent to test the integration of medical and operational responses to a biological attack, provide the potential for a large-scale difficult consequence management operation focused on COMUSNAVCENT and regional naval forces, challenge the ability of the battle management cell to maintain and promulgate a coherent tactical picture of the emerging epidemic, and take appropriate countermeasures.

95 McGrady and Morrow, "Shipboard Biological Contamination Scenarios," 7-29.

Before doctrine, TTPs, or LPs can be operationalized, it is important to consider the means by which warriors would be certain that a BW attack is either, in progress, or has occurred. A BW attack can take many forms, but the most likely representation would be in one form or another of aerosol cloud. Since agents used in an attack must first be identified before CM and HSS actions can begin, the means for detecting BW release is critical.

## D. DETECTION AND PROTECTION

Because NSF possess no long range BW detection capability, identifying a BW attack remains an important technical problem.[96] A detection system should provide rapid, accurate detection and identification of BW agents. Under battle conditions it is essential that a variety of samples be collected and tested via systems that provide immediate results with a low false alarm rate.[97] In a traditional BW attack scenario, the agents are delivered as aerosols – the lethal "fluffy cloud." Concern therefore has usually focused on environmental detection, particularly of aerosolized agents. In addition to the usual desiderata for most systems that will be used under battle conditions, there are a number of specific requirements for an ideal system.[98]

In the "fluffy cloud" scenario, the concentration of organisms is likely to be fairly high, and therefore sensitivity may be less critical than specificity. This requires the ability to distinguish pathogens from harmless organisms, for example, using as assay targets virulence factors or pathogen specific products, and to differentiate biologically active from nonviable organisms.[99]

Time is of the essence. The primary goal of detection is to provide sufficient warning of an attack to allow appropriate protective actions to be taken. Because BW

96 Thomas C. Linn, "Adversarial Use of Weapons of Mass Destruction," in Joint Force Quarterly: A Professional Military Journal, No. 23 (Autumn/Winter 1999-2000), 58-64.

97 Stephen S. Morse, "Detecting Biological Warfare Agents" in Raymond A. Zilinskas, Biological Warfare: Modern Offense and Defense, (Boulder: Lynne Rienner, 2000), 94. The nature of potentially cross-reacting materials that could give false positives or that could interfere with the test for BW will also be different depending on the nature of the sample and its source.

98 Systems should be rugged, easy to use by persons with minimal training, have high sensitivity to detect target agents at low concentration, and high specificity to identify accurately with few false positives.

99 Morse, "Detecting Biological Warfare Agents," 95. Sample collection and preparation become especially troublesome in open-air environments. Efficient, high-throughput aerosol sampling is necessary, current equipment is bulky requiring considerable power to operate, and require liquid samples that must be transferred into suitable liquid medium for testing.

attacks can come at any time, this usually translates into requirements for detectors that can operate automatically and unattended and that give results in near real time.

Sampling and sample preparation are among the paramount issues because many of the samples are complex and are likely to have high backgrounds of interfering substances. At present, several core assay technologies have been tested, but immunoassays, with a variety of possible detector formats for read-out, remain preeminent.[100] Immunological or nucleic acid assays are extremely sensitive and specific, but completely blind to unknown agents. They also require a number of exhaustible reagents that cannot be regenerated in the field. Mass spectrometry, by contrast, requires signature recognition that can be confounded by mixtures.[101]

**1. Technologies**

The ratification resolution for the Biological Weapons Convention, states that U.S. Armed Forces are inadequately equipped, organized, trained and exercised for CB defense, and that too much reliance is placed on non-active duty forces which receive even less training and possess older equipment.[102] A common thread in policy statements from senior American civilian and military leaders is the threat from the spread of WMD. A key DoD response to proliferation is a well-funded CB defense program set to deliver a number of new technologies to the U.S. Navy.[103]

Growth of the CBDP has been substantial, with defense wide appropriations rising from $390 million in FY 1996 to $840 million in FY 2001. Nearly 57 percent of FY 2001 appropriation is dedicated to procurement. During the next five years, spending is expected to reach $1.1 billion, $400 million will go to R&D for developing protective equipment and vaccines, and $700 million will be spent purchasing new equipment.[104]

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100 Morse, "Detecting Biological Warfare Agents," 96. Current sensors identify specific agents using immunoassay, polymerase chain reaction or a physical method such as mass spectrometry. Immunological or nucleic acid assays are extremely sensitive and specific, but completely blind to unknown agents.

101 J. R. Wilson, "Chem-Bio Detection: A Race against Time," Military Medical Technology Online, September 2001), 1-6. Available at: http://www.mmt-kmi.com/.

102 The NBC Industry Group, The Health of Chemical-Biological Defense in the U.S. Military: A White Paper by the NBC Group, (NBC Industry Group, November 1997).

103 Department of Defense Chemical and Biological Defense Program, Annual Report to Congress (Washington, D.C.: Defense Technical Information Center (DTIC), U.S. GPO, March 2000), 5. Available at: http://www.defenselink.mil/pubs/chembio02012000.pdf.

104 John G. Roos, "Grappling with Demons: Deficiencies in Chem-Bio Protection Pose 'Moderate to High Risk' in the 2MTW Plan," in Armed Forces Journal International, (November 2000), 36-40.

The program conducts research, development, and procurement in three commodity areas of CB defense: contamination avoidance, protection and identification, and decontamination. CB defense programs are categorized broadly under five operational-oriented commodity areas (pillars of NBC Defense): contamination avoidance, protection (individual and collective), medical protection, decontamination, and modeling and simulation.[105] Sound doctrine and realistic training remain fundamental to defending against WMD. The result is a variety of new sensor systems, personal and collective protection systems, and decontamination systems. But the training and doctrine to implement these programs, and the baseline competence for operating in a BW environment, is still far from becoming a reality.[106]

Major systems that are currently being tested, or which are already in place, for detection, protection, decontamination and defense of maritime ports, ships and air facilities, include:

***a. Portal Shield***

The Portal Shield Advanced Concept Technology (ACTD) is designed as an interim capability to protect critical fixed sites such as airbases and ports. It consists of an array of automated detectors networked into a central command post to provide rapid identification and warning of BW attacks while decreasing false alarms. It is currently being used in several critical sites worldwide, and can potentially reduce casualties and maintain operational tempo at an air facility (See Figure 3.2).

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105 Assistant to the Secretary of Defense, Chemical and Biological Defense, FY-00-FY01 Overview, Joint Service Chemical and Biological Defense Program, (Washington, D.C., 2000). The Navy invests heavily in products such as: sensor networks for detecting large area attacks, theater warning and reporting for multiple attacks, protective suits designed to enable continued operations, shipboard sensor systems and personal hand held biological agent detectors, to meet the objectives of NDAA.

106 Christopher J. Vogt and Peter Novick, "Toward More Effective Technology Insertions for Chem/Bio Defense," (paper presented at ASNE Day 2001 Proceedings, American Society of Naval Engineers, May 2001), 3-7. CBDP invests heavily in technologies to provide improved capabilities to U.S. forces ensuring minimal adverse impact to operational tempo on the asymmetric battlefield.

 

Figure 3.2. Portal Shield Advanced Concept Technology (Portal Shield ACTD) and Joint Point Portal Shield (JPPS - XM-99).[107]

### *b. The Interim Biological Agent Detector (IBAD)*

The Interim Biological Agent Detector (IBAD) provides the U.S. NSF with a near-term detection capability aboard combatant ships. It is a Point Detector System that semi-automatically detects background change through air sample collection and alarms the crew of potential biological attacks. It is composed of a particle sizer/counter, particle wet cyclone sampler and a manual Hand Held immunochromatographic Assay (HHA) identifier (see Figure 3.3). HHAs are designed to identify one agent per assay and can identify eight different BW threat and four simulant agents. HHAs can also be assigned to individual personnel.

Within twenty minutes of activation, IBAD can detect, identify and produce a safely configured sample for laboratory analysis, and warn of the presence of biological agents. One shortfall of the system is the decision framework about when to activate it and the time necessary to provide results. Another is that the IBAD program currently provides only seventeen surface ships a contingency warning capability.[108]

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107 DoD CBDP, Annual Report to Congress, (July 2001).

108 IBAD system upgrades are part of the Arleigh Burke (DDG-51) Class Aegis Destroyer Flight IIA upgrades procured in FY 1999.

