Countering Weapons Of Mass Destruction

(CWMD)

Community of Interest (COI) Summary

Chair: Dr. Steven Wax (DTRA)

Co-Chair: Dr. Vahid Majidi (ASD-NCB/NM)

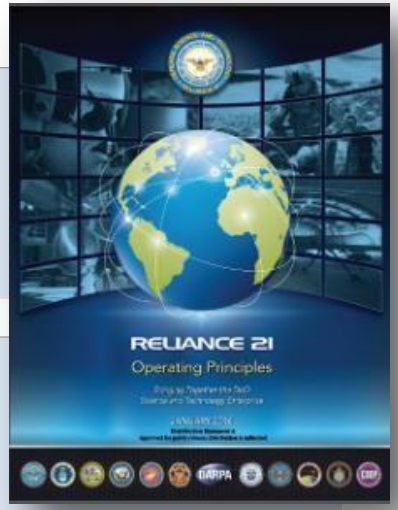
Background on COIs

- **Communities of Interest (COI) were established as part of Reliance 21 to ensure a coordinated DoD S&T (6.1-6.3) programs that:**
  - Maximizes effectiveness of investments through joint planning
  - Provides a conduit for COCOMs' engagements with the S&T community
  - Provides a forum for interagency, industrial and international participations in technological areas of interest.
- **CWMD COI, like all COIs, is responsible for developing an S&T roadmap**
  - Consolidated and coordinated view of the CWMD S&T Programs
  - Capabilities derived from vetted requirements and strategies
  - Roadmap of program juxtaposed against capabilities
  - Identification of gaps and recommendation on the way forward
- **CWMD COI assessed state of health of CWMD enterprise (expertise, infrastructure, etc.)**

Overview of DOD Reliance 21 COIs

Mission focus
Roadmaps describe capabilities enabled by advanced technologies and systems

- Counter-IED
- Counter-WMD
- Biomedical (ASBREM)



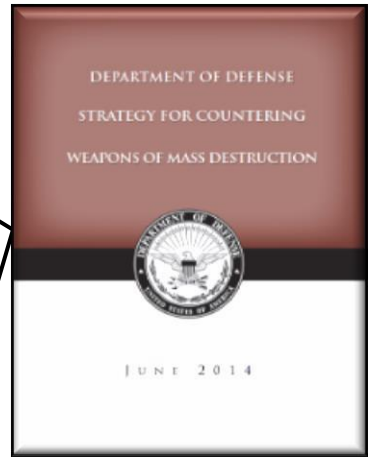
Systems/ Capability focus
Roadmaps describe how multiple technologies are integrated into complex systems to achieve mission impact

- Command, Control, Comms, Computers, and Intelligence (C4I)
- Human Systems
- Cyber
- Autonomy
- Engineered Resilient Systems
- Electronic Warfare / Electronic Protection
- Sensors
- Air Platforms
- Ground & Sea Platforms
- Weapons Technologies
- Space

Technology focus
Roadmaps describe technology goals with multiple applications

- Advanced Electronics
- Energy & Power Technology
- Materials & Manufacturing Processes

Structure of the COI is Based on the DoD Strategy for CWMD



DoD Strategy for Countering WMD – June 2014

Synchronizing Activities and Tasks
Incorporate CWMD Efforts & Leverage Enabling Capabilities
Integrate, Harmonize, Employ

Foundational Activities and Tasks

Maintain and Expand Technical Expertise
Recruit, Develop, Retain

Cooperate with and Support Partners
Partner, Coordinate

Specialized Activities and Tasks

Understand the Environment, Threats, and Vulnerabilities
Locate, Identify, Characterize, Assess, Attribute, Predict

Control
Isolate, Divert, Intercept, Secure, Seize

Defeat	**Disable**	**Dispose**
Delay, Disrupt, Destroy, Neutralize	Exploit Degrade, Destroy	Reduce, Redirect Dismantle, Monitor,

