Joint Concepts for Countering Weapons of Mass Destruction

Weapons of Mass Destruction (WMD) Early Warning White Paper

**History.** This white paper updates prior concepts, concept experiment results, and doctrine on how the Joint Services will conduct Weapons of Mass Destruction (WMD) Early Warning activities. This effort forms the foundation to identify and establish the path forward in the 2025-2040 timeframe.

**Summary.** This white paper is a fundamental shift in the Joint CBRN Defense community’s view of how the integration of sensors (CBRN and non-CBRN) provides WMD Situational Awareness (Proliferation Prevention/Counterproliferation) and Situational Understanding of CBRN Hazard Activities (CBRN Defense/CBRN Consequence Management) to provide WMD Early Warning.

This white paper uses the outputs generated by the Joint Chemical, Biological, Radiological, Nuclear (CBRN) Hazard Awareness and Understanding Concept Experiment, February 2010 and refreshes the approved Concept for Joint Hazard Awareness and Understanding, 10 September 2010, as well as studies and assessments previously conducted to meet Joint Force Commander’s requirements for Countering WMD. This white paper informs future Joint Countering WMD capabilities development and assessment efforts. It serves as the conceptual basis for conducting integrated Joint Countering WMD operations and developing solutions, at the tactical level, across the doctrine, organizations, training, materiel, leadership and education, personnel, facilities, and policy (DOTMLPF-P) domains.

**Applicability.** This white paper applies to Department of Defense (DoD) services, agencies, and activities involved in DOTMLPF-P requirements.
Chapter 1 – Introduction

“The ISR Joint Force 2020 construct should focus on networked joint ISR solutions rather than platform-centric sensors and processing, exploitation, and dissemination (PED) methods. It should encourage the integration and innovation of multiple sensors to provide the fidelity and redundancy required to support rapid and sound decision-making.” Intelligence, Surveillance, and Reconnaissance Joint Force 2020 White Paper, June 2014

1-1. Purpose.
This white paper builds upon the Concept for Joint Hazard Awareness and Understanding. The purpose is to describe how the future Joint Force will provide situational awareness of WMD threats and early warning of CBRN hazards down to the tactical edge so that the commander can make informed decisions through understanding. It presents a conceptual description of how the future Joint force will evolve, extend, and adapt applicable sources to achieve WMD early warning. These capabilities are described in broad, operationally based terms, and the concept should encourage exploration beyond the boundaries of our current capabilities, foster progressive and provocative new ideas, and accept discord as an essential part of the concept development process. This white paper is not limited or constrained by current or programmed capabilities or doctrine. Ideally, this concept will lead to the development of future military capabilities.

1-2. Key terms
For the purpose of this concept WMD Early Warning is described as situational awareness and understanding of WMD threats and CBRN hazards to enhance survivability.

WMD Environment. A condition in which WMD threats and chemical, biological, radiological, or nuclear (CBRN) weapons can be developed, proliferated, transferred, or employed.

WMD Situational Awareness. Having data, information, and the resulting knowledge of WMD within time and space.

CBRN Situational Understanding. The result of applying the assessment and analysis of WMD situational awareness to recognize the change and magnitude of effect concerning or regarding CBRN hazards.

This White Paper addresses the use of CBRN and non-CBRN assets to inform, at the tactical level, WMD early warning across the future Joint force (2025-2040). This white paper adopts a holistic approach that includes operations in domestic and foreign environments, pre- and post-event, and integrating with national and strategic policy.

1-4. Background.
The Capstone Concept for Joint Operations cites ten primary missions through which the Joint force will protect U.S. national interests. Countering WMD is one of these primary missions. The Joint Operating Environment forecasts that joint forces may have to counter WMD threats, and if required, operate in chemical, biological, radiological, and nuclear (CBRN) environments. Depending on the scenario, WMD threats and CBRN hazards may impose severe impacts across
the range of military operations. These impacts could include equipment and personnel availability, possible degradation, and mass casualties of civilians and military personnel. The constraints imposed by a WMD threat and/or CBRN hazard environment can impact entire joint operations making logistics more difficult, personnel less productive, and complicating the environment.

1-5. Linkage to Joint Concepts, white papers, and other defense documents.

a. Capstone Concept for Joint Operations (CCJO). The Capstone Concept for Joint Operations (CCJO) was approved on 10 September 2012 and describes high level requirements on how the future Joint Force will operate. The CCJO introduces globally integrated operations (GIO) as the central theme on how the Joint Force should prepare for the future security environment. GIO is the idea of quickly forming, evolving, dissolving and reforming again for purpose in time and space that provides unique capabilities and formations to project decisive military force. More importantly, the CCJO describes the integration of unique capabilities and emerging capabilities with special operations forces, cyberspace operations, space, and ISR. This white paper will continue along those lines describing a very specific capability to timely inform the Joint Force to preserve personnel and resources, and ensure mission continuation.

b. Joint Force 2020 White Paper: Intelligence, Surveillance, and Reconnaissance (ISR). The Joint Chief of Staff (JCS) has recognized the need to develop ISR solutions to provide commanders sufficient early warning capabilities that are timely, diverse, interoperable, survivable, efficiently managed, and simplified programmatically so that commanders can make informed decisions and be warned of a dangerous environment. The ISR Joint Force 2020 construct focuses on networked joint ISR sensors and processing, exploitation, and dissemination (PED) methods. The threat of WMD and the possibility that the Joint Force will have to continue to operate and recover from CBRN hazards will require commanders to have a robust capability that provides timely warning and knowledge to aid in decision making.

c. The Joint Concept for Denying the Use or Transfer of Weapons of Mass Destruction guides Countering WMD capabilities development to transform military operations to deny the loss, transfer, or use of WMD in hostile and uncertain environments in the 2020 timeframe and beyond. It integrates Countering WMD activities into all phases of Joint operations to rapidly identify, adapt to and defeat WMD threats across the range of military operations. The Joint Concept for Denying the Use or Transfer of Weapons of Mass Destruction provides WMD risk reduction precepts to guide the execution of Countering WMD activities to manage WMD risks emanating from hostile, fragile, or failed states and safe havens.

d. Joint Hazard Awareness and Understanding Concept. The Concept for Joint Hazard Awareness and Understanding described how the Joint Force employs/conducts CBRN hazard awareness and understanding to support all military operations in the 2016-2028 timeframe. The concept aligns these capabilities with the applicable Tier 1 and 2 JCAs so that they are related and linked to the processes used for (non-CBRN defense) battlespace awareness and situational understanding. In so doing, it attempts to expand the traditional perspective of CBRN detection and reconnaissance activities from detect-to-warn and contamination avoidance (as described in current doctrine, e.g. JP 3-11, FM 3-11.3, FM 3-11.86, etc.) to awareness of the CBRN hazard environment, which is achieved from comprehensive battlespace awareness capabilities in
addition to CBRN sensors, and assessing the impact of the CBRN hazard environment to contribute to the JFC’s overall situational understanding.