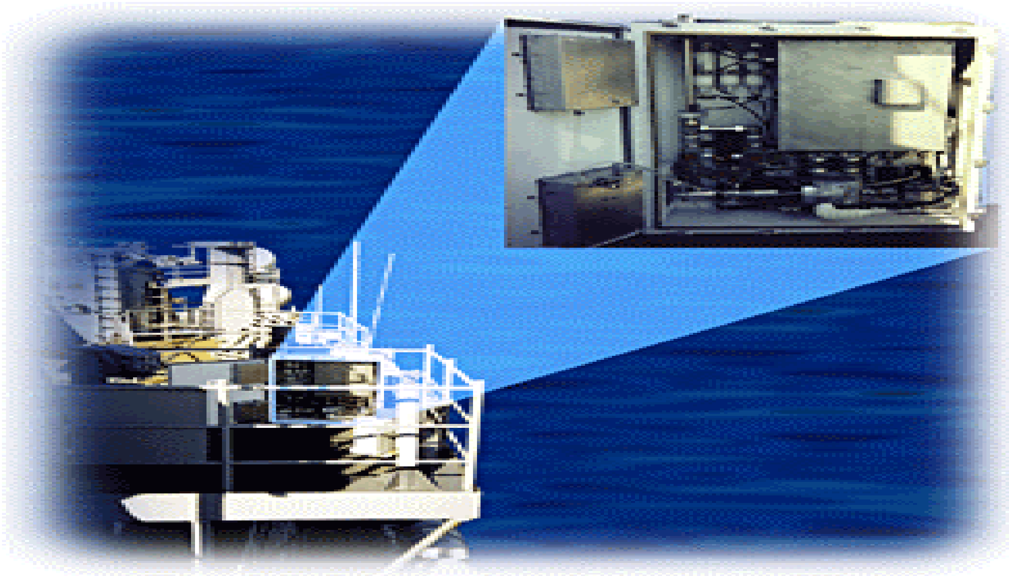

Figure 3.3. The Interim Biological Agent Detector (IBAD) System.[109]

Because BW defense of NSF cannot exist on its own in LWZ or during inport operations in foreign ports, other service capabilities are critical in the overall defense initiative for providing security to ports and airfields. To this end, the U.S. Army is the lead agent in the Joint spectrum. Two critical systems for meeting collective protection goals for port and airfield security are the Army BIDS system and the Long Range Biological Standoff Detection System (LRBSDS).

#### c. *The Biological Integrated Detection System (BIDS)*

The present system for aerosol detection on the battlefield is BIDS: a mobile laboratory (including a suite of instruments and reagents, and technical personnel) in a truck (Humvee). BIDS primarily protects the battle space against large area attacks.[110]

#### d. *The NDI-Long Range Biological Standoff Detection System (LRBSDS)*

The NDI-Long Range Biological Standoff Detection System (LRBSDS), (LRBSDS), mounted on UH-60 Blackhawk helicopters, screens large areas of the battlespace. With a thirty-kilometer range, it provides both an early warning and a

109 Ibid.

110 BIDS also provides rapid detection identification of BW agents, a liquid sample for subsequent analysis, and communication of results over long distances. It consists of a shelter mounted on a dedicated vehicle and is equipped with a biological detection suite employing complementary technologies.

mobile detection of manmade aerosols. The "on-call" system mounts into a Blackhawk helicopter but does not require a dedicated aircraft (see Figure 3.4).[111]

Figure 3.4. NDI – Long Range Biological Standoff Detection System (LRBSDS).[112]

#### *e. The Joint Biological Point Detection System (JBPDS)*

The Joint Biological Point Detection System (JBPDS) is in development to consolidate, coordinate, and integrate BW defense requirements of all services into a single defense program. JBPDS will offer a detection system that will provide BW detection capabilities throughout the Services and throughout the battlespace.[113]

JBPDS consists of a system-of-systems, including the Joint Point, Man Portable XM-96, the Joint Point, Shelter XM-97, and the Joint Point, Ship XM-98. Each serve four functions: (1) trigger, (2) collector, (3) detector, and (4) identification. JBPDS will provide fully automated warning and detection, networked-based integration into regional theaters in concert with the Joint Warning and Reporting Network (JWARN) (as depicted in Figure 3.5) system.[114]

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111 J. R. Wilson. "Chem-Bio Detection: A Race against Time," Military Medical Technology Online, (2001), 1-6. Available at: http://www.mmt-kmi.com/. It takes about 30 minutes to load into the helicopter and plug into the aircraft's power system. The device can detect biological clouds out to 30 kilometers but is only capable of mapping it, not actually identifying the agent involved. Identification requires a point detection device.

112 DoD CBDP, Annual Report to Congress, (July 2001).

113 Department of the U.S. Army, Navy, Air Force and Marine Corps. Technical Manual, Operators Manual for Detection System, Biological Agent – Joint Point, Man Portable, Shelter, Ship and Auxiliary Equipment, (PCN 182-107470-00), (Washington, D.C.: U.S. Army, Navy, USAF, USMC, June 2001).

114 Ibid.

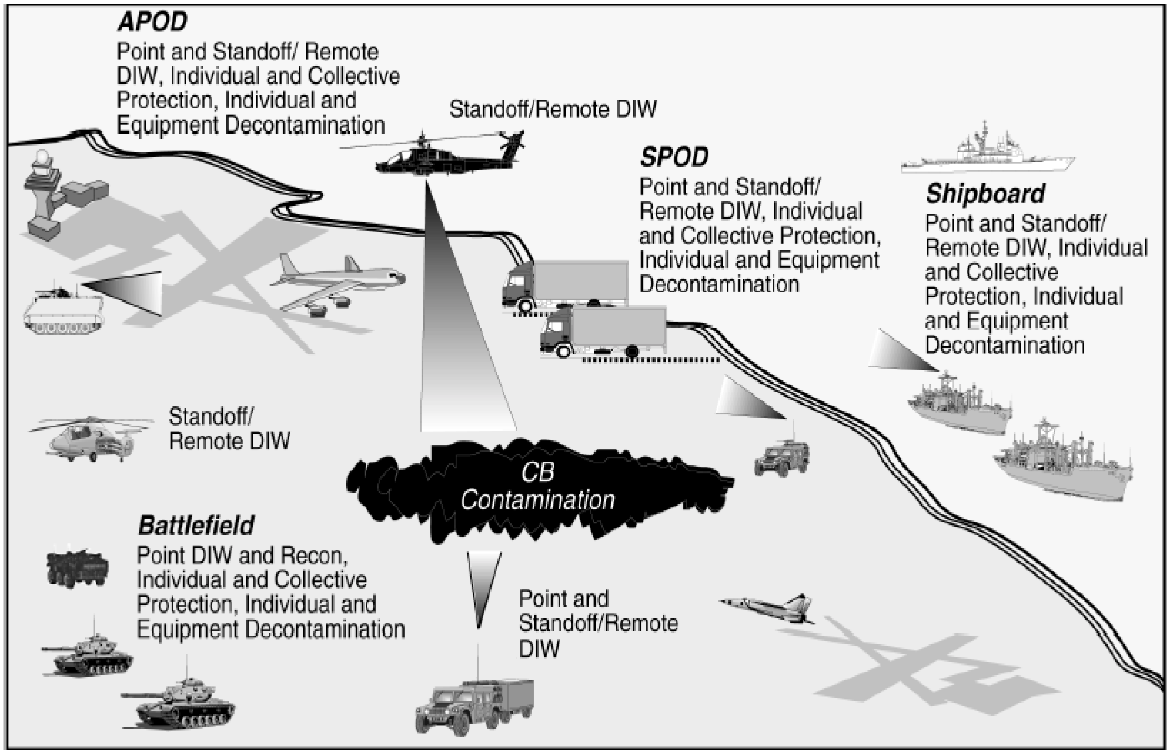


Figure 3.5. The Battlefield Model under the Joint Warning and Reporting Network (JWARN).[115]

#### *f. The Joint Biological Point Detection System ("JBPDS-Ship XM-98")*

The Joint Biological Point Detection System ("JBPDS-Ship XM-98") was first installed for operational testing onboard a DDG-51 Arleigh Burke Class Destroyer in August 2001. It is touted as a possible means for providing the shipboard component of a common point detection network to be integrated with joint forces. It detects BW agents in less than fifteen minutes, provides automated, knowledge-based, real time detection, and identification, and provides a point detection capability not yet realized in the U.S. Navy. Once approved for use, it will replace the Navy IBAD system and Army BIDS, and provide detection capabilities for the Air Force and Marine Corps as well (see Figure 3.6).

115 From Deputy Assistant to the Secretary of Defense for Chem/Bio Defense Dr. Anna Johnson-Winegar, "The DoD Biological Detection Program NDIA Discussions," discussion topics brief, (24 October 2000).

