Countering Weapons of Mass Destruction (CWMD)

A Joint, Accelerator for Innovative Minds (AIM) Project

20-21 February 2019: Industry Day **(RSVP NLT 08 February)**
08-09 May 2019: Capability Assessment Event **(Submit NLT 22 March)**

Overview

SOFWERX, in collaboration with the U.S. Special Operations Command (USSOCOM), Joint Program Executive Office for Chemical Biological Radiological and Nuclear Defense (JPEO CBRND), and Edgewood Chemical Biological Center (ECBC), will host a series of events to identify Countering Weapons of Mass Destruction technologies available now, under development, or anticipated to be developed. These events will provide opportunities for direct dialogue with Industry, Academia, Warfighters, and Government subject matter experts to lower barriers to working with the DoD and accelerate disruptive technologies and processing to the field. The collaborative CWMD DoD group intends to align transition pathways across the full technology spectrum, regardless of maturity. The technologies being sought are focused around specific problem statements designed to satisfy near-term prioritized needs.

SOFWERX

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Overarching Problem Statement: Is the Space/Area Safe?

Seeking novel, innovative concepts and/or solutions to the following focal areas inclusive of hardware and software responses:

(1) Are there concepts/technologies capable of indicating a presence of chemical, biological, radiological, and/or nuclear hazard(s)/material(s) while enabling the operator to maintain a safe distance?
   a. Cross-cutting technology components:
      i. Disparate sensing solutions
      ii. Integrated sensing solutions
      iii. Platform agnostic sensor integration software
      iv. Delivery/recovery platforms
      v. Fully integrated sensing platforms
      vi. Multi-purpose application

(2) Are there concepts/technologies capable of leveraging autonomy, Man-Machine teaming, Machine-Machine teaming, and/or swarming methods to interrogate a potentially hazardous space?
   a. Cross-cutting technology components:
      i. Automated “sense, analyze, respond” solutions
      ii. Autonomous platforms
      iii. Integrated platforms capable of machine-machine cooperative actions
      iv. Machine learning hardware/software solutions
      v. Artificial intelligence

(3) Are their concepts/technologies capable of conducting multi-domain surveillance and predictive data analytics within a secure network?
   a. Cross-cutting technology components:
      i. Data collection solutions
      ii. Data processing solutions
      iii. Data analytics solutions (predictive)
      iv. Ability to distribute information over various network types

(4) Are there low cost, low burden, disposable solutions across the chemical, biological, radiological, and nuclear sensing/detecting spectrum to remotely provide operators early warning indicators of hazardous materials/environments?
   a. Cross-cutting technology components:
      i. Low unit cost
      ii. Minimal logistical support necessary
      iii. Very easy to use/operate
      iv. Environmentally friendly – “Green”
      v. Ability to cross communicate between sensing solutions and a central hub

CWMD Problem Statements

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CWMD Problem Statements

Problem Statement Number: 1

Problem Statement Title: Deployment of Multiple Hazard Reporting Sensors using Small Unmanned Aircraft

Problem Statement: Deployment methods for CBRN-relevant unattended ground sensors are sought. Individual devices in the 1 to 10-pound weight range are not commonly deliverable by small vertical take-off and landing (VTOL) unmanned aircraft, and those that are are often limited to one device per flight due to center-of-gravity changes affecting flight stability.

Operational Use Scenario: Small unmanned aircraft capable of precisely deploying multiple payloads (such as CBRN sensors) would enhance the ability to form information gathering networks across the battlespace by reducing the number of flights required to deploy a fixed number of sensors.

Standards/Desirements: A man-portable, light weight system capable of deploying multiple payloads (1-10 lb range) with a high position accuracy to reduce the time and resources necessary to create a battlespace sensor network to gather information on CBRN threats.

Technology Research Areas of Interest: Unmanned aircraft technologies, with adaptations for payload deployment and precision emplacement. Reduced-size/weight CBRN detection devices able to communicate relevant information back to a common operational picture.

