The Chemical Corps in 2020:

Using Network-Enabled Operations to Interdict CBRN and TIC Releases

By Major David Bergman

". . . our relevance to the combatant commander requires us to be more than just a reactionary force."

Brigadier General Stanley H. Lillie
Chief of Chemical, August 2003–June 2006[1]

Historically, decontamination has been viewed and used as a defensive measure, normally as part of force protection within the warfighting sphere. With the development and procurement of chemical, biological, radiological, and nuclear (CBRN) sensors, the shift to network-enabled operations (NEO) by the year 2020 and the advances in decontamination solution dispensing from air platforms, decontamination operations can be refined to be used as an offensive tool (in relation to early interdiction). This advancement will be significant to warfighting operations and homeland defense, with the U.S. Army Chemical Corps playing a critical part in the joint initiative.

The Chemical Corps will play a lead role in integrating defensive measures into decontamination operations in a warfighting system. The desired outcome of future decontamination operations must be to interdict CBRN releases. In order for this to occur, the Chemical Corps must use advances in network-centric warfare (NCW), current sensors and programs, and remote delivery systems to forge capability initiatives. "The CBRN defense capabilities we provide are essential to our warfighters in winning the Nation's wars and helping federal, state, and local agencies defend the homeland."[2] This article explores how the Chemical Corps, as the recognized leader in CBRN defense, can develop advanced capabilities for use by joint warfighters and homeland defenders.

Background

In many regions where American, British, Canadian, and Australian (ABCA) countries are likely to operate, an increase in CBRN personal-protective equipment (PPE) levels corresponds with a marked decrease in individual performance to such a degree that a "survive-to-evacuate" policy prevails. This is due to the difficulties of PPE use in equatorial environments with high temperatures or high humidity. To reduce the risk from CBRN and toxic industrial chemicals (TIC)/toxic industrial material (TIM) contamination, ABCA countries are on the cusp of having the ability to use interdiction platforms to reduce the effectiveness of CBRN and TIC/TIM releases.

The current principles of decontamination—perform as soon as possible, use only when necessary, perform as far forward as possible, and apply by priority—are defensive in nature and concede opportunities to the enemy. The enemy carries out an attack, and we respond with defensive operations. The way forward is to take technological advances and shape them to produce a desired outcome. We still need traditional decontamination techniques; however, the need will be reduced due to heightened offensive decontamination capabilities.

Force Structure

Australia, along with fellow ABCA countries, is planning the structure of future defensive forces. All of these countries are moving along similar paths to create new force structures by 2020. In this area, our greatest challenge is keeping up with ever-changing technological improvements. The major reorganization of Chemical units, including the development of multicapable Chemical companies, will enhance the support available to the combatant commander by consolidating functions and simplifying unit structures.

Australia is embracing the future joint operating concept (FJOC), which describes how the Australian Defense Force (ADF) will fight. The NCW is an integrating and supporting concept designed to organize the ADF using modern information technology that links commanders directly to sensoring equipment and weapons systems to allow real-time visibility. NCW is a tool that can contribute significantly to producing a warfighting advantage.[3]

Network-Enabled Operations

NEO forms part of the NCW concept. The Australian document that outlines these plans is *Force 2020*.[4] This document outlines the need to transition from platform-centric operations to NEO. Force 2020 goes on to explain how NEO derives power from effectively linking organizational elements to conduct warfare operations more effectively. The NEO concept treats platforms as "nodes" in a network. Since all elements of the network are securely connected, personnel can collect, share, and access information to create a common, real-time battlespace picture across all components and services. This allows for a greater level of situational awareness, coordination, and offensive potential.

A desired outcome for using NEO is a common and enhanced battlespace awareness that delivers a maximum combat effect. The maximum combat effect for the Chemical Corps is the interdiction of CBRN release plumes to neutralize agent effects. Traditionally, the focus of decontamination operations has been on liquid contamination, but we should be exploring the nontraditional gap areas. One such gap area worth exploring is the aerial release of decontaminants to neutralize vapor clouds.

The NEO concept is a tiered system of grids—sensor, command and control (C2), and engagement—with specific purposes:

- A sensor grid collates real-time information from every type of sensor, from satellites to Soldiers, to create a shared picture of battlefield conditions. The ability to connect to this grid will emerge as the primary source of combat power.
- A C2 grid collates, analyzes, and makes rapid maneuver and target allocation decisions based on the battlefield picture.
- An engagement grid executes the decisions of the C2 grid, using the best "shooter" regardless of the equipment designated to deal with the target.[5]

Sensor Grid

The Chemical Corps should develop the sensor grid as a priority. This does not mean an increase in the number of sensors, but rather an upgrade in their ability to communicate with the C2 grid. Each sensor should have the ability to link into the system as needed. This may mean a "drill down" ability where the main Chemical Corps C2 grid (such as the hazard prediction and assessment capability [HPAC]) automatically processes sensor information as it moves further into an area.[6] The Australian HPAC does this by linking into meteorological sensors around the world. The GID-3™ also has a remote sensing capability that links back to a base station.[7] The Chemical Corps needs unit-based sensors to link into the C2 grid.