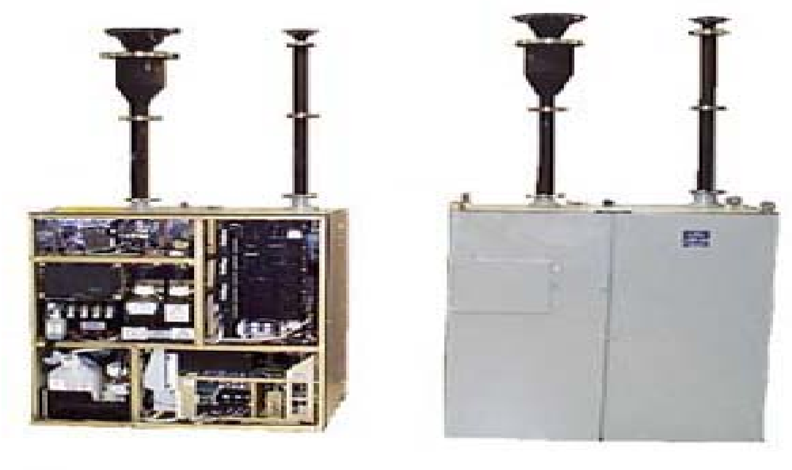

Figure 3.6. Joint Biological Point Detect System (JBPDS).[116]

The JBPDS will not be placed on U.S. Navy platforms until 2003, at the earliest. When fully installed it will provide coverage to only eighty-four surface vessels including DDG, LHD, LPD, and CVN classes.[117]

In the event that early warning is not possible or units are forced to occupy or transit through contaminated environments, individual and collective protection systems provide the warfighter life-sustaining and continued operational capabilities. Personal protection systems include the Joint Service General Purpose Mask (JSGPM), which will provide protection against biological, chemical, and radiological agents (see Figure 3.7), the Advanced Chemical Protection Garment (ACPG), and the Joint Service Lightweight Integration Suit Technology (JSLIST) (see Figure 3.8) (once accepted for use) to provide protection from the effects of BW contaminants.[118] Collective protection equipment includes two general categories: stand-alone shelters and integrated systems that provide contamination-free, environmentally-controlled surroundings for personnel to perform their missions. Collective protection, i.e., overpressure, can be applied to mobile and fixed sites, medical facilities, aircraft, vehicles, and ships.[119]

116 DoD CBDP, Annual Report to Congress, (July 2001).

117 NSWC Crane Division, Code 805D, 6 September 2001. Available at: gates_bill@crane.navy.mil.

118 CBDP, Annual Report to Congress, (July 2001), 10-11. Available at: http://www.defenselink.mil/pubs/chem_bio_def_program/2001_CBDP_Annual_Report.pdf. JSLIST is lighter and less bulky, imposes less heat stress and reduces psychological physiological burdens. It comes in three parts: protective suit, protective boots and protective gloves.

119 CBDP, Avoid, Protect, Recover - Joint Service Chemical and Biological Defense Program FY00-02 Overview, (undated), 6-7.

Figure 3.7. JSGPM.

Figure 3.8. ACPG/JSLIST.

## E. CONCLUSIONS

Adversaries may strike using BW anywhere, with little or no warning. The first indication of a BW attack may be a suspicious package or sick personnel, perhaps coupled by a claim of responsibility by a non-state actor, or it could be an overt attack with munitions from a state actor. It will then be necessary to identify the cause, guide appropriate responses, and differentiate an actual attack from a false positive, which can itself cause serious disruption in U.S. NSF activities.

In the next five-ten years, the BW proliferation threat will increase, resulting from development of BW agents that are far more difficult to detect and more capable delivery systems.[120] DoD expects that more states with existing programs will master production

120 DoD CBDP, Annual Report to Congress, (July 2001), 10-11.

processes for complete weapons and will be less dependent on outside suppliers. States will be more proficient at incorporating BW agents into delivery systems and will focus on battlefield training, employment strategy and doctrine. Therefore, the threshold of some states to consider using these capabilities may be lowered.[121]

Individual detectors may be the only initial source of information to predict and report downwind hazards. This information must be consolidated with tactical information (radar tracks, observed explosions, etc) to refine the information about an attack. This concept requires "networking" ships sensors across the theater of operations and data integration and analysis at a higher level of command through information management system that considers detector inputs, intelligence reports, meteorological data, and other tactical information regarding own force and adversary's capabilities. This data in conjunction with tactical systems should provide the capability to support command decision making and risk management, including personnel protection levels, ship maneuvering and decontamination, and CVBG movement.

Many unfulfilled immediate needs have already been identified, for example, the need for rapid response and high sensitivity, the difficulty of integrating sampling and sample preparation into the system, the desirability of unattended operations, ruggedness for combat use, and so on. In both the laboratory and in the combat environment, the U.S. Navy requires broader capabilities for diagnosing exposure and for identifying the unexpected than is currently possessed. These shortcomings in detection and identification are widely recognized as a major limitation in BW defense capabilities.[122]

The U.S. Navy is responsible for personnel and life cycle management, and for TTPs, training, exercises, and doctrinal assessments.[123] Technology alone will not supply U.S. NSF military supremacy without TTPs and LPs consistent with doctrinal foundation and approved performance standards; the ability to organize and equip NSF, and to ensure personnel are appropriately trained through reinforcement by present technology is also critical to decreasing BW threats.

121 An assessment of potentially new biological agents that may challenge U.S. forces is in a DoD report to Congress entitled Advances in Biotechnology and Genetic Engineering: Implications for the Development of New Biological Warfare Agents, June 1996.

122 Stephen S. Morse, 101.

123 Kristin S. Kolet, "Asymmetric Threats to Threats to the United States," National Institute for Public Policy, (Fall 2001), 282-284. For more discussion see Richard J. Harkness and the JCISS Study Group, "The Risks of a Networked Military," Orbis (Winter 2000), 127-143.

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# IV. SUSTAINING THE MISSION IN THE FACE OF BW ATTACKS

## A. INTRODUCTION

What actions must the U.S. Navy take to ensure Naval Surface Forces (NSF) possess the required capabilities to fight through a BW attack? The twenty-first century battlefield promises to be a novel and diverse environment that will distort the way U.S. NSF prepare to counter Biological Warfare (BW). Mechanisms for change require broad and sustained efforts that cannot be restricted to specialized units or deferred to convenient times and future initiatives. They must be instilled in daily actions, routine intentions and directives, and codified in NSF TTPs, training plans, and battle orders, and promulgated to warriors via General Operating Instructions and Tasking (OPGEN/OPTASKS); further, they must be "networked" and adapted to Joint Doctrine and JTTPs to allow U.S. NSF primacy in the joint arena.

The United States continues to have global commitments and a continuing need for a forward-deployed naval presence as international response to a wide range of crises.[124] The BW threat must be viewed as a possible condition of warfare, the backdrop against which American sailors and marines must be prepared to operate effectively.

## B. SUSTAINING THE MISSION

### 1. Force Operations

NSF must be capable of responding and deploying quickly to a variety of worldwide needs. Counter-proliferation (CP) capabilities are required to meet those needs and BW defense is integral to CP. The Commanders-in-Chief (CINC) Annual Assessment identified priorities that the CINCs themselves singled out as most crucial to achieving their peacetime and wartime missions (see Table 4.1) .[125] Providing protection to U.S. and coalition forces must be effected by first ensuring that U.S. forces are prepared to sustain the BW mission.

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124 Washington Times, “A Littoral Linchpin of Access,” (Washington, D.C.: Washington Times, 12 August 2001).

125 Department of Defense [DoD] Chemical and Biological Defense Program, Annual Report to Congress and Performance Plan, (Washington, D.C.: Defense Technical Information Center [DTIC]: U.S. Government Printing Office [U.S. GPO], March 2000), 3-5. Available at: http://www.defenselink.mil/pubs.

| | |
|---|---|
| **1.** | **Provide individual protection to forces and assist allies/coalition partners with relief from the effects of NBC** |
| 2. | Intercept conventional delivery of WMD and control collateral effects |
| **3.** | **Provide collective protection to forces and assist allies/coalition partners with relief from the effects of NBC** |
| **4.** | **Mitigate the effects of WMD** |
| **5.** | **Detect** and monitor development, production, deployment, **employment of WMD** |
| 6. | Communicate the ability/will to employ interdiction/response capabilities |
| 7. | Determine vulnerabilities in WMD development, production, transfer, deployment, and employment |
| 8. | Conduct off-site attack to destroy, disable, and deny WMD targets |
| 9. | Establish and maintain relations with allies, and potential adversaries to discourage development, production, and use of WMD |
| 10. | Seize, destroy, disable, and deny transport of WMD |
| **11.** | **Communicate the ability/will to employ defensive capabilities** |
| 12. | Determine vulnerabilities in decision making process related to WMD |
| 13. | Conduct information warfare to destroy, disable, and deny WMD |
| 14. | Support treaties, export controls, and political/diplomatic efforts |
| 15. | Provide alternatives to the pursuit of WMD |
| 16. | Provide intelligence collection capabilities in support of USG non-proliferation efforts |
| 17. | Conduct on-site attack to seize, destroy, disable, and deny WMD targets |
| 18. | Provide personnel, training, materiel, and equipment to support security assistance |
| 19. | Destroy, disable, and deny actor's non-WMD resources and capabilities |

Table 4.1. Required CINC Counter-Proliferation Capabilities.[126]

U.S. NSF must prepare for several possible scenarios, including NSF in port, within the Continental United States (CONUS) and in foreign theaters, and those operating in Littoral Warfare Zones (LWZs), or on the high seas. NSF conducting In-port operations must configure active and passive defenses support the local military command element as called for under Force Protection initiatives.[127]

CP responsibility must reside at the Service level. The CINC is required to provide CP capabilities but those means must be developed tactically at CO and OTC levels. Both must be accountable for providing guidance and conducting operations associated with LPs designed to "fight the ship."