CWMD Problem Statements

Problem Statement Number: 2

Problem Statement Title: Deployable and Disposable UAS or Throwable CBRN Point Microsensor or Distributed Sensor Net

Problem Statement: Low weight, low cost, and low power CBRN point sensor are sought that can be deployed autonomously or by single units on an as needed basis to sample, assess and communicate the threat level of a small spaces.

Operational Use Scenario: This technology will be used to surveil & reconnoiter discrete areas of interest and communicate threat assessment to forces located some distance from the target. The system could be single use and deployable by unmanned airdrop or ground placement. Items should be capable of being used in isolation at a single suspected site or communication linked in a distributed fashion to create a sensor web to map zones of interest prior to entry.

Standards/Desirements: 1. The system should be lightweight, occupy minimal form factor, and be capable of being dropped or thrown into a space. Secondary ability to self locomote towards a region of interest is desired.

2. Detection should be threat agnostic meaning assessment of threat should be towards multiple threats across the CBRN spectrum. Detection technologies that classify threats into families or that employ programmable libraries are desired because they can learn and be updated.

3. The system should be capable of actively collecting samples as required (aerosol collection or other) in order to achieve assessment of the space.

4. The system should be capable of communicating output at a distance..

5. It is desired that systems be capable of being linked in a distributed fashion to merge data to increase confidence levels (achievable at remote database consolidation)

Technology Research Areas of Interest: Air sampling, unmanned ground micro-vehicles, colorimetric, microarrays, FRET sensors

CWMD Problem Statements

Problem Statement Number: 3

Problem Statement Title: Stand-Off Detection and Identification of Airborne Hazardous Biological Materials

Problem Statement: The capability to detect and identify airborne potentially hazardous biological materials from a distance is sought.

Operational Use Scenario: This could be accomplished by:

- A sensor that interrogates the threat cloud from afar;
- Flying a sensor on a small UAV into a threat cloud to perform the detection/identification;
- Flying a sensor on a small UAV into a threat cloud to perform the detection which triggers a sample collection for identification;
- Or by other novel means.

Standards/Desirements: Sample collection for confirmatory identification with a low false alarm rate, GPS location of detection/ID location. If UAV, ability to detect continuously. If UAV, ability to fly to a specific GPS location.

Technology Research Areas of Interest: Remote airborne biological material detection. Remote airborne biological material identification. Remote airborne biological material sampling

CWMD Problem Statements

Problem Statement Number: 4

Problem Statement Title: Autonomy for Recon of CBRN (ARC)

Problem Statement: Many robotic platforms equipped with CBRN sensors are teleoperated. This is time intensive and does not account for how the sensors works (range, density, proximity, etc). Desire to lessen the physical and cognitive load of CBRN Soldiers using robotics to recon areas of interest.

Operational Use Scenario: Soldiers could use autonomous robots, quadcopters, or other devices with onboard sensors to recon an area of interest. Most of the time and effort spent navigating the area would be done autonomously with relayed communications to a central point. Desire to have these platforms execute CBRN search patterns as part of route, area, or zone recon in congested areas.

Standards/Desirements: Autonomous; machine learning capability, Smart autonomy that recognizes threat and sensor performance and recommends the right search pattern (Machine Learning and Artificial Intelligence)

Technology Research Areas of Interest: Autonomy, Machine Learning, Algorithm Development

CWMD Problem Statements

Problem Statement Number: 5

Problem Statement Title: Persistent Chemical, Biological, Radiological (CBR) Surveillance

Problem Statement: The community seeks the ability to conduct persistent CBR surveillance.

Operational Use Scenario: Hazardous area of interest have been identified in a combat zone that are likely locations for CBR attacks. A CBR attack in this area would compromise the friendly forces employed nearby.

Standards/Desirements: The CBR persistent surveillance system must be able to detect and communicate CBR hazards for 1 month, continuously and be able to detect CBR agents at levels below those immediately dangerous to life and health. This data must be able to be communicated on current military C2 systems within 2 minutes of an attack and be distributed throughout a secure network, in order to give a Commander situational awareness of a CBR attack.

Technology Research Areas of Interest: Long-life batteries, Sensor-Communications Integration, Information analysis tools/decision support tools, Low power CBR Sensors

CWMD Problem Statements

Problem Statement Number: 6

Problem Statement Title: Cooperating Robots for Area Reconnaissance

Problem Statement: To leverage cooperating air and ground robots to enter a space and conduct CBR surveillance autonomously.