Along with the development of unmanned aerial vehicles (UAVs), the Chemical Corps should focus on the development of UAV CBRN sensors. Current UAV development focuses on imagery and striking platforms that fly high and fast. The UAV CBRN sensor platform will fly slow and low. The Corps should be involved with UAV CBRN sensors now, as they will become more critical to future operations.

Doctrine that addresses the employment of sensors in an NEO environment needs to be developed now. It must be linked to the new CBRN doctrinal concept, which is framed in the areas of sense, shape, shield, and sustain. Forward thinking is required for this developing doctrine, which would include sensor sighting, information transfers, decision-making processes within the C2 grid, and the employment of relevant Corps engagement grid resources (such as UAVs, unmanned ground vehicles [UGVs], and air platform-based decontamination assets).

Command and Control Grid

C2 grid networking is broken down into a two-phase response. Phase 1 calls for the incorporation of current warning and reporting systems and the enhanced C2 technology needed to incorporate air platforms into an interdiction plan. Using HPAC as an example, the upgraded system will display the sensor grid information, the current location, and the state-of-readiness status of all chemical engagement grid platforms. Upon receipt of information from the sensor grid, the Chemical officer in the C2 grid plans the immediate plume interdiction and transfers the plan to the respective engagement sensors. These engagement sensors could include C-130 aircraft, UAVs, UGVs, or troops. Phase 2 involves an ongoing assessment of the long- and short-term threats and the identification of ground forces required to go to a higher level of PPE.

This threat assessment is as relevant to homeland defense operations as it is to conventional warfighting operations. Phase 2 also includes the performance of ongoing response requirements.

With the goal of using new technical advances to show the Corps' early interdiction of a CBRN plume, the challenges of conducting successful sensor information transfers to airborne platforms is critical. A Northrop Grumman Corporation/Lockheed Martin Corporation industry group recently demonstrated success in high-bandwidth communication transfer to and from air platforms. "In the demonstration, electronic signals generated by the [active, electronically steered array] AESA radar were used to transmit imagery data transmission to [the] L-3 Communications [Corporation] common data link [CDL] modems, at a speed of 274 megabits-per-second, twice and four times the basic common data CDL data rate. . . . This demonstration is part of the F/A-22 Non-Traditional Intelligence, Surveillance and Reconnaissance (NT-ISR) missions, considered for possible spiral application into F-22 and F-35 aircraft programs, allowing them to transmit and receive large, uncompressed data packages, such as synthetic aperture radar images and other data, within seconds."[8]

The mentioned demonstration is one example of the ground-to-air data transfer capability available. This capability will allow the Chemical Corps C2 grid to transfer the required data to an engagement grid (which in this case is a C-130 aircraft from the 910th Airlift Wing) to interdict a CBRN release. The development and conceptual validity of the information transfer capability between the C2 grid and the 910th Airlift Wing platform should be considered urgent!

A C-130 performs an aerial-spray mission.

The development of a Chemical Corps engagement grid component will diminish the threat through a network of interdiction platforms. "The vital importance of seaports of debarkation (SPODs) to U.S. power projection capability makes them an attractive target for a chemical-biological (CB) attack. . . . As such, SPODs in immature theaters are considered strategic centers of gravity requiring careful protection and commitment of resources to ensure that they are adequately protected and, if attacked, quickly restored to operation. The ability to defend SPODs against CB, toxic industrial chemical[s] (TIC), and toxic industrial material (TIM) attacks is an operational necessity for all unified combatant commands during power projection and force deployment operations."[9]

The development and advances in the sensor and C2 grids provide the opportunity to include force multipliers in the engagement grid. In particular, a main Chemical Corps weapon in the armory to interdict CBRN releases should be the aerial-spray capability of the 910th. Aerial-spray capability has historically been limited to the eradication of pests such as mosquitoes and beetles, but the capability of the 910th to perform wide-area decontamination operations is outside current Chemical Corps engagement grid assets.