### 2. Working within the CBDP Management Structure

The National Defense Authorization Act (NDAA) of Fiscal Year 1994 mandated a buildup of the Department of Defense (DoD) Chemical and Biological Defense

126 Ibid.

127 Thomas W. Murrey, Jr., "Who's Responsible: Understanding Force Protection," in Joint Force Quarterly: A Professional Military Journal, No. 22 (Summer 1999), 105-108. U.S. NSF should be prepared to pass BW defense information to the military authority for the local port, as well as through the chain of command. BW defense requires actions be split between tactical management of responses and performance of BW defensive functions. The operational commander/CINC then should be a position to provide subject matter experts with regard to agent behavior and effects, detection, individual and collective protection and decontamination.

Program (CBDP). It requires that each service provide requirements and responsibility for the operation and maintenance of product delivery. The CBDP management structure, seen in Figure 4.1 represents program coordination and integration for all Services. This structure was developed in 1996 to provide integration of medical and non-medical CB defense efforts at the Service level.

The Deputy Assistant to the Secretary of Defense for Chemical and Biological Defense, DATSD(CBD), as deputy to the Director, Defense Research & Engineering (DDR&E), is responsible for overall coordination and integration of all defense research, development, and acquisition (RDA) efforts and provides overall guidance for planning, programming, budgeting, and program execution. The program is divided into six commodity areas, each managed by one of the Services in accordance with the Joint Service Agreement, as follows:[128] Contamination Avoidance; army, individual protection; marines corps, collective protection; navy, decontamination; air force, medical defense; army, modeling & simulation; navy.[129]

128 Department of Defense [DoD] Chemical and Biological Defense Program, Annual Report to Congress and Performance Plan, (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], July 2001), 13. Available at: http://www.defenselink.mil/pubs/chem_bio_def_program/2001_CBDP_Annual_Report.pdf. DATSD(CBD) remains the single office within OSD responsible for oversight of the DoD CBDP and retains approval authority for all planning, programming, and budgeting documents, responsibility for ensuring coordination between the medical programs and the non-medical CB defense efforts, and management oversight of CBDP. The Secretary of the Army is the Executive Agent (EA) for the CBDP and is responsible to coordinate, integrate, and review all Services' CB defense requirements and programs. The commodity areas correspond to the projects under the budget program elements. There is also a program budget element to support program management and oversight, user testing, and doctrine development in accordance with the Joint Service Agreement. The OSD NBC Defense Steering Committee provides direct oversight of the CBDP and is composed of the following members: (1) DDR&E, (2) Director, Defense Threat Reduction Agency (DTRA), (3) Director, Chemical Biological Defense Directorate, DTRA, (DTRA(CB)), and (4) DATSD(CBD). The Joint Service Integration Group (JSIG) is the principal steering group that oversees Service coordination and integration and CINC requirements and priorities for RDT&E and procurement. The Joint Service Materiel Group (JSMG) is the principal steering group that manages execution of materiel development efforts to mitigate program risk across commodity areas, and to ensure ongoing efforts are not duplicative.

129 Ibid., 11-21. The military departments' acquisition organizations execute the individual CB defense programs according to Service and DoD directives.

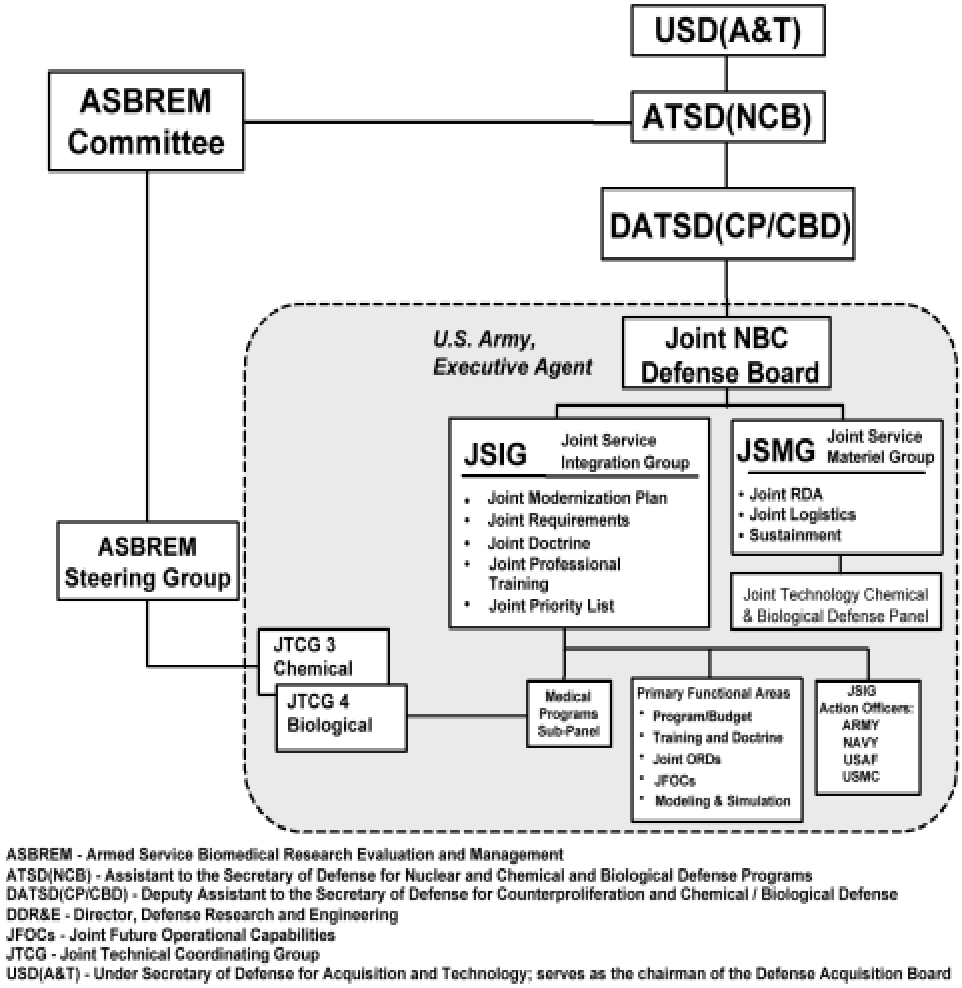


Figure 4.1. The CB Defense Program Management Structure.[130]

### 3. In-Port/Theater Operations

As provided in the CBDP, local forces from each service must be capable of assisting naval forces in warning, reporting and assessing BW threats and response measures.[131] U.S. NSF organic BW management can help augment protection and decontamination measures for NSF and landing forces. In areas where there is no local military NBC command, NSF would coordinate with U.S. Government (USG) agencies as well as the regional CINC for WMD issues.[132]

130 Ibid., 14-21.

131 Ibid.

132 Supporting capabilities must include intelligence alerts and warnings of BW threats when in port, and must provide for appropriate force capabilities to fight, survive and sustain the mission. For landing forces, responses must begin at the lowest tactical level and proceed through the appropriate chain of command to the CINC.

The predominant function at the company, troop, or battery level is warning and reporting: Sub-units and many ships have few BW defensive assets other than individual alarms and sensors.[133] Higher commands must provide automated collection of detectors alarms and hazard warnings.

Aircraft must collect results from passive detectors at airbases. Air bases and port facilities should use automatic networked sensor configurations. This concept can rely on commercial, non-propriety communications protocols and security, to prevent "spoofing" of the sensors.[134]

If a BW attack has already occurred, or intelligence shows one as imminent, COs and OTCs must be prepared to respond. Appropriate steps may include ordering a *BW Decontaminated Zone* (BWDZ) around port facilities, units, or airfields commensurate with intelligence reports, technical assessments, and doctrine, by issued OPTASKs that establish capabilities and limitations for access to these zones.[135]

## C. CONSEQUENCE MANAGEMENT

Consequence Management (CM) counters effects of BW attack by preserving life, reducing suffering, and mitigating effects after an attack has occurred.[136] Within DoD, the precise definition of CM is still an evolving concept.[137] CJCSI 3214.01, *Military Support to Foreign Consequence Management*, defines CM as "Interagency assistance to mitigate damage resulting from the employment of NBC weapons by national, transnational, or sub-national actors."[138]

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133 Department of Defense [DoD] Joint Publication 3-11. Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense, 2000, III-5-19. Staff level personnel must bear the responsibility for conducting hazard prediction, capability to integrate reports from several units, and perform limited vulnerability analysis and attack area resolution between conflicting biological agent analysis, then have the ability to pass that information to the tactical level.

134 Warning and reporting functions and BW information management and analysis, and basic meteorological data should be processed at this level to generate projections for CINC/CTF planning and execution of military responses.

135 Forces can be marshaled away from contaminated environments unless extreme operational requirements dictate access to those zones. If the location of the threat is identified and no attack has occurred, commanders should possess TTPs and LPs that establish minimum BWDZs for the threat, taking into consideration, actors, delivery means and meteorological situations. Personal detection and protection equipment would then be capable of allowing forces to access the BWDZ if deemed necessary.