Chapter 2. Operational Context

2.1. The Future Operational Environment

a. Over the next 20 years, warfare, in all its forms, will continue to occur in the global operating environment. The adversary's regular forces, irregulars, our own coalition partners, criminals, refugees, nongovernmental organizations (NGO) and others intermingle in this environment and interact in many ways. Each of these actors has an agenda and they often will not be in consonance with our objectives nor with one another's goals. Besides the broad range of conventional weapons readily available on the global arms market, threats and other forces can select from an array of affordable, but sophisticated technologies and adapt them to create unexpected and lethal weapons. Social media will enable even small groups to mobilize people and resources in ways that can confine or disrupt operations.

b. Most threat actors will not be able to match U.S. conventional capability and will adopt unconventional methods for their use. Among these unconventional methods will be the use of WMD. Adversaries train on techniques to counter our superior sensing capabilities and will attempt to hide their acquisition or production of WMD. The dual-use nature and physical properties of WMD materials often restrain our ability to discern an adversary’s intent or conduct effective standoff detection and surveillance. This will seriously challenge the ability of the U.S. and our allies to locate WMD, their precursors, related materials, and expertise. Failed states or states in transition that cannot guarantee the security of their WMD and related material will pose additional challenges in the future as these weapons could fall into the hands of terrorist organizations or hostile factions within the state.

c. Continued urbanization and industrialization, access to information, and growing international discontent contribute to the increasing likelihood that WMD will be used against the U.S. and its allies in the future. WMD proliferation will transform non-state actors and traditionally low-threat countries into high-threat actors over a relatively short timeframe. Although regional competitors will continue to acquire WMD primarily for deterrence, the most likely threat will come from non-State actors seeking to paralyze U.S. leadership by using WMD weapons against high value targets to cause catastrophic or mass-casualty effects. These groups will attack U.S. military, economic, and cultural power bases in an attempt to weaken the U.S. and to cause Americans to lose the will to fight an enemy who remains in the shadows. The threat of peer/near-peer states use of WMD in order to decisively engage critical landpower assets will continue. These actors will attack US military targets in order to disrupt critical functions and defeat unified action.

d. Ungoverned Areas. Individuals and groups who use violence in ways that threaten the United States, its allies, or its partners habitually find or create ways to operate with impunity or without detection. Whether for private financial gain (e.g., by narcotics and arms traffickers) or for harmful political aims (e.g., by insurgents, terrorists, and other violent extremists), these illicit operations are most successful — and most dangerous — when their perpetrators have a place or situation that can provide refuge from efforts to combat or counter them. Such places
and situations are often called safe havens, and potential safe havens are sometimes located in ungoverned areas. A key component of counterinsurgency, counterterrorism, counternarcotic, stabilization, peacekeeping, and other such efforts is to reduce the size and effectiveness of the safe havens that protect illicit actors. Agencies in defense and other areas all have capabilities that can be applied to countering such threats and building the capacity and legitimacy of U.S. partners to prevent ungoverned, under-governed, contested, and exploitable areas from becoming safe havens. On September 11, 2001, al-Qaeda launched its devastating attacks from one of the world’s most war-torn and poverty-stricken nations, convincing the United States that it was now threatened less by peer or near-peer competitors and more by failing states. The Pentagon soon launched an Ungoverned Areas Project and directed its Combatant Commands to build the capacity of fragile states to control their borders and territories. Al Qaeda training camps in Afghanistan were used to conduct chemical, biological, and radiological basic training courses for hundreds of extremists. Abu Khabab al-Masri, a chemist and bomb maker, who was part of Osama bin Ladin’s inner circle, led the training courses at the Durante and Tarnak Farms camps. Ungoverned areas also merit the attention of policy makers if the areas feature CBRN stockpiles, materials, or experts, or if they function as a potential transit route for WMD into the U.S. Homeland.

e. Unconventional Methods to Counter U.S. Operations. The asymmetrical threats currently challenging U.S. national policies are not that of large standing armies. They are individuals and groups of like-minded individuals. This is an enemy that lives and hides among the civilian population. The boundaries between “regular” and “irregular” warfare are blurring. Non-state groups are increasingly gaining access to the kinds of weapons that were once the exclusive preserve of states and even states will increasingly turn to unconventional strategies to blunt American power. Potential threats to the United States or those that are concerned about a threat from the United States will base their military estimates and actions upon their perceptions of the U.S. and its armed forces. Perceptions of the U.S. and its military forces serve as a guide to seek ways to negate its advantages in training, technology, organization, and conventional ability. Adversaries have employed unconventional methods to negate the effectiveness of US military tactics and equipment. An example of this includes the maturing of the improvised explosive device (IED) to counter the effective employment of armored track and wheeled vehicles.

f. The U.S. Homeland remains vulnerable to attack from extremist groups. Despite success in reducing the effectiveness of al-Qaeda and its affiliates, extremists—both foreign and domestic—will use terrorist tactics in attempts to strike the Homeland during the projected timeframe. The expanding collaboration and cooperation between criminal enterprises and entities associated with extremism and terrorism will significantly boost their potential for success. The proliferation of WMD and related technologies will continue during the forecast period, and this proliferation represents the most serious future threat to America. The Joint force must be prepared to operate in WMD environments, including the U.S. Homeland, and continue to improve its ability to locate and defend against such capabilities or respond to their use.

g. The future OE holds an increasing probability of nuclear proliferation. Failure to prevent continued proliferation will erode established nonproliferation regimes. As states demonstrate nuclear weapons capabilities, regional balances of power will shift, and the risk of
nuclear confrontations will grow. Countries without nuclear weapons may decide to seek them and hedge against perceived threats from nuclear armed regional rivals, especially in Asia and the Middle East. Additionally, proliferation from nuclear armed states will reduce the time required for countries to develop nuclear weapons. The Army must be prepared to participate in cooperative efforts to reduce incentives to pursue and possess nuclear weapons; increase the barriers to nuclear proliferation; contain nuclear armed adversary states and maintain regional security; and defeat any nuclear armed state threatening the US, its allies, and its interests.