The 910th Airlift Wing conducted limited trials in the 80s and 90s. These trials demonstrated the ability to deliver spray decontamination from aircraft.[10] "From 1983 to 1993, the 910th Airlift Wing developed a one-of-a-kind [ultrahigh volume] UHV technique for the C-130 [Modular Aerial-Spray System] MASS to apply 250 [gallons per acre] gallons/acre or more with very little drift. From 1993 to 1997, they also conducted feasibility testing with the Joint Contact Point at Dugway Proving Grounds [*sic*] UT [*sic*] and demonstrated that the MASS in the UHV mode can evenly cover a 60-foot by 4,000-foot assault strip with 250 [gallons per acre] gal/ac [of] water using 2.5 sorties."[11]

An October 1998 field test showed that a mild 1.25 percent bleach mixture delivered by the C-130 MASS UHV technique decontaminated 99.9 percent or more of a biological simulant on concrete and painted metal. In the target area, a 1,000-fold average reduction in bacterial contamination was exceeded.[12] The development of aerial-decontamination interdiction capability is moving to larger aircraft that can be contracted at short notice to augment

capability gaps. There is a need for more research on decontamination solutions and methods, particularly in radiological material.

The Chemical Corps engagement grid should not end with traditional equipment and fixed-wing aircraft. The ability to use rotary-wing aircraft and UAVs to deliver decontamination solution should also be explored. For example, equipping the Schiebel Corporation next-generation CAMCOPTER® S-100 tactical UAV (which has a 50-kilogram payload) with a decontamination dispersal system would allow a CBRN release to be remotely, safely, and quickly interdicted. Civil support teams would benefit from the augmentation of engagement grid resources (such as the 910th Airlift Wing) during periods of heightened threat levels.

Summary

Operations in support of homeland defense operations or the warfighter commander will likely require the earliest interdiction to combat a CBRN release, particularly in an urban environment. The plume modeling studies conducted by various research institutions demonstrate the way a CBRN release will act in an urban environment and with various wind patterns. Future plume modeling should focus on real-time scenarios that address how an agent release will likely move and how we will reduce the effectiveness of that release. The goal should be to reduce the need for troops to increase their PPE posture. Addressing agent releases early will result in threat neutralization or minimization.

Detectors as part of a sensor program will detect the release of CBRN agents. This information will then be sent to the command headquarters and interdiction platforms. This will then allow a release interdiction plan to be developed and implemented, which will activate the employment of fixed, rotary, and UAV platforms. NCW advances enable the transfer of information. A common operating warning and reporting package forms the basis of any response. Fixed and mobile sensors (including UAVs) provide the initial identification and verification notification (reporting the information through the Warning and Reporting System). This information flows to the C2 area and interdiction platforms. At the C2 area, the Chemical officer develops and coordinates the interdiction plan based on the available information. Interdiction platforms such as the 910th Airlift Wing C-130s and Chemical Corps UAVs then implement an interdiction strategy based on the plan. This would see the 910th carrying out decontamination runs from appropriate heights, rotary-wing aircraft performing bulk spot drops, and UAVs conducting hot spot missions. The overall goal is to contain the initial agent release and limit the agent spread.

Warfighters need the Chemical Corps to be more than just a reactionary force. NEO and the tiered system of grids will see the seamless transition from detection to precision engagement in interdicting CBRN or TIC/TIM releases. The transition to the future force will see an increased use of remote technology, particularly in the use of UAVs and UGVs (including miniature and micro systems). The immediate boost will be the introduction of the aerial spray capability in engagement grid resources. Incorporating the 910th Airlift Wing so that the C2 grid can share a real-time picture and control the interdiction of CBRN plumes will form the basis for the Chemical Corps to move to the future more effectively. The interdiction of CBRN or TIC/TIM plumes will contribute to the Corps' relevance to the Warfighter and homeland defense commander and its transition to becoming more than just a reactionary force.

Endnotes:

[1]Chief of Chemical, "Moving our Corps Into the 21st Century," *Army Chemical Revie*w, April 2004, p. 7.

[2]Ibid.

[3]Andrew Hetherington, "NCW–The Future is Here," *Australian Army*, *<http://www.defence.gov.au/news/armynews/editions/1137/Default.htm>*, accessed on 25 July 2006.

[4]"Force 2020," *<http://www.defence.gov.au/publications.cfm>*, accessed on 25 July 2006.

[5]Ibid.

[6]The HPAC is a hazard prediction system with an atmospheric-dispersion model as its core.

[7]The GID-3 is an automatic chemical-agent detector and alarm system manufactured by Smith Detection©. It warns of the presence of chemical-agent vapor in the surrounding air.

[8]"Converting Aircraft for Broadband Data Transfer Capability," *Defense Update, International Online Defense Magazine, <http://www.defense-update.com/features/du-1-06/aircraft-com.htm>*, accessed on 14 July 2006.

[9]Victor Ellis, "Science and Technology in a Dynamic CBRN Landscape," *Army Chemical Review*, April 2004, p. 32.

[10]Youngstown-Warren Air Reserve Station, "Fact Sheets: Aerial Spray Mission," *<http://www.youngstown.afrc.af.mil/library/factsheets/factsheet.asp?id=3413>*, accessed on 14 July 2006.

[11]Headquarters, U.S. Air Force Reserve Command, 910th Airlift Wing briefing notes.

[12]Ibid.

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