136 Presidential Decision Directive 39. "U.S. Policy on Counterterrorism", (21 June 1995), 3. Available at: http://www/fas/org/irp/offdocs/pdd39.htm. For additional background on CM see Scott R. Taylor et, al. "Consequence Management: In Need of a Timeout," in Joint Force Quarterly: A Professional Military Journal, No. 22 (Summer 1999), 78-85.

137 Lieutenant Colonel Kim Corcoran. "Consequence Management: An Increasing Need for Joint Doctrine"; in U.S. Joint Forces Command Joint Warfighting Center, Doctrine Division's Newsletter, Vol. 8, No. 1, (Suffolk: U.S. Joint Forces Command, April 2000), 10.

138 Chairman, Joint Chiefs of Staff Instruction (CJCSI) 3214.01, "Military Support to Foreign Consequence Management Operations," (30 June 1998), 3.

CM responses include efforts to reduce the harmful effects of successful attacks and integrates passive and active defenses, facility and personnel protection, and mitigation of effects through Health Services Support (HSS), and emergency response procedures.[139] U.S. NSF often are the first to arrive on the scene during some crisis.[140] While the synergy produced by joint CM operations is important, naval doctrine and TTPs should allow NSF to conduct CM alone in an emergency.[141]

The Chinese have an ancient saying, "kill one, frighten ten thousand." The world saw truth in that concept during the 1993 terrorist bombing of the World Trade Center in New York City, the Tokyo subway attack by Aum Shinrikyo in 1995, the 1996 Centennial Park bombing in Atlanta, the bombing of the USS COLE (DDG-67) in the port of Aden, Yeman in October 2000, and most recently the bombing of the World Trade Center Twin Towers and U.S. Pentagon on 11 September 2001.[142]

BW provides state and non-state actors an inexpensive means to carry out asymmetric warfare on U.S. conventional strengths. Since there is no proven long range detection capability in the U.S. Navy arsenal, what can be done subsequent to an attack to ensure U.S. NSF are capable of sustaining the mission? Prevention and management of BW attacks or incidents is one of the most challenging priorities outside of detection and prevention. Only the U.S. Army has a specialized Chemical Corps force structure that specializes in all aspects of NBC.[143]

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139 Report of the Commission to Assess the Organization of the Federal Government to Combat the Proliferation of WMD. Combating Proliferation of Weapons of Mass Destruction, (Washington, D.C.: U.S. GPO, 14 July 1999), 156. For example, strong efforts in detection capability at ports and airfields may act as a partial deterrent by forcing the aggressor to resort to other tactics or may reduce their willingness to use BW capabilities because of its presumed ineffectiveness.

140 Chief of Naval Operations Admiral Jay Johnson, Navy Strategic Planning Guidance: With Long Range Planning Objectives, (Washington, D.C.: DoD Printing Office, April 2000), 18.

141 Corcoran. "Consequence Management: An Increasing Need for Joint Doctrine", 6. Currently, in the event of a BW attack, U.S. NSF do not possess the full array of response assets and expertise required to adequately deal with the effects of BW or the necessary depth to sustain CM operations. In the case of an actual attack or incident, Commanding Officers and Operational Commanders would require immediate assistance from the CJTF/CINC that would not in "total" be forth coming due to lack of "full-up-round" doctrine, TTP, what has been described here as LP, as well as institutionalized CM leadership measures.

142 William Rosenau, "Aum Shinrikyo's Biological Weapons Program: Why did it Fail?" (Washington, D.C.: Rand Corporation, 2001), 289.

143 The Army Chemical School is the training facility for all the services in both chemical and biological detection, and while the Navy has its own NBC instructors where training covers BW (and CW) detection, there are significant differences in both the detection of and response to biological agents and the manner in which CM might be carried out in the event of an attack.

Joint Publication 3-11, outlines doctrine for NBC Defense. It stresses the need to counter NBC operations with defense and deterrence.[144] To defend against this threat requires command, control, communications, computers and intelligence ($C^4I$), logistical support, medical support, and education and training. Although not directly addressing WMD use by terrorists, it also points out "the potential for their use can range from blackmail or acts of terrorism during peace to escalation during conflict or war."[145] The strategy of defense and deterrence is based on, "providing direction, intelligence, and employment of U.S. forces in countering enemy NBC war making capabilities."[146]

Presently, a BW attack would have catastrophic effects causing both military and psychological impact on NSF that could affect their ability to succeed in a contaminated environment. The lack of unified doctrine for Naval and Joint forces in the critical arena of CM deserves immediate notice. The inability of NSF to sustain the CM mission, without reliance on CM partnerships for BW DP of port embarkation areas and airfields could entail the difference in achieving National Strategic Objectives.

**D. HEALTH SERVICES SUPPORT (HSS)**

Force protection includes individual, collective, and casualty protective measures, as well as medical countermeasures, resulting from the implementation of policies, doctrines, procedures and equipment to enable personnel to survive and operate in a biological environment.[147] It considers DP aspects of BW integrated defense, including medical countermeasures, and requires doctrine, TTPs, and LPs for combating BW.

Immediate medical diagnostics are required to evaluate exposure, to identify individuals who have been exposed, and to guide appropriate treatment, control, and response. These instruments are not currently available.[148] Because a BW attack may occur where no detectors are present, there is an essential need for rapid and sensitive medical diagnostic capabilities to determine the cause and to differentiate possible attack from a myriad of other infections that may begin with similar signs and symptoms.

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144 Joint Publication 3-11. Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense, 2000, I-1.

145 Ibid.

146 Ibid., I-3.

147 Chairman, Joint Chiefs of Staff Instruction (CJCSI) 3214.01, (Washington, D.C.).

148 Stephen S. Morse, "Detecting Biological Warfare Agents", in Raymond A. Zilinskas. Biological Warfare: Modern Offense and Defense, (Boulder: Lynne Rienner Publishers, 2000), 96.

The objective of HSS in BW contaminated areas must be to: (a) return to duty the maximum number of personnel as soon as possible, (b) manage casualties so that BW agent injuries are minimized and any other injuries or illnesses are not aggravated, (c) protect persons handling contaminated casualties or working in contaminated areas, (d) avoid spreading contamination into other areas, and (e) continue Medical Treatment Facilities (MTF) operations to maintain services unrelated to the BW illnesses and injuries.

All U.S. NSF must be prepared to operate in contaminated environments; HSS personnel also must be prepared to provide patient care.[149] Staffing HSS units is based on conventional warfare requirements; these units will likely be taxed in their ability to provide effective response. Depending on pre-treatment or vaccination, a relatively significant "ramp up" period may be required. Future research and development work must focus on combining as many of these individual countermeasures as possible, while at the same time finding other means of increasing efficacy of their use.

On a contaminated battlefield Mission-Oriented Protective Posture (MOPP) levels III and IV result in body heat buildup, reduced mobility, and degraded senses and may ultimately reduce unit effectiveness.[150] The focus of HSS should be on keeping forces in the battle through effective and efficient triage, emergency treatment, decontamination and control, and prompt evacuation to save lives and maximize the return-to-duty rate.[151]

BW attacks are difficult to recognize because they may not have an immediate affect. HSS personnel must monitor for BW indicators such as: an increase in disease incidences or fatality rates, sudden presentation of an exotic disease, and other sequential epidemiological events, especially when presented in lines of communications.[152]

Navy doctrine, TTPs, and LPs must deal directly with HSS operations to limit the spread of disease and minimize casualties and must include HSS and first responders'

149 Decontamination of patients and transportation assets causes evacuation delays, making first aid and patient care even more critical. Current use of medical countermeasures demonstrates a plethora of medications whose use is either specific to a small family of threat agents, or requires multiple vaccinations.

150 United States Marine Corps (USMC). Marine Corps Warfighting Publication (MCWP) 4-11.1: Health Services Support Operations, (Washington, D.C.: USMC Headquarters [HQ], 10 March 1998).

151 Ibid. To maximize the unit's survival and effectiveness, commanders must take action to avoid BW contamination by making maximum use of alarm and detection equipment and unit dispersion; overhead shelters, shielding materials, and protective covers; and collective protection shelters.

152 Passive defensive measures (such as immunizations, physical conditioning, use of arthropod repellents, use of protective masks, and practice of good sanitation) lessen the effects of most biological intrusions.

capabilities into the calculus of requirements.[153] Information on enemy BW use is important for planning and executing HSS operations.[154] HSS operations must be integrated into all levels of BW responses. For example, Phasing Support Ashore during movement of amphibious operations is essential.[155]

Preventive medicine efforts can dramatically reduce the incidence of disease.[156] Proactive preventive medicine measures should be included into all levels of TTPs, incorporating phased coordination of casualty movement and medical regulating processes.[157]

Once BW agents have been used, agent identification is important to medical intelligence channels for operational purposes. HSS personnel must be familiar with symptoms of BW casualties. Operational forces must attempt to distinguish between epidemics of natural origin and BW attacks and ensure that medical and tactical intelligence channels communicate.[158]

Basic protection consists of denying agent access to the respiratory and digestive systems and immunization of individuals. If a field detection and identification capability is not available, recognition of BW agents must be based on epidemiology and symptoms. Table 4.2 provides Indicators of a BW attack.