3-0. The Military Challenge
“\textit{In 2025-2040, how will the tactical commander make proactive decisions to protect forces and critical assets while operating in a WMD Environment?}”

When operating in a WMD environment, the tactical commander is challenged to make proactive decisions to enhance survivability. These decisions must be supported by information, awareness, and understanding. The tactical commander must know the implications of the character, nature, or subtleties of information about WMD threats; neutral, enemy, and friendly activities that may result in operating in a CBRN hazardous environment.

3-1. Central Idea
\textit{To provide a functionally integrated WMD Early Warning framework that allows commanders to make proactive decisions that enable survivability, maintain Freedom of Movement & Maneuver, and Freedom of Action.}

3-2. Temporal components of WMD-EW.
The temporal components of integrated early warning (IEW) are depicted in Figure 1. Generically, this includes the gathering of information to inform situational awareness and the analysis of this information to develop situational understanding. Decision (D) made by the tactical commander, based on awareness and understanding, can occur throughout the IEW timeline with increasing confidence and impact; as depicted in Figure 1.

The specific time components depicted in Figure 1 are key variables (albeit not the sole variables) upon which advanced IEW architectures should be optimized; for example, maximizing information gathering pre-attack (T\textsubscript{pre-attack}) and minimizing the time to full situational understanding (T\textsubscript{maximum understanding}).

Ideally, information is gathered continuously pre-attack through attack recovery. Examples of pre-attack information may include: intelligence assessments on enemy WMD capabilities, surveillance and reconnaissance data from force protection assets, open source
information, medical surveillance data, environmental background sensing, and other CBRN and non-CBRN related data. This pre-attack information may be routinely collected at a steady rate in accordance with operational tempo.

During an attack and immediately post-attack new information may arrive very quickly as near-discrete events in time, increasing the total amount of information in an almost step-like manner, as shown in Figure 1. For example, CBRN sensing assets may indicate the presence of a release. Later in time, there may be medical information from casualties, including exposure signs and symptoms. This information, in combination with the pre-attack information, may be the majority of information available \( T_{\text{majority info}} \) on the timescales relevant to situational understanding and decision(s) needed to reduce attack impacts and maintain mission success.

Over time additional information \( T_{\text{maximum info}} \) may be added that further increases confidence and enhances understanding to the point that any additional information no longer enhances understanding in a way that impacts key decisions. Examples of this may be environmental samples analyzed through consequence management tasks.

Situational understanding will be derived from the interpretation of relevant information. Understanding will require access to information in a timely and reliable manner from both CBRN and non-CBRN assets. Ideally, analytic capabilities, applied to a subset of orthogonal information sources, will speed up the time to initial understanding \( T_{\text{initial understanding}} \) to enable more confident decisions, faster. As more information arrives or more information sources are added to the CB defense architecture, additional analytics may be required to deepen situational understanding. At \( T_{\text{maximum understanding}} \), a final decision related to the event occurring at \( T_0 \) would be made by the tactical commander that is based on the most relevant information and the highest current level of understanding.

In general the components of the IEW architecture should be selected to maximize the orthogonality, relevancy and aggregate confidence of the information set resulting from the architecture, including information collected pre-attack that is sufficiently prepared for use during a WMD attack. As mentioned earlier, the time to reach the point of an information maximum relative to key decisions and to develop this information into a clear situation understanding picture should be reduced as much as possible. Additionally, information should be collected and understanding developed in parallel and in rapid iteration to reduce the time to a
These goals are reflected in the timeline shown in Figure 2A. In this rendering the pre-attack information is substantial and ongoing. Once an attack occurs new information is collected rapidly, combined with pre-attack information, and analyzed in near-parallel fashion to develop situational understanding, culminating in a confident final decision as quickly as possible. Figure 2B depicts the worst case IEW scenario where information collection and understanding development are sequential leading to a much longer time to final decisions, presumably with diminished benefit to those near the attack.

Concepts such as these should be used to develop IEW architectures (variants will likely be needed for key mission types) and the metrics for their evaluation. Important consideration in developing these architectures will certainly include time but also the articulation of the relevance of a given data source to inform decisions to mitigate a CB attack, the availability of that source, its orthogonality to others, the cost of their development and integration, and the relative benefit of a given information source in comparison to other options in the context of an architecture.

4-0. WMD Situational Awareness.

WMD Situational Awareness is possessing data, information, and the resulting knowledge of WMD within time and space. The tactical commander obtains data, information and knowledge from Intelligence, Reconnaissance, and Surveillance (ISR) sources to establish knowledge of WMD threats in the joint operational environment (JOE). Employment of ISR assets provides the tactical commander physical space so that timely and informed decisions can be made.

Success in WMD situational awareness can be contributed to the efforts of the IC. As described in JP 2-0, the IC is all departments or agencies of a government that are concerned with intelligence activity, either in an oversight, managerial, support, or participatory role. By employing the full range of IC capability to assess WMD threats within a specific region or operational area, and having access to the collection and analysis of those threats, provides the tactical commander a focused WMD threat base.

