CBRN Preparedness Transformation Vision and Strategy

By Lieutenant Colonel James Demyanovich

This article describes a vision and strategy for the military services to achieve near-term, transformational capabilities in chemical, biological, radiological, and nuclear (CBRN) situational awareness based on today's technologies. This vision and strategy are proposed by the author using selective CBRN sensor technologies, linked to organic communications architectures, and inserted into near-term military systems (platforms). This technology insertion and integration would be selective and, in most cases, transparent to system operators. Only through analyses (not attempted here) can this vision be crafted into a feasible approach that transforms diverse and disconnected elements of CBRN defense equipment into a network of situational awareness. Follow-on, robust systems analyses and experimentation may shed light on specific material solutions and approaches that can provide our military with the integrated and efficient CBRN situational awareness it has long sought (provided as architecture built into military platforms).

An overarching premise: In an operational environment under a credible CBRN threat, situational awareness, vulnerability assessment, and hazard estimation are clearly commander's critical information requirements (CCIRs). Leaders need accurate and understandable information on CBRN incidents. And this information must be constantly updated and transmitted in situational assessments. CBRN events can affect large swaths of operational space and impact forces for hours and at distances up to tens of kilometers downwind. Current methods of equipping forces for CBRN situational awareness have focused on providing handheld equipment to individual operators and units. The incorporation of a selected set of automated and integrated CBRN sensor technologies into platforms is a step in transforming military situational awareness with potentially near-term, achievable benefits across the force.

How do U.S. forces sense CBRN events? At the unit level, CBRN equipment is electronic and nonelectronic. Nonelectronic items are typically single-use items meant for critical individual and small-group survival tasks (such as liquid contamination detection, highly toxic vapor detection, or individual decontamination). Most electronic CBRN sensors provide information on CBRN hazards that are immediately dangerous. Critical CBRN detection information is first directed to the unit CBRN equipment operators and then to unit leadership to brief higher commands. This user level information focus has incrementally helped equipment operators with new end items of equipment that provide added CBRN capability.

Unfortunately, every added piece of equipment requires user attention. When CBRN sensors alert operators to positive detections, the operators must focus first on survival actions such as donning a protective mask, warning others, and donning protective suits. Later, the operators report sensor findings through command channels. Sharing CBRN sensor data and updating it regularly becomes a significant task, often overcome by other operational priorities. This is particularly problematic due to the lack of connectivity between most CBRN sensors and military command, control, communications, computers, and intelligence (C4I) systems that are often within arm's reach of one another on military platforms. Equipment operators often interpret and report CBRN sensor readings by typing text reports or relaying voice messages using their organic C4I systems.

How can CBRN situational awareness be significantly improved? Transferring critical CBRN sensor data automatically into C4I systems is the key. The proposed, transformational approach equips military platforms with a set of high-value CBRN awareness sensors as built-in features "behind the dashboard." Such features will displace some existing CBRN sensors (following a required capabilities reevaluation). This displacement is possible because many of the CBRN sensors dedicated to area warning are fielded as handheld equipment. Following a realistic, CBRN operational scenario analysis and capability requirements review, selected CBRN sensors could be recommended for platform integration. These sensor capabilities may or may not use existing CBRN sensors rugged and reliable enough to be integrated directly into platforms as subsystems. Appropriate, low-maintenance CBRN technologies could be modularized and systematically applied to a myriad of platforms at the subsystem level.

What is transformational about this approach? The real change is not just the value of automatic and local CBRN sensing, but the process of sensing and reporting data consistently and automatically at and from the

platform level. Automating the CBRN reporting task is a vital and needed capability, but automatic reporting requires negative detection reports that also indicate hazard reductions and passage restrictions. Adding such reports for areas free of CBRN hazards would significantly enhance the operational understanding of evolving CBRN events and provide a more accurate ground truth. CBRN technology connectivity to existing platform level C4I systems is required. This C4I integration would be included to distribute CBRN data digitally. The availability and interpretation of CBRN data would then provide significant information to platform operators and higher command echelons. Each platform would give individual elements a larger web of friendly CBRN situational awareness. This totally contrasts with the low level of CBRN awareness created using manually generated text or voice reports. The platform level CBRN data streams and updates would provide command echelons with required, regularly updated CBRN CCIR for operational forces to provide a better understanding of CBRN events.

For example, the current inventory of high-mobility, multipurpose, wheeled vehicles (HMMWVs) in use could be transformed under this proposal. The changes could occur at the depots or factories during recapitalization or as modifications during the construction of new end items for fielding. Outwardly, there would be little indication of significant changes to the platform. Today, many military units are equipped with HMMWVs, and some transport organic CBRN sensors. However, the use of CBRN equipment while traveling in a HMMWV varies significantly from situation to situation, vehicle to vehicle, and unit to unit.