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153 Ronald M. Atlas, "Biological Weapons Pose Challenge for Microbiology Community: Microbiologists Should Help Shape Policies Protecting Against BW but Safeguarding Legitimate Research," ASM News 64 (1998), 383-389 in R. M. Atlas, "Combating the Threat of Bio-Warfare and Bio-Terrorism: Defending Against BW is Critical to Global Security," BioScience 49, (June 1998), 18. To increase chances for success, personnel must keep immunizations current, use available preventive treatment against suspected agents, pre-treat for suspected agents, and have antidotes and essential supplies readily available for known or suspected biological agents.

154 The Commander, Amphibious Task Force (CATF) has overall responsibility for HSS services to embarked personnel and can benefit from information such as the current threat level, mission, terrain, geography, weather, forces at risk, opposing forces, etc.

155 Prevention of disease and non-battle injuries is a critical function. Naval Medical (NAVMED) P-5010 BUMED Manual of Naval Preventive Medicine, prescribes specific preventive medicine measures available to NSF. The concept of operation/scheme of maneuver during BW defenses scenarios, combat intensity, predicted size and duration of the contaminated environment, and casualty estimates is crucial to ensuring the entire HSS system is responsive and can only be obtained through institutionalized principles:

156 United States Marine Corps (USMC), Marine Corps Warfighting Publication (MCWP) 4-11.1: Health Services Support Operations (Washington, D.C.: USMC HQ).

157 Ibid. Patient movement may occur in two phases: (1) evacuation—the movement of patients between point of injury or onset of disease to a facility that can provide the necessary treatment capability, and (2) medical regulating—the process of selecting destination medical facilities with necessary biological defense capabilities for patients being medically evacuated, between, into, and out of different theaters of geographic combatant commands and CONUS.

158 United States Marine Corps (USMC), Marine Corps Reference Publication (MCRP) 4-11.1C: Treatment of Biological Warfare Agent Casualties; U.S. Army. Army FM 8-284; U.S. Navy. NAVMED P-5042; U.S. Air Force. AIR FORCE AFMAN (I) 44-156, (Washington, D.C.: Headquarters, Departments of the Army, The Navy, and the Air Force, and Commandant, USMC, 17 July 2000). It is likely that a BW attack will be completed before the local commander, or the medical advisor, is aware that it has taken place. HSS units should rely on information not only from detectors and intelligence sources, but also from the casualties themselves

- Point-source epidemiology with a record number of sick and dying patients presenting within a short period of time (within 12 to 48 hours).
- Very high attack rates (60 to 90 percent of personnel are affected/symptomatic).
- A high incidence of pulmonary involvement signaling an aerosol route of infection. This would apply to such agents as plague, tularemia, anthrax, and Q fever where the usual form of infection is not pulmonary.
- "Impossible epidemiology." i.e. if CCVHF occurred in Alaska or New York, or VEE in England, a man-made epidemic would be extremely likely.
- Record fatality rates would be expected for many agents, since a large number of victims would receive doses of organisms far beyond what could possibly occur in nature. This is especially true of an aerosol attack.
- Localized areas of disease epidemics might occur in an area or sector downwind from the point of attack.
- Multiple infections at a single site with unusual pathogens.
- Increased numbers of dead animals of all species, such as rats for plague, or horses with equine encephalitis viruses.
- Protection of those working within in-door environments or environments with filtered air at the time of the attack.
- The near simultaneous outbreak of similar or different epidemics at the same site or at different sites or at military installations around the world.
- Direct evidence of an attack, such as finding an unexploded munitions or a contaminated exploded munitions; admission by hostile forces or terrorists that BW are being used; witnessing an attack; or intelligence information reporting use of BW agents by hostile forces from covert agents working within those hostile forces.

Table 4.2. Medial "Indicators" that a BW Attack has Taken Place.[159]

Although most BW agents require days to manifest, some agents produce their effects in minutes to hours. Problems with recognition and diagnosis of BW casualties include: (1) signs and symptoms of most BW agents are similar or identical to those of endemic and epidemic diseases, and (2) the nature and timing of symptoms will vary with the route of exposure. This information is used to facilitate the diagnosis of individual cases, to initiate immediate treatment, and to permit the arrangement for the reception of casualties (see Table 4.3).

159 United States Marine Corps (USMC), Marine Corps Reference Publication (MCRP) 4-11.1C: Treatment of Biological Warfare Agent Casualties (Washington, D.C.: USMC HQ), Series. Once illness begins to appear, the presence of an airborne BW agent should be relatively obvious because of the large numbers of casualties and the absence of a common exposure source such as food or water. However, food and/or water may also serve as a vehicle of transmission. If the situation is not readily apparent, the attack will not have been effective.

| | |
|---|---|
| *a. Conventional Casualties (CC.* | (1) Conventional casualties with no BW injury and with no contamination of their clothing and equipment.<br><br>(2) Conventional casualties with no BW injury but with contamination of their clothing and equipment. |
| *b. Direct BW Casualties (DBC)* | (1) BW agent casualties with no other injury.<br><br>(2) Mixed casualties with conventional and BW injuries. Since BW munitions often include burst charges, such injuries may occur as part of a BW agent attack. They may also be present when the injury and conventional injury occur at different times. Also, mixed casualties may result when biological injuries are combined with natural illnesses (infectious disease still accounts for the majority of casualties in conventional warfare). |
| *c. Indirect BW Casualties (IBC)* | (1) Casualties suffering combat stress reaction occur often in warfare, but may be more frequent where BW threats exist. The service member will have the additional stress of isolation from wearing the protective ensemble; additional fatigue when wearing the protective garments; and fear of BW agents.[160]<br><br>(2) Some BW agent treatments can have undesirable side effects when taken inappropriately, or in large enough quantities. Antibiotics kill desirable bacteria in the digestive tract, causing abdominal pain and frequent bowel movements. Medical personnel must be alert for their appearance.<br><br>(3) Wearing the protective ensemble makes dissipation of excess body heat more difficult. Wearing the mask also makes water intake difficult. Both will increase the probability of heat injury (heat exhaustion or heat stroke).<br><br>(4) Indirect BW casualties will most likely be the largest group requiring treatment. |

Table 4.3. Types of Casualties that May be Seen in BW Environments.[161]

Initial casualty management and treatment of those contaminated with BW will vary with the situation and the nature of contaminant.[162] HSS must be prepared to treat any range of the following:

- BW agent casualties generated within the geographical area
- Patients received from a forward and, in some cases, a lateral MTF

160 For additional information regarding Combat Stress Control, see FM 8-51, FM 22-51, and MCRP 6-11c. Available at: http://www.usmc.mil/.

161 USMC, Marine Corps Reference Publication (MCRP) 4-11.1C: Treatment of Biological Warfare Agent Casualties, (Washington, D.C.: USMC HQ), Series.

162 Specifics on BW contaminated patients at MTFs can be found in USMC FM 8-10-7. BW attacks should be suspected with any sudden increase in unexplained numbers casualties presenting with the same signs and symptoms. Consideration should be given to: (1) groups of patients from a specific unit/area presenting with the same illness signs and symptoms in a short period of time (hours to days), and (2) signs and symptoms not associated with any known endemic diseases in the area of operations.

- Patients suffering from a combination of injuries/illnesses (BW and conventional, BW and CW, and BW and endemic disease)
- Patient suffering from battle injuries and that have not been exposed to any BW agents, and
- Enemy prisoners of war, detained persons, and noncombatants, when directed.[163]

U.S. Navy Level I MTFs include battle dressing stations (BDS), NSF medical departments, and BDSs in support of the Fleet Marine Forces (FMF). Casualties must be considered contaminated until proven otherwise, and all levels should prepare to receive casualties. After initial receipt, five levels of care can be demonstrated (see Table 4.4).

| | |
|---|---|
| **Level I** | Level I includes self-aid and buddy care, examination and emergency lifesaving measures such as maintenance of airway, control of bleeding, prevention and control of shock, and prevention of further injury. |
| **Level II** | Level II care could be carried out onboard U.S. Navy ships by Independent Duty Corpsman (IDC) personnel. There are limited outpatient clinical services, initial trauma response, and no patient holding capability. |
| **Level III** | Level III care can be accomplished on larger amphibious force ships that possess large medical facilities or on one of the two Medical Ships if positioned in the region. |
| **Level IV** | Level IV care provides definitive therapy for patients in the recovery phase. If rehabilitation cannot be accomplished within a pre-determined holding period, patients are sent to Level V. |
| **Level V** | Level V care is convalescent, restorative, and rehabilitative. Level V care is normally provided by military, Department of Veterans Affairs, or civilian hospitals in CONUS. |

Table 4.4. Five Levels of Care Post BW Attack (or Incident).[164]

## E. CONCLUSION

The events of 11 September 2001 dictate that a new approach to force deployment and doctrine is needed. U.S. NSF can no longer assume that their entrance into LWZs, foreign harbors, or access to air bases will go unopposed by unconventional weapons.