Within ISR, national intelligence resources are able to utilize the time before, during, and after employment of joint forces to analyze and report on national and non-state WMD capabilities.
and intentions. Active intelligence is necessary to maintain a high degree of situational awareness of the nature, disposition, and potential for employment of WMD and related program elements. Knowing where a WMD, critical WMD program elements or WMD related capabilities are located after they have left their fixed storage, production, or research and development facility is critical to joint or coalition operations. The Joint Concept for Preventing the Use and Transfer of WMD provides samples of program networks within the respective area of responsibility (AOR) that include ideas, materials, technologies, facilities, processes, products, events, and support (e.g. financial, transportation, supply, etc.). These include:

**Leadership.** Activities to provide motivation and the physical means to control activities of the WMD program. This includes providing strategic direction, coordinating the activities of other networks, facilitating the flow of information and resources throughout the networks, and providing the motivation to acquire WMD. This function may be state directed or may reflect ideological, financial, business, or other concerns that motivate WMD proliferation.

**Finance.** Activities to secure and transfer the financial resources to fund all aspects of a WMD program. These activities can include brokers, intermediaries, financial institutions, banking systems, and charities.

**Scientific and Technical Expertise.** Activities to provide the knowledge and expertise necessary to produce WMD and related infrastructure (e.g., designing, producing, machining, testing, storing). This function harnesses information and expertise from scientists, researchers, engineers, and technicians necessary to support capability development.

**Communications.** Activities to provide the necessary information throughout the network. These activities link automated systems to delivery capabilities; establish rapid and reliable channels between WMD resources, expertise, and leadership; and bring required components together for coordination. Because of the importance of these programs, great effort will be taken to protect communication channels.

**Logistics.** Activities to acquire, produce, and transport the raw material, people, production materiel, and finished products. This function acquires missing components or technology; trains and recruits needed expertise, as required; and may support the theft of WMD technology, components, or functional weapons. This facet includes a significant portion of the network, such as front companies (clandestine or legitimate), shipping companies, producers, import/export companies, and other means of conveyance.

**Weapon Delivery.** Activities to deliver the WMD to the target and direct its firing. These activities can be both conventional and unconventional.

**Security.** Activities to protect the identity of the leadership or the operations being conducted (e.g., finance, production of WMD, acquisition, and logistics). This action allows the organization the ability to operate undetected while preparing for future operations.
WMD understanding involves the process of determining the implications of the adversary’s WMD on the Joint force commander’s operational situation. Gaining awareness of an adversary’s WMD and WMD program elements and having insight into the Joint forces ability to accomplish CWMD-related tasks in the projected operational environment(s) are critical to the Joint force commander’s understanding of the tactical impacts on operations. This combination of awareness and understanding will facilitate effective decision making.

4-1. CBRN Situational Understanding.
CBRN Situational Understanding is the result of applying the assessment and analysis of WMD situational awareness to recognize the change and magnitude of effect concerning or regarding CBRN hazards.

The product of CBRN situational understanding actions is shared situational understanding about the impacts to the joint force and the state of the joint operating environment. This comprehension is achieved when the SMEs combine, interpret, store and retain actionable information and intelligence that is integrated to determine the relationship between the various pieces of the WMD threat, CBRN hazards and operational information (friendly, enemy, and neutral activities/status) and their relevance to the desired end state once the CBRN event or incident has been resolved. Situational understanding is an extension of the basic understanding of the CBRN situation on current operations. It is achieved by CWMD and Intelligence SMEs as they interpret enemy CBRN events and actions, determine the enemy objectives for employing WMD, predict possible future CBRN incidents and project their outcomes on friendly force operations. This enables commanders to understand the impact of projected future CBRN events throughout their operating environment and understand expected impacts on the end state of operations. Ideal CBRN hazard situational understanding will be available to both the individuals and organizations throughout the joint force.

The tactical commander uses a CWMD Board, Bureau, Center, Cell, Working Group (B2C2WG) to manage collection, and the process of assessing, analyzing, fusing, and synthesizing all information used in situational awareness to achieve situational understanding. This is a continuous process that potentially lead to decisions. A B2C2WG, led by the CWMD SME and Intelligence SMEs, are able to perform knowledge fusion, which is the cognitive process of combining information and intelligence knowledge with experience and expertise required to understand the CBRN hazard situation.

Activities required during this time include both an assessment and analysis of the evolving joint operational environment of the specific impacts that CBRN hazards will have upon the joint force.

JIPOE is the joint process through which the joint force intelligence directorate manages the analysis and development of products that help the commander and staff understand the complex and interconnected operational environment. It is through JIPOE that anticipated future adversary WMD actions will be assessed. Collaboration is required between intelligence, operations, and CWMD subject matter experts.
Independent of the ICs efforts, the commander will interact with his CBRN subject matter experts; his staff; higher, subordinate, and supporting commanders and staffs; and other key resources to determine specific effects of CBRN hazards on joint force operations, impacts on civilian populations, and upon the supporting and extended operating area infrastructures.

Through decisions support tools, the JFC uses the information provided from WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities that the joint force now shares, coupled with a fuller understanding of the impacts that CBRN hazards impose on joint force planning, preparation, execution, and assessment of joint operations to make sound decisions designed to solve problems throughout the joint operating environment. This results in several actions:

- It provides the operational context for visualizing broad solutions to CBRN hazard impacts.
- Planners consider both direct and indirect methods to address problems affecting the joint force as a result of CBRN hazards.
- As an approach to solving the problems emerges, the commander and staff devise indicators of progress that they will incorporate into plans or orders to use for assessment during execution.
- Certain assessment indicators act as triggers during the operation to help the commander determine the necessity to reframe CBRN hazard-imposed problems or to revise original solutions.

5-0. Supporting Ideas.
Supporting ideas are the ways by which the joint force accomplishes the central idea: individual and collective comprehension of the implications of the character, nature, or subtleties of information about WMD Situational Awareness (Proliferation Prevention/Counterproliferation) and Situational Understanding of CBRN Hazard Activities throughout the JOE to aid decision making.

5-1. The Cyclic Nature of Situational Awareness and Situational Understanding. WMD situational awareness and understanding CBRN hazards processes are both ongoing throughout the operational continuum. There is usually ‘some’ awareness that is coupled with ‘some’ understanding. As the situation progresses, the joint force applies increased awareness to gain better understanding of the implications on joint operations. In turn this better understanding assists in determining the requirement for even greater awareness. Each feeds the other to create improved situational understanding of the implications the threat or CBRN hazard(s) may have on the JFC’s operations (see Figure 1).
The JFC usually begins in a predeployment phase and with some rudimentary awareness and understanding of the possible WMD threats and enemy, neutral and friendly actions that may result in CBRN incidents. The assessment is gained through the collaboration of the staff which is trained to recognize and share key information that aid and assist in establishing the vulnerability analysis. That knowledge is used to make decisions on how to organize, train and equip the force to best support mission accomplishment.