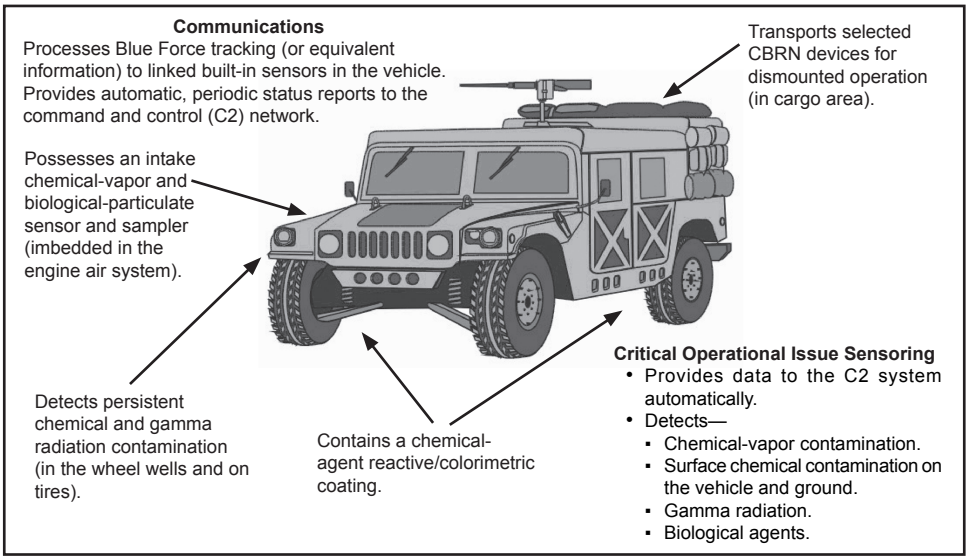
Current CBRN sensors—

- Are used primarily to warn operators of grave danger.
- Are manually employed and visually monitored.
- Depict CBRN detection events that must be reported with existing C4I systems (typed digital reports or voice reports).
- Require that the operator direct tasks for initial CBRN detection reporting and periodic situation updates through typed digital reports or verbal reporting on C4I systems.
- Operate at the discretion of equipment operators.
- Are mostly disconnected from platform C4I systems.

With sensor integration and data connectivity, CBRN sensors and capabilities built into platforms can—

- Warn operators of grave danger and automatically notify higher commands.
- Automatically operate when platform C4I systems report sensor information and alerts.
- Automatically report CBRN detection events as digital data on existing C4I systems (in standard report formats) with operators adding information as needed.
- Provide initial CBRN detection reporting and periodic situation updates based on algorithms, without operator direct actions (unless directed to do so, using available C4I systems).
- Exploit platform C4I systems to provide CBRN sensor data using existing critical data streams (such as Blue Force tracking) to provide CBRN event information as CCIR (in addition to friendly force locations).
- Provide added features, such as chemical-biological sample collection ports (added as a vehicle power plant air intake) as sample collector modules.
- Establish a common baseline of CBRN sensing capabilities across military services to ensure common and uniform operations.

What should a priority set of integrated CBRN sensors consist of? Based on experience, an initial set of



Future HMMWV with added CBRN capabilities

CBRN equipment for integration at the platform level may include—

- The detection of chemical warfare agent (CWA) in the vapor phase from ambient and crew compartment air.
- Selected or tailorable toxic industrial chemical (TIC) gas sensors.
- Gamma radiation sensors.
- Aerosol, particulate biological-agent discrimination and collection equipment.
- Toxic-gas sample collection and accumulator (CWAs and TIC).

A new feature that is not currently in the military could include equipment coating as a replacement for current chemical agent-resistant coating. A new reactive coating would indicate, by a color change, the presence of liquid chemical-agent surface contamination and perhaps react with the agent destructively and delaminate to remove surface and penetrated contamination.

A possible technology experimentation and demonstration process could provide cross-community evaluation and refinement of an initial selection of CBRN technologies.

Parallel joint and service experimentation efforts should be initiated and could include, but are not limited to, CBRN technologies focused on—

- Joint warfighting experimentation that takes into consideration the value of near-real-time, platform level CBRN sensing, as compared to existing capabilities against threat scenarios. This would establish a balanced need for services operating as part of joint operations.
- Joint concept development and experimentation efforts that determine service needs and desires for platform level CBRN sensing, initial service desires for initial and periodic sensor data updates before and following CBRN events, and priority ranking.
- Current C4I systems, particularly when evaluating the suitability of existing and planned systems to transmit CBRN sensor data. This would include evaluating existing systems and available infrastructure capabilities to accommodate key CBRN data and estimating how much data could be accommodated during routine and surge CBRN events.
- Department of Defense (DOD) level requirement reviews and documentation (as needed).
- Science and technology reviews for available CBRN sensing technologies that might provide required user near- and mid-term capabilities and information.
- Acquisition program reviews of existing technologies that might be selectively harvested for sensor integration.

What are some challenges in a transformational CBRN sensor approach to platforms?

Programmatic challenges are indicated above and would include—

- Accepting built-in features as a transformational vision for CBRN capabilities involving collective agreements from DOD CBRN defense efforts and service level programs.
- Establishing an overarching CBRN sensor and C4I integration baseline for platform levels that will ensure DOD commonality of CBRN capabilities.
- Establishing a DOD draft, platform level, CBRN subsystem integration baseline.

Military operations are more dispersed over wide areas and can benefit from automating and integrating available CBRN preparedness enhancements to their platforms. These enhancements would provide consistent levels of continuous CBRN situational awareness. The integration of selected CBRN sensors at the platform level, with C4I integration incorporated, provides a leap ahead in CBRN situational awareness capabilities. Current CBRN sensing systems do not readily interface with C4I systems without fielding added C4I interface devices. The integration of CBRN sensing into platforms focused on C4I system connectivity provides a new level of CBRN sensing. U.S. Forces, with continued enhancement of net-centric operations, will benefit from this effort. This approach can truly transform CBRN situational awareness and provide our services with capabilities that allow for the best awareness of and response to CBRN operational conditions.

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