NSF requirements for BW defense should be addressed individually and jointly along with research, development and acquisition programs, both overseen by ATSD(CBD). Under the direction of Navy Counter-Proliferation (OPNAV N70CP),

163 USMC, Marine Corps Reference Publication (MCRP) 4-11.1C: Treatment of Biological Warfare Agent Casualties, (Washington, D.C.: USMC HQ).

164 Ibid. Under operational conditions, psychological effects may complicate the medical situation. Upon recognition of BW attacks, the agent identity must be determined. It is unlikely that BW agents will produce single casualties under field conditions.

NSF are facing a pinnacle point where new doctrine, TTPs, and LPs must be "singled up" towards satisfying necessary threats from BW aggressors.

Integration between Naval forces and Joint resources under CBDP management structures is necessary to develop capabilities that will sustain U.S. NSF in the near future by providing necessary support in LWZ, and in foreign ports and airbases. Creation of these vital directives will allow Surface Warriors to work within the Joint Spectrum where capabilities exceed the U.S. Navy's without risk of facing a BW catastrophe analogous to the attacks on USS COLE (DDG-67), the World Trade Centers, and the Pentagon.[165]

COs and OTCs face new problems when considering the BW threat. The emergence of a new "Revolution in Military Affairs" (RMA) with the attacks on American soil, further highlight the steps that actors are willing to take to compliment their asymmetric strategies against the United States.[166] Doctrine must be envisioned that enables NSF to detect, protect, project, coordinate and counter BW threats and attacks.

Substantial gains can be recognized by diligent efforts in transitioning from the passive to active stage of BW preparation. This requires transformation and positioning personnel from collateral BW functions to sound manning positions suitable for countering the threat. At a minimum, personnel possessing expertise should be positioned in billets ranging from CVBG Staffs, amphibious squadrons, and destroyer squadrons, to USMC battalion, regiment and wing staffs to ensure expertise is available to direct BW efforts *when* needed.

Until each and every platform is self-capable, collective protection must harness the capabilities of each of the Services.[167] While addressing BW defense and CF, the United States cannot afford to "stovepipe" capabilities between services. Emphasis must be placed on how to achieve DP for all forces using means from the most capable in

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165 Editor in Chief Dick Cole, "USS COLE: Where Do We Go from Here?" in Surface Warfare, Vol. 26, No. 1, (January/February 2001), 6-12. Available at: http://surfacewarfare.nswc.navy.mil/.

166 The author's use of the term "Revolution in Military Affairs," (RMA) here refers to a fundamental change in the means of warfare. Doctrine, TTPs, and LPs along with present technology to combat adversaries' asymmetric means of warfare equates to a "new set of rules" and organizational relationships versus simply technological enhancements.

167 The author's use of the term Collective Protection should not be confused with its usage in formal models already presented in DoD, instead it is meant to imply a "collection" of all of the most effective offensive and defensive technologies, capabilities, doctrine and TTPs that either currently exist or are emerging, but with an increased emphasis on engaging operators in cognitive approaches for employment through use of LPs.

specific areas, such as BW, to work together to provide vital defenses (i.e. CM, HSS, and Training).

In June of 1942, Admiral E. J. King stated to the graduating class of the U.S. Naval Academy, "[D]ifficulties is the name given to things it is our business to overcome."[168] Though BW defense is difficult, preventing and countering BW proliferation will prove impossible if we do not address the cause as well as the symptoms, the demand as well as the sources.

Moreover, horrific consequences of BW from state and non-state actors place a premium on deterrence, and if that fails, actions taken in response to BW.[169] The U.S. Navy can close the gap in this area with emphasis on doctrine, TTPs, and LPs that harness detection and protection technologies, and that make critically important CM and HSS actions to combat this threat.

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168 E.J. King, address to the graduating class of the U.S. Naval Academy (19 June 1942) in Commander Douglas G. Hancher, ed., Executive Decision Making (Newport: National Security Decision Making Department, U.S. Naval War College, 2000), 2-1.

169 Ronald F. Lehman, "Reassurance and Dissuation: Countering the Motivation to Acquire WMD," in Peter L. Hays, Vincent J. Jodoin, and Alan R. Van Tassel, eds., Countering the Proliferation and Use of Weapons of Mass Destruction, (New York: McGraw-Hill, 1998), 116-117. Adapted from Lehman's conclusions of the central message of Proliferation: Threat and Response.

# V. THE WAY AHEAD -- PROPOSALS, RECOMMENDATIONS AND CONCLUSIONS

The U.S. Navy prepares to counter biological warfare (BW) largely through advances in technology; however, materiel superiority alone is not sufficient. Of greater importance is *institutionalization* of training and education, doctrine, leadership organizations, and warrior-centric humans that effectively take advantage of technology.

U.S. NSF will remain inadequately prepared and vulnerable to BW attack until a full spectrum of defenses is implemented. Further, doctrine must capture key tenants of joint concept developments to ensure integration into Joint Doctrine and JTTPs where necessary.[170]

Executive and legislative branches of government have voiced concern about BW which could be used by state actors, or by terrorist groups, in the combat theater against NSF. In contrast to nuclear weapons, BW are relatively easy to produce but their production is exceptionally hard to detect. Realizing this, the U.S. Government is trying to reduce the BW threat through a variety of means.[171]

Means range from the Biological Weapons Convention (BWC), to requirements under the CBDP. Behind these efforts is the knowledge that as long as the use of biological agents provides an advantage to a military or terrorist force, some national or non-national entity might be willing to develop and use them. In the 1996 *Proliferation: Threat and Response*, former Secretary of Defense William J. Perry stated:

> Hostile groups and nations have tried - or have been able – to obtain these weapons, the technology, and homegrown ability to make them or ballistic missiles that can deliver the massive annihilation, poison, and death of these weapons hundreds of miles away...Terrorists operate in a shadowy world in which they can detonate a device and disappear…regimes may try to use these devastating weapons as blackmail, or as an inexpensive way to sidestep the U.S. military's overwhelming conventional military superiority...The bottom line is, unlike during the Cold War, those who possess…NBC weapons may actually use them.

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170 Commander Joint Warfighting Center [CJWC], Concept for Future Joint Operations: Expanding Joint Vision 2020, (Fort Monroe: JWC Printing Office, 1997), 76-79.

171 Ibid.

Because the BW threat is prominent, it is not surprising that American leaders are concerned about the ability of the military to meet that threat. Investigations into this area provided information that was not reassuring.[172] BW defense readiness, however, has always been an elusive target. There has existed a gap between high level political actions aimed at improving readiness and actual accomplishments at the operations level. Although increased funding is important to BW readiness, the problem is more difficult and complex than can be solved by dollars alone.[173]

## A. PROPOSALS – FUTURE THOUGHTS

As a result of the 1997 Quadrennial Defense Review, CB defense funding was enhanced by $1 billion. Emphasis on detection and protection technologies, however, with minimal regard for means of employment, organization and training, doctrine, and TTPs required to implement them, present a cost to NSF *collective protection*; NSF have little capability to protect facilities or supplies from contamination if they suffer a BW attack. The worse case scenario could have terrorist BW attacks in the United States timed to coincide with the deployment of U.S. NSF to an overseas theater to face a BW capable enemy.

On February 13, 2001, at Norfolk Naval Air Station President George W. Bush stated, "[W]e must prepare our nation against the dangers of a new era. The grave threat from…BW…has not gone away with the cold war. It has evolved into many separate threats…adversaries seeking tools of terror are less predictable and more diverse."[174]

Point detector systems currently available provide a measure of defense against smaller scale attacks, but cannot in themselves provide the necessary warning to prevent exposure to landing forces and associated personnel. Detectors must be deployed to ensure both detection of source attacks at a considerable distance upwind of the forces, and rapid response to point attack. Consequently, detection, identification and confirmation should be multi-layered and in sufficient depth.

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172 When the Senate ratified the CWC, important issues were raised about the need for improvements in the BW defense readiness (the ability to survive and operate in a BW environment) of the U.S. Armed Forces.

173 Wiener. "Biological Warfare Defense," in Raymond A. Zilinskas. Biological Warfare: Modern Offense and Defense, 119-120.

174 President George W. Bush, remarks at Norfolk Naval Air Station (13 February 2001) in Department of Defense [DoD] Chemical and Biological Defense Program, Annual Report to Congress and Performance Plan, (Washington, D.C.: U.S. Government Printing Office [U.S. GPO], July 2001). Available at: http://www.defenselink.mil/pubs/chem_bio_def_program/2001_CBDP_Annual_Report.pdf.

Detector systems should be augmented with standoff or remote point systems to provide early warning capability beyond current capabilities. Means of agent detection and identification include:

- Non-specific. A system that can discriminate an unusual or man-made cloud from naturally occurring background aerosols, such as mist or fog;
- Generic. Capable of analyzing aerosol or particle content to determine if they are a hazard (chemical or biological);
- Specific. The ability to identify specific BW agents at the highest level of field agent detection, prior to laboratory confirmation; and
- Deployment of Detectors. Detector placement requires the detection requirement become part of doctrinal understandings, TTPs, and LPs, which must account for assessments of the detector capabilities, intelligence and environmental factors related to the risk of an attack utilizing BW.