Once deployed, the JFC updates the initial assessment based on any new data received. Sources of new WMD threat data may include, but is not limited to, intelligence assets, recent events (such as accidental releases), and reports from host nation or coalition forces. The JFC immediately seeks to improve awareness and either initiates or falls in on the establishment of a WMD/CBRN sensor network that integrates with non CBRN sensor networks to improve the confidence in the reliability of the data. Similarly, the JFC improves understanding by modifying or expanding knowledge related to WMD threats and potential enemy, neutral and friendly actions that may result in CBRN hazards. This information is catalogued for shared analysis and additional assets are employed to increase awareness, as needed.
The sensor network provides near real-time awareness of a WMD threat and understanding of a CBRN hazard. In the event of a CBRN incident a network identifies the location of the CBRN Hazard and the agent involved. This awareness allows for the rapid warning and alerting of affected personnel who employ CBRN protective equipment and mitigation capabilities to negate the effects of the event and sustain operations. The JFC processes this awareness of the event to gain an understanding of its implications of his operations.

5-2. Networking and Synchronization of WMD Situational Awareness (Proliferation Prevention/Counterproliferation) and Situational Understanding of CBRN Hazard Activities (CBRN Defense/CBRN Consequence Management).

The global threat of WMD is always present, but a CBRN incident marks a specific point in time. Networking and synchronization of both WMD Situational Awareness and Situational Understanding of CBRN Hazard activities ensures that decisions can be achieved quickly and effectively. By providing the joint force and mission partners with the technical connectivity and organizational interoperability necessary to rapidly and dynamically share data, information, and knowledge among decision makers and others, synchronization will facilitate the coherent achievement of WMD Situational Awareness and Situational Understanding of CBRN Hazard activities. Effective synchronization has the potential to revolutionize WMD Early Warning by optimizing and even transforming how information and knowledge are generated, presented, and used throughout the joint force and by mission partners. Most importantly, the need for synchronization must be realized and the ideas and management/organizational changes required must be enacted. Even though a CBRN incident marks a specific point in time, all actions associated with WMD Situational Awareness and Situational Understanding of CBRN Hazard activities before, during, and after the incident, particularly the decision making requirements of the commander, may be occurring simultaneously or seemingly out of rational time sequence.

5-3. Collaboration for Situational Awareness and Situational Understanding.

Interpersonal communication for official purposes is called collaboration. It is defined as “joint problem-solving for the purpose of achieving shared understanding, making a decision, or creating a product across the joint force and mission partners.” It can be either formal or informal. Collaboration both shares and constructs knowledge, including actionable knowledge, by tapping into and combining various information sources and human perspectives.

One of the most visible collaborative methods is provided in the context of a staff. Within the staff, there will be staff elements who must interact for a common purpose and/or interests (such as WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities), typically because of interdependent tasks and responsibilities. Tools can enable a group of CBRN SMEs and others—such as Joint/Multinational Force personnel, academics, interagency officials, representatives from nongovernmental organizations (NGOs) and industry—to establish a virtual collaborative environment wherein, having a common purpose, they can leverage the right experience, expertise, and information to advise decision-makers and receive the decisions made. The staff can use tools of this kind as a means to develop, advise, discuss, disseminate, and share WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities knowledge.

Although not unique to WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities, commanders must realize decision making in a knowledge sharing
environment will be heavily influenced by dynamic, self-defining patterns of collaboration. However, for exclusively military missions, collaboration is not—and must not be construed as—a form of decision making that lacks individual accountability. Collaboration can inform a decision-maker but it does not make the decision. Leaders retain their decision-making responsibility based primarily on the staff planning mechanism.

WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities is the ability to exploit intelligence about WMD threat dispositions and intentions and to determine the characteristics and parameters of CBRN hazards throughout the joint operating environment that bear on decision making and CBRN defense activities. There are three components of WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities, all of which require collaboration to effectively address CBRN hazards:

• Understanding/Awareness of the Enemy Force Capabilities (i.e. Threat Identification)
• Understanding/Awareness of the Geo-spatial Environment
• Understanding of the CBRN Hazard

5-4. WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities Decision Support Tools.

The massive volume of complex data and information will be unmanageable without the availability of technical tools. Purely collaborative tools will help bring required WMD Situational Awareness and Situational Understanding of CBRN Hazard participants together. WMD threats and CBRN hazard-centric collaborative tools will facilitate WMD data, CBRN-hazard data fusion, process synchronization, and WMD threat and CBRN hazard information/knowledge management, cataloging, prediction, profiling, forensics, archiving, and effect modeling.

A variety of generic decision support/knowledge management technologies exist to facilitate collaboration, including videoconferencing, shared whiteboards, audio-conferencing (similar to telephone conference calls), chat rooms, shared documents, and e-mail. Collaboration can occur simultaneously or at different times. No single collaborative tool is ideal for every situation. Other, more CBRN-hazard-centric tools, perhaps including some with enabling technology, not yet mature, might offer value for WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities use:

• Tools that can facilitate WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities data fusion. Various knowledge, skill and even experience sets may need to be brought together for specific purposes.

• Tools that can facilitate information organization and synchronization during collaboration. This type of synchronization has time, location, action, and resource implications.

• Tools that can facilitate management of enormous amounts of WMD Situational Awareness and Situational Understanding of CBRN Hazard effect data. Each sensor on the battlefield can potentially contribute a critical data element that will enhance understanding of a WMD threat or
a CBRN hazard. Too much data could be counterproductive. A filtering mechanism for data fusion will be required.

- Tools that can help with WMD threat and CBRN hazard prediction and effect modeling among widely separated participants.

- Tools that allow continuous and synchronized analysis of pre and post incident potential impacts on friendly courses of action.