Operational Use Scenario: Operators need to be able to enter a building, a tunnel or underground location or outdoor space to perform a mission. Prior to entering this area/space; the operators would like to know if it is hazardous to enter and what hazards they might encounter. These hazards could be chemical, biological, or radiation. The operator can take the appropriate precautions if they know what they are encountering.

Standards/Desirements: This effort is focused on specifically using multiple, autonomous (man on the loop) robots to map a space efficiently and detect any chemical, biological or radiological hazards in the space and report the hazard map back to the operator. The robots should operate semi-autonomously by self-organizing, carrying out the mission with minimal decision support from the operator.

Technology Research Areas of Interest: Autonomous robotic control of swarming robotic platforms, mission-directed autonomy, autonomous feedback control loops, small and effective sensors -- all with minimal human inputs and making key decisions.

CWMD Problem Statements

Problem Statement Number: 7

Problem Statement Title: Man-portable hazardous chemical material standoff detection

Problem Statement: An interest exists to conduct stand-off detection of hazardous chemical materials and toxic industrial chemicals (TIC) in permissive and non-permissive environments.

Operational Use Scenario: This technology will be used to conduct permissive vapor detection of hazardous chemical materials and TICs of named areas of interest in order to confirm and detect the presence of threat material and distinguish threat environments. In addition, safeguard the force by identification and avoidance of a threat area.

Standards/Desirements: Detection range as far away as 5 km with a man-portable device.

Technology Research Areas of Interest: Extended range of hazardous chemical materials and TIC detection technologies able to perform stand-off detection; man-portable configuration.

CWMD Problem Statements

Problem Statement Number: 8

Problem Statement Title: Comprehensive Automated Data Collection, Aggregation, and Sharing of CBRN/CWMD Capability Information

Problem Statement: Seeking comprehensive, automated tools or systems to capture, aggregate, tag, share and display the vast quantity of friendly CBRN/CWMD capability-related information which is currently avilable by a multitude of separate databases.

Operational Use Scenario: Leaders and planners at all levels have a need to access CBRN/CWMD capability-related information in order to support planning, training, and response to a broad range of potential CBRN/CWMD events.

Standards/Desirements: Tool or system must be predominantly automated and not rely on constant human input; it must pull and aggregate data from a multitude of existing sources and formats. Tool or system must be able to sort and tag data into a variety of categories and searchable to quickly respond to user information needs. The tool must support high-definition graphics and must include a geo-spatial display. The tool should be scalable/ adaptable to low-bandwidth or combat environments where resources are limited.

Technology Research Areas of Interest: Artificial intelligence.

CWMD Problem Statements

Problem Statement Number: 9

Problem Statement Title: Predictive Analytics to Identify Potential Hazardous Material Threats Through Automated Data Fusion and Template Development

Problem Statement: Predictive analytic capabilities for anomaly detection through an automated sensors, social media and commercial data fusion to map data trends to specific templates to identify a potential threat.

Operational Use Scenario: This technology could be used to surveil and reconnoiter areas of interests to confirm/deny the presence of a hazardous material threat by employing predictive analytics tools that utilize real-time sensor data, social media and commercial transaction data sets to identify data trends that match defined robust adversary templates.

Standards/Desirements: This problem statement encompasses one system that provides solutions to the following two specific interest areas:

1. Automated Data Fusion: In order to identify specific anomalies that may indicate a potential threat, a desire exists for real-time data fusion across sensors, social media, and commercial transactions. Ideally, the system would be autonomous, operating independently, with dedicated personnel monitoring the system.

2. Template Development: A desire exists for the development of robust adversary templates and scenarios to which specific data anomalies could be matched to identify any adversarial intent.

Technology Research Areas of Interest: 1. Automated Data Fusion, Artificial Intelligence. Note: Data fusion is well understood and has been utilized across several industries. However, incorporating commercial and social media data with sensor alerts is of interest. Development of APIs that allow for interoperability of sensors with various data packages would be desired.