Could the lack of qualified, trained, and prepared U.S. NSF cost success in a combat environment? The U.S. Navy has a valued stake in sustaining professional forces with means, expertise, and responsibility for BW readiness for its forces.[175] The lack of NSF trained in BW defensive tactics generates concern about future conflicts should ports and airfields be attacked with BW. The U.S. Army Chemical Corps could be used as a model for the best example of a significant military entity dedicated to BW readiness.[176]

If the U.S. Navy desires to ensure that BW expertise and organizational support is available for future threats it should create and maintain organizations with personnel and expertise in this critical area. The only place the U.S. Navy can realistically get that expertise currently is from the Army's Chemical Corps.[177]

An NBC Industry Group report reflects that GAO investigations have repeatedly stated that commanders have not adequately prioritized BW defense, despite the lessons

175 The U.S. Marine Corps possesses a small number of dedicated BW defense experts but a large percentage are in the CB Incident Response Force (CBIRF) whose mission includes force protection and support to homeland defense of CB attacks by terrorists.The CBIRF also supports the Marine Expeditionary Units (MEU), however it relies on personnel who perform BW readiness functions as a collateral, rather than primary, duty.

176 The U.S. Army has the most prominent role in the Joint Services Integration Group (JSIG) which addresses national defense requirements and priorities.

177 The U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID), is responsible for the medical management of infectious diseases and BW agents and the U.S. Army Medical Research Institute for Chemical Defense (USAMRICD) is responsible for medical chemical warfare defense. These organizations handle very unique aspects of CB defense which are not duplicated by any other element of the Services, DoD or the private sector.

learned from the 1990-91 Gulf War.[178] It proposes a reporting system through higher echelons to target attention to this critical area through reporting measures incorporated into current Status of Readiness and Training reporting System (SORTS). As it would be a visible and documented measure of effectiveness (MOE), fostering command attention, it would send an unmistakable message that BW is a priority.[179]

Two types of information on such a report could be: (1) a comparison of serviceable BW defense equipment on hand versus requirements and (2) training conducted by the unit. No longer would BW defense readiness be in the category of "out of sight - out of mind."[180]

**B. RECOMMENDATIONS**

As directed by the CBDP, the U.S. Navy is responsible for personnel and life cycle management, and has primary responsibility for TTPs, training, exercises, and doctrinal assessments. While current systems are presumably the building blocks of an equitable defense network against BW, they will not provide U.S. NSF with supremacy without the benefits of doctrine, TTPs, LPs, appropriately trained personnel, and actions that support Consequence Management (CM) and Health Services Support (HSS).

To enable the U.S. Navy to take advantage of investments in biological defense, and to ensure they result in improved capabilities against current threats, the following recommendations are offered. The U.S. Navy should:

- Develop a dedicated BW CP Warfare Community for full-time biological (chemical and radiological) defense with adequate manning, training, expertise, and career incentive to attract professionals matching the BW threat. Instituting this major force multiplier should be approached to focus talents of those few for the benefit of the entire fleet.

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178 The NBC Industry Group. The Health of Chemical-Biological Defense in the U.S. Military, (Washington, D.C.: The NBC Industry Group White Paper, November 1997). Available at: http://www.nbcindustrygroup.com/. It suggests that an important, low cost action to improve BW defense readiness would be to require that each unit document its state of CB defense readiness on its unit readiness reports. When an area is reportable, the commander has to pay particular attention to it since he approves the report.

179 The Joint Program Office for Biological Defense (JPO-BD) is focused on the mission of BW defense, an important function in light of Iraqi disclosures in this area. The work being done in the CB defense area within the Defense Advanced Research Projects Agency (DARPA) is important in that it promotes research in very advanced technological applications. The successful technologies can then be passed to the Services to exploit.

180 The NBC Industry Group. Available at: http://www.nbcindustrygroup.com/. Once the information is available, focused actions can be taken to bring units with lower levels of equipment or training to a suitable standard. Also, contingency planners can consider the level of readiness of different elements of the force and the actions needed to prepare units for deployment to a theater where a BW threat exists.

- Provide cognitive definition of the threat to the fleet -- and then focus on planning, training, funding, equipping, and exercising vital resources that will ensure NSF sustain supremacy in the face of asymmetric attacks.
- As an important step towards minimizing the asymmetric effect of BW on conventional capabilities, provide support to commands and agencies that directly contribute to BW defense readiness and train NSF to the effects of BW.
- Establish explicit and out-come oriented goals linked to Warfighters' ability to survive, fight, and prevail in BW environments
- Identify quantitative and qualitative MOEs for use in assessing progress towards toward achieving BW defense
- Maintain a source of BW experts who can support U.S. NSF needs in the defense against BW in operational staffs. A tremendous example of this effort is illustrated by the U.S. Army's Chemical Corps.
- Improve BW knowledge and training through the use of improved Navy Operational Requirements relating to biological defense defined in BW General Operating Instructions and Tasking (OPGEN/OPTASKs)
- Reevaluate the manner in which Consequence Management (CM) and Health Services Support (HSS) are conducted — CM and HSS must be integrated with DP in doctrine and TTPs, and must position NSF to defend organically without other Services support where necessary
- Reassess doctrinal perceptions of operationally employing assets during BW warfare and provide visibility to the specific level of BW readiness throughout the Navy. Unit readiness reporting via SORTS might be an important element in accomplishing this.
- Increase Navy and Joint exercises to include BW defense training requirements and incorporate them into Individual Deployment Training requirements, and Fleet Battle Experiments (FBE)
- Establish In-port and At-Sea BW performance and readiness standards for NSF Commanding Officers and OTC's use in promulgating Local Unit Practices (LPs)
- Hasten the Doctrine Review and Development process to ensure that Naval doctrine and TTPs feed directly into Joint doctrine and JTTP
- Pursue Navy doctrine and TTPs necessary for BW readiness in the Navy-after-Next. It is paramount that resources be directed towards these efforts sooner than later.
- Adequately compensate Fleet staffs, Battle Group staffs, Tactical staffs and Amphibious Ready Groups through "Manning" procedures meant to realize appropriate levels of knowledge and capability

- Invest significantly in appropriations designed to ensure that NSF are capable of defeating any adversary that chooses to adopt BW as a means to counter U.S. Navy capabilities

Many of the recommendations suggested above, while conceptually simple, present challenges in the Navy organization. If the recommendation to develop a BW CP warfare community was adopted, the U.S. Navy would need to identify specific deliverables with implications for each element of the Navy's responsibilities of Organizing, Training, and Equipping its new forces to sustain the mission in the face of contaminated environments.

**C. THE WAY AHEAD**

Against the backdrop of the BW threat, the U.S. Navy must consider its position, it has funded and built systems, added new technologies, and created a BW management source through the establishment of CNO Executive Agent for CB Defense, Deputy Secretary of the Navy for Resources, Warfare Requirements and Assessments (OPNAV N70) and the Office of Counter Proliferation (N70CP). What is now needed is the next "progression of criticality," that is development of new doctrine, and a better doctrine review process. These developments will enable creation of adequate TTPs at Numbered Fleet and Operational levels, and clear the way for precise direction via Operational Orders and Tasking that benefit COs and OTCs in the establishment of Local Unit Practices (LP).

The U.S. Navy should add experts in the field of CP and BW defense. The experts can create a decision making process that can evaluate and assess potential threats, identify and counter BW aggressors, provide for emerging technologies and new processes against viable threats, streamline the doctrinal process to allow for the establishment of comprehensive TTPs and LPs fleet-wide, and take a "long view" at training strengths and weaknesses.[181] Through sound doctrine, LP training and requirements, and TTPs the U.S. Navy is capable of emerging victorious against both state and non-state actors using BW.

The terror associated with BW can be overcome by looking now to emerging threats and quickly overcoming the strategic advantage that can be put forth by state and

181 Peter Schwartz, The Art of the Long View, (Washington, D.C.: Doubleday Dell Publishing Group, Inc., 1991), 3-10, 105-123.

non-state actors.  Technologies research and development at the DoD level shouldered upon strict doctrine and Navy TTPs can achieve goals established by the CBDP. Enhanced training programs sanctioned by the Chief of Naval Operations (OPNAV) and Fleet changes to operational practices of CP can become the catalyst that institutionalizes U.S. NSF capabilities to survive, fight and prevail in contaminated environments.

Without this revolutionary understanding of the BW threat and early action on the part of the U.S. Navy, NSF could face barbaric actors who may attempt to deter or deny U.S. forces from the sea and thereby denying United States national interests.

The success of today's Navy, and Navy-after-Next demands that the BW threat will flourish until resolve is established to diminish fear from BW through institutionalized practices that are comprehensive, allow forces to proceed into contaminated areas without hesitation, and complement Joint doctrine and JTTPs producing a synergy of force against this very real threat.

Post these progressions, U.S. NSF will adequately possess the capability to sustain the naval mission and meet and exceed legislative and warfighting criteria.

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