- Tools that facilitate archiving for rapid retrieval of historical data elements.

6.0. Application of the WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities Central Idea

The following three examples demonstrate how new or improved WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities can be achieved through the application of the capabilities, tasks, and ideas in this concept. These examples are not exhaustive, showing only some of the many potential benefits that WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities will provide to the future joint force. These examples can be easily extended to similar scenarios. For instance, an industrial chemical/pharmaceutical complex accident within a mega-city could be easily applied to destruction of an adversary WMD munitions site by blue forces.

Each example contains italicized references to the specific supporting ideas, capabilities, tasks, or enablers used within, showing how they help to fulfill the example. Additional development, modeling and simulation, experimentation, etc., can be employed to further develop these ideas, capabilities, tasks, and enablers. The three examples are:

- Joint staff coordination of WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities.

- Integration of CBRN reconnaissance and surveillance resources, ISR resources, and non-CBRN sensor resources.

- An industrial chemical/pharmaceutical complex accident within a mega-city.

6-1. Joint Staff Coordination of WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities

When a Joint Task Force (JTF) is established, integration of staff functions (relying heavily on the JIPOE process) will be needed quickly to exploit intelligence about WMD threat capabilities, dispositions, and intentions; to discover what neutral, enemy, and friendly activities may be sources of potential CBRN hazards; and to determine the characteristics and parameters of CBRN hazards throughout the joint operating environment that bear on decision making and CBRN defense activities. At the same time, in a continuous effort, WMD and CBRN environment situational awareness and understanding will be developed to ensure that the JFC’s operational requirements are pursued with superior decision making. Awareness and
understanding activities will be continuous and require constant updating and coordination. The JFC realizes the anticipated complexity of the WMD threat will require changes in his plan for achieving CBRN hazard situational understanding and that the sheer magnitude of requirements to direct resources to achieve Early Warning will overwhelm traditional staff resources. Therefore, a CWMD deployable team with both WMD situational awareness and CBRN situational understanding expertise/experience is on the scene quickly to help integrate with joint staff functions.

The joint deployable CWMD team helps the staff to begin to develop WMD Situational Awareness and Situational Understanding of CBRN Hazard Activities based on the prioritized WMD EARLY WARNING requirements received from the JFC. The next task is to coordinate net-centric operations to ensure that knowledge management (KM) capabilities are available to facilitate the process of discovering, selecting, and distilling WMD/CBRN environment information.

Each staff member must, for KM purposes, define the knowledge structure to include objectives, constraints, courses of action, uncertainties, and cultural influences. Every staff member involved in WMD Early Warning-related activities will use collaborative tools to transform/process data into information with cogent, actionable context. This will enable the decision maker to understand and decide.

6-2. Integration of Intelligence, Reconnaissance and Surveillance Resources, and Non-CBRN Sensor Resources.

In order to maximize the capability to collect WMD threat and CBRN hazard environment data, it will be vital to ensure that all collection resources are integrated for efficient and effective employment and data management. This begins with obtaining the intelligence and WMD threat and CBRN hazard information required for planning—specifically for collection activities. Intelligence information will be required to determine adversary WMD capabilities, dispositions, and intentions; once WMD is employed, all available sensors will be used to determine the characteristics and locations of CBRN hazards.

The staff will gather, review, and examine all information necessary to create an integrated Reconnaissance and Surveillance plan. They will use this information to develop an integrated asset collection plan to determine the best approach for collecting data/information, and for characterizing and locating CBRN hazards. Synchronization of both pre-CBRN incident and post-CBRN incident activities is extremely important to ensure that all collection resources are integrated to maximize efficiency.

To determine if the coordination between the operations, intelligence, and CWMD communities are effective and efficient (both pre-incident and post-incident) it will be necessary to assess ISR/CWMD synchronization and to assess information shortfalls.

The collection capabilities available to the joint force and supporting agencies and commands will produce enormous amounts of data. Fusion tools will greatly assist in handling this data by
combining or blending data from multiple sources (sensors, logistics, etc.) into information that is essential to generating knowledge about the different aspects of the hazard. Data archiving tools will be essential to the rapid retrieval of historical data elements. Collaboration tools that can facilitate knowledge management and fusion will be essential to translate WMD threat and CBRN hazard awareness into understanding that can be used to support timely decision making. Each sensor on the battlefield can potentially contribute a critical data element that will enhance understanding of a WMD threat or a CBRN incident/hazard. But it is important to utilize every available means to effectively manage WMD Situational Awareness and Situational Understanding of CBRN Hazard to gather this data. The quality of the collaboration between the JFC’s staff and the Service component’s ISR (or IAA) and WMD threat or CBRN hazard data collection capabilities will be of paramount importance to the success of data gathering.

ISR visualization will be used in this management process to graphically display (i.e. on the COP) the current and future locations of intelligence, surveillance, and reconnaissance sensors along with CBRN reconnaissance and surveillance capabilities, their projected platform tracks, vulnerability to threat capabilities and meteorological and oceanographic phenomena, tasked collection targets, and products to provide a basis for dynamic re-direction and time-sensitive decision making. This ability to redirect activities will allow the shift of planned or ongoing collection activities in response to changed or improved situational awareness or directive. The JFC may also modify his commander’s critical information requirements (CCIR) causing collection managers to reprioritize requirements.

6-3. An Industrial Chemical/Pharmaceutical Complex Accident within a Mega-City/Dense Urban Area.

The staff has been effective ensuring the integration of CBRN Reconnaissance and Surveillance, ISR (or IAA), and non-CBRN sensor resources and data. The staff has collaborated using the JIPOE process to ensure that the potential for accidental release of TIM hazards within the operational area (a major JIPOE analytic concern) is fully integrated into WMD Early Warning planning and resource management.

As a result, collaborative tools ensure that when a friendly aircraft accident is reported in the vicinity of an industrial chemical/pharmaceutical complex within the largest city under the JFC’s control, the coordinates for the accident provide the tip that cues an alert for the potential of a toxic industrial material CBRN incident at that location. Two large transport aircraft, loaded with jet fuel, collided and devastated the Harkdoll Chemical and Pharmaceutical Complex in the capital city of Daveston, Kendenian. The Harkdoll complex was earmarked for operations designed to render it safe, but with combat operations only recently completed, those safety operations had not yet begun. Now, it was believed that toxic hazards were being released that would impact both the safety of the joint force along with the 7 million inhabitants of Harkdoll.

The staff had included this large complex as part of its initial planning function of obtaining the intelligence and WMD threat and CBRN hazard information required for planning WMD Early Warning activities, including information available from the media, off the internet and through document exploitation. As a result, WMD Early Warning information requirements were identified, prioritized, and deconflicted. These requirements for information were also integrated
as part of the JFC’s priority intelligence requirements (PIR). When the information begins to come in, products are assessed for completeness of information and resubmitted if required.

In accordance with the JFC’s communication of intent and guidance, all potential TIM hazards with the potential to impact the huge population of Harkdoll had received special assessment during the effort to prioritize WMD Early Warning requirements and the Harkdoll complex figured prominently during the development of a WMD Early Warning strategy.

Now, the staff works to manage the WMD Early Warning activities that are part of the strategy. The first things that are done are to redirect activities and reprioritize requirements. This action ensures that the joint force will have the capability to collect WMD threat and CBRN hazard environment data that will help ensure that WMD threats are identified and CBRN hazards can be detected in near-real time. It is anticipated that both friendly forces and civilians under the JFC’s control are likely to be in the unavoidable hazard area—so time is of the essence. All sensors in the potential hazard area are monitored and specialized tools are used to collect and screen data (including data from non-CBRN sensors) that may indicate the presence of hazards or provide tips that would cue the need for more specialized investigation. Previously designated specialized/conventional/general purpose forces are instructed to conduct CBRN reconnaissance, in accordance with the WMD Early Warning strategy. They employ both unmanned robotic platforms and manned reconnaissance assets.

Medical forces, to include environmental health specialists, are already participants in the collaboration process and are on the alert to medically diagnose CBRN hazard exposure associated with the lists of potential hazards previously developed for the Harkdoll complex. They also ensure that all medical facilities and personnel are familiar with the lists during routine conduct of medical surveillance. Medical forces also ensure that actual CBRN exposure incident rosters are developed for the purposes of post-event medical care follow-up and active health surveillance of potentially exposed personnel.

As the initial data set begins to flow in, the staff uses its capability to analyze collected CBRN hazard data. They begin to characterize CBRN hazards in order to provide identification of the CBRN hazards involved. This requires that the unique characteristics of specific agents be determined from other compounds or organisms and provides information to base specific measures to minimize casualties. The staff also uses its ability to predict CBRN hazard states, using predictive models, analysis and tools to predict the future character of CBRN hazards and also to predict the future location of CBRN hazards as winds blow them across and through Harkdoll.

As more data begin to flow in from the affected areas, analysts exploit CBRN hazard data for integration into hazard awareness or operational activities. This includes exploitation of any data from non-CBRN sources (e.g., radars, listening devices, etc.) that can provide pertinent CBRN hazard information. Methodologies are employed to select appropriate and relevant hazard data/information for integration into hazard awareness or operational activities.

As the joint force becomes aware of all aspects of the hazards that may affect them or the civilians under their control (such as hazard types, locations, and generic hazard effects) the staff uses its capability to develop situational awareness to analyze information, methodically
examining CBRN hazard information and status of the joint force and the city’s civilian population. The information is decomposed into its constituent parts and the effects of the hazards upon both the joint force and civilians, within the context of the mega-city, are developed. The staff now must determine the implications of these relationships. The consequences of potential JFC decisions will be determined by applying CBRN hazard effect implications. Time constraints to civilian rescue or evacuation efforts required by CBRN hazard implications will be derived. The staff will share this situational awareness with the appropriate audience, by communicating synthesized information, ensuring that only authoritative information/sources are provided to users. In this way, confidence in the authority of the information received is maintained. Information is provided only as required or made necessary by risk in order to avoid information overload.

Finally, and on a constantly recurring basis, the staff will assess changes in the situation and update the commander. The JFC must conduct operations in this hazardous environment subject to continuous assessment of results. The observed results are assessed in relation to the expectations that were developed when the staff initially took action to establish metrics that would cover such a situation. Both the understanding of the situation and subsequent operations must be modified in accordance with the changes that occur.

7-0. Key Concept Enablers
Enablers are crosscutting capabilities that are introduced, developed, and controlled by other strategies and concepts. These enablers facilitate execution of the Concept for WMD Early Warning as it is envisioned. Enablers that are elements of other disciplines and concepts are sometimes so closely related to WMD Early Warning concept elements that overlap or fusion issues will arise and will ultimately need to be explored and resolved. These enablers support and enhance the effectiveness and integration of WMD Early Warning. Throughout the exploration of this concept, commanders, staffs, and the science and technology/materiel development communities must continually test and assess the effectiveness of enabling capabilities and identify required improvements to the responsible communities.

7-1. ISR Capability
Intelligence, surveillance, and reconnaissance (ISR) is an activity that synchronizes and integrates the planning and operation of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations. This is an integrated intelligence and operations function. ISR requirements must be specified and ISR missions executed in order to satisfy user-specific operational or technical WMD threat information needs. These needs are the key issues the commander and staff need to understand about the adversary’s ability or intent to use WMD and how the JFC should can prevent/mitigate CBRN hazards. Measurement and signature intelligence (MASINT) is key both pre/post CBRN incident.

7-2. ISR Visualization
ISR visualization is the capability to graphically display the current and future locations of intelligence, surveillance, and reconnaissance sensors, their projected platform tracks, vulnerability to threat capabilities and meteorological and oceanographic phenomena, fields of regard, tasked collection targets, and products to provide a basis for dynamic re-tasking and time-sensitive decision making. This is a key enabler of the “collection” capability.
7-3. Joint Intelligence Preparation of the Operational Environment
JIPOE describes the process in which the adversary and other relevant aspects of the operational environment are analyzed to identify possible adversary courses of action related to producing CBRN hazards and to support integrating WMD threat considerations into joint operation planning, execution, and assessment. JIPOE analysts help mitigate the WMD threat by assessing the adversary’s potential proliferation or employment of WMD, characterizing the consequences of a WMD-related activity, and supporting the joint force’s WMD defense effort. The potential for accidental or deliberate release of CBRN hazards within the operational area is also a major JIPOE analytic concern. Current JIPOE doctrine, however, has little to no guidance on how to proceed in these various areas.

7-4. Geospatial Intelligence Support to Joint Operations
Geospatial intelligence (GEOINT) supports joint forces in their ability to rapidly respond to threats around the world by providing geo-referenced visual and data products that serve as a foundation and common frame of reference for any joint operation. GEOINT is the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on Earth. GEOINT consists of imagery, imagery intelligence (IMINT), and geospatial information. This information is important to assessing the effects of possible CBRN hazards.

7-5. Net-Centric (Cyberspace) Operations
In order for the future joint force to achieve decisive levels of shared knowledge and technical connectivity when seeking WMD Early Warning, Net-Centric Operations must provide the joint force with pervasive knowledge through the full integration of knowledge management (KM), network management (NM), and information assurance (IA).

• **Knowledge management** is the process of discovering, selecting, organizing, distilling, sharing, developing and using information in a social-domain context to improve warfighter effectiveness.

• **Network management** focuses on the people, technology, processes, policy and capabilities necessary to effectively operate the systems and networks, including their configuration, availability, performance, manageability, and enterprise connectivity.

• **Information assurance** will provide the joint force and mission partners with assured mission management, assured information sharing, confidentiality, and integrity/non-repudiation capabilities.
Appendix A. Capabilities

1. Command & Control: Pervasive knowledge management to create shared understanding. Future forces require the ability to skillfully employ knowledge management to accelerate learning, facilitate collaboration, create shared understanding, and enable decision making during joint combined arms operations.

2. Command & Control: A single information network that enables a regionally-engaged and globally-responsive force. Future forces require a single and secure network of command posts; air, ground, and waterborne platforms; dismounted leaders and Soldiers/Sailors/ Marines/Airmen; and sensors linked by a tailorable suite of mission command applications, information services, and communications infrastructure to enable expeditionary movement and maneuver, dispersion, decentralization, interoperability, collaboration, and uninterrupted mission command during joint combined arms operations.

The display and sharing of relevant information; Multi-form collaboration; Interoperability with unified action partners. Future forces will require the capability to display and share relevant information on a common operational picture from the lowest to the highest echelon of command to enable battlefield visualization, shared understanding, coordination, and synchronized action. Future forces require the capability to ensure effective communication, collaboration, and exchange of relevant intelligence and information to enable shared understanding and unity of effort.

3. Intelligence: Create cross domain synergy through complementary collection layers (space, aerial, and terrestrial) of intelligence partner collectors.

4. Intelligence: Collect both environmental and threat signatures of all operational environments.

5. Intelligence: Integrate information collection across the intelligence enterprise.

Future intelligence force requires the capability to conduct ISR synchronization to support the Commander’s issuing of mission commands and specifically to answer the Commander’s Priority Intelligence Requirements (PIRs) and Commander’s Critical Information Requirements (CCIRs). The intelligence enterprise must be capable of managing and employing information and intelligence collection capabilities including technical and non-technical, persistent and non-persistent, manned and unmanned collection methods across the terrestrial, aerial, and space layers with sufficient capacity and flexibility to adapt to situational awareness/situational understanding (SA/SU) information requirements. The intelligence enterprise must process, exploit, and disseminate (PED) collected data, information, and intelligence collected in the terrestrial, aerial, and space layers to generate intelligence products and combat information for commanders and staffs in any environment and in all phases.

6. Movement & Maneuver: The Future force must be able to fight for information as it conducts reconnaissance and security to enable friendly force freedom of maneuver; to exploit success at the operational and tactical levels; and to deny enemy freedom of maneuver.
7. Movement & Maneuver: Future forces must conduct air and ground integration with manned and unmanned systems while conducting reconnaissance and security in close contact with the enemy and populations to shape the battlefield.

8. Movement & Maneuver: Future forces require the capability to conduct joint reconnaissance and security to generate situational understanding of routes, terrain, climates, populations, and infrastructure to facilitate route and area security.

9. Movement & Maneuver: Future forces require the capability to protect formations against enemy UAS, rockets, mortars, artillery, WMD, manned aircraft, and long range missiles to preserve the force during joint combined arms operations.

10. Movement & Maneuver: Future forces require the capability to employ remote and standoff CBRN detection capabilities to enhance situational understanding during joint combined arms operations.

11. Movement & Maneuver: The future force requires the capability to conduct armed aerial reconnaissance with the man-in-the-loop decider forward and/or exercising control of unmanned aircraft to collect, develop and report near real time actionable combat information during joint and combined arms air-ground operations, to provide early warning, reaction time, and maneuver space in order to provide security for the air-ground team and counter enemy reconnaissance efforts.

The Future force will conduct reconnaissance and security to enable friendly forces freedom of maneuver to exploit success at the operational and tactical levels and to deny enemy forces freedom of maneuver. This includes conducting reconnaissance, security and offensive/defensive operations over wide areas under the special conditions presented by subterranean and CBRN environments.

12. Maneuver Support: Future forces require the capability to conduct CBRN defense activities including a combination of active and passive defensive measures to identify, prevent the employment of, and mitigate CBRN effects to minimize or negate the vulnerabilities of weapons of mass destruction employment during joint combined operations.

13. Maneuver Support: Future Army forces require the capability to conduct the CBRN consequence management activities supporting joint, interorganizational, and multinational partners in foreign and/or domestic environments to mitigate the effects from weapons of mass destruction employment during joint combined arms operations.

14. Fires: Future forces require a COP created and sustained collectively by joint, interorganizational, and multinational sensors to enhance situational understanding of the land, air, maritime, space, cyberspace domains, and the electromagnetic spectrum during joint combined arms operations facilitating air ground integration.
15. **Fires:** Future forces require the capability to integrate joint, interorganizational, and multinational sensors to mutually share information, facilitate targeting and engagements, and provide early warning of enemy forces during joint combined arms operations.

---


\* Army CWMD Whitepaper, 19 June 2014