Safeguard the Force and Manage Consequences
Mitigate, Sustain, Support

CWMD S&T Strategic Objectives*

Understand the Environment, Threats, and Vulnerabilities

Control, Defeat, Disable, and/or Dispose of WMD Threats

Safeguard the Force and Manage Consequences

** S&T for Strategic Deterrent is included in these objectives*

CWMD COI Organization

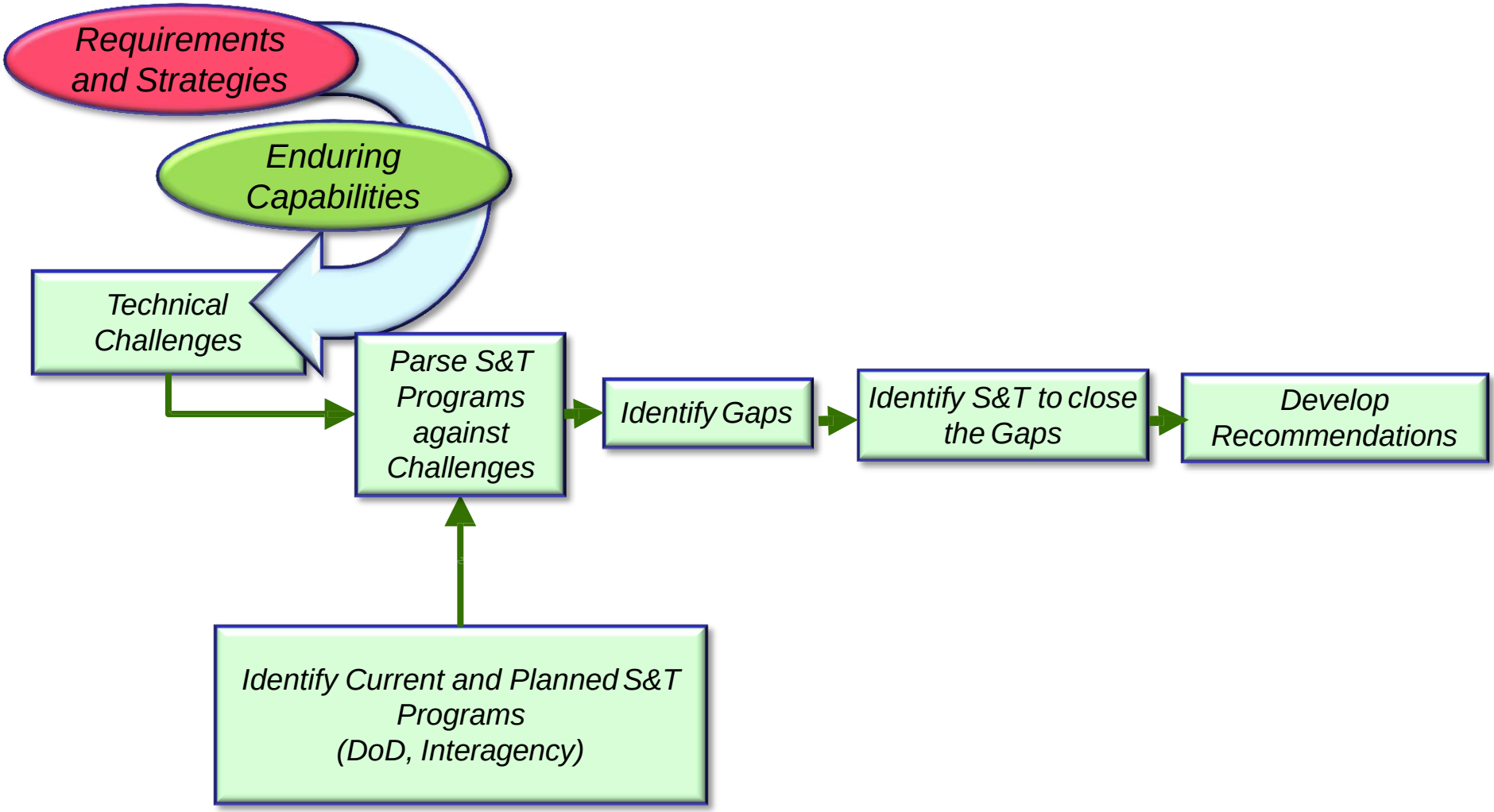
Principal Steering Committee Membership

- DTRA - Chair
- OASD (NCB/NM) - Co-Chair
- Army/ECBC
- USN
- USAF
- DARPA
- DIA
- USSTRATCOM
- USD (I)
- ASD (R&E)
- ASD (R&E-EC&P)
- ASD (NCB/CBD)
- CBDP/JSTO
- DTRA

Understand the Environment, Threats, and Vulnerabilities	Control, Defeat, Disable and/or Dispose WMD Threats	Safeguard the Force and Manage Consequences
DTRA	**DTRA**	**Army/ECBC**
Navy/NRL	Army/ECBC	DTRA
DARPA	Navy/NRL	CBDP/JSTO
USDI	AF/AFRL	Army
(ASD/R&E)	DARPA	Navy
(ASD/NCB)	DIA	USAF
US AF – A10	USDI	CBDP/JPEO
	USSTRATCOM	J8-JRO
	DOE	

- Champion

CWMD COI Road-Mapping Process



Strategies and Requirements

- DoD Strategy for Countering WMD (June 2014)
- Joint Capability Documents
- Joint Staff- Joint Requirement Office of CBRN (JRO CBRN) Priority List
- Integrated Priority List (IPLs)
- Applicable Joint Urgent Operational Needs (JUONs) / joint emergent operational needs (JEONs)
- Theater Security Cooperation Plans
- Defense Planning Guidance
- Other Strategy and Requirements Documents

Strategies and Requirements (Cont.)

- National Strategy for CWMD
- Sustaining US Global Leadership Priorities for 21st Century Defense
- National Security Strategy
- National Intelligence Strategy
- National Strategy for CBRNE Standards: National Science and Technology Council Committee on Homeland and National Security
- National Strategy for Countering Biological Threats
- National Strategy for Bio Surveillance
- National Military Strategy
- Guidance for Employment of the Force
- Quadrennial Defense Review
- The Nuclear Posture Review
- Chemical Biological Defense Program Strategic Plan
- National Strategy for Countering Biological Threats [Presidential Policy Directive 2]
- Homeland Security Presidential Directive 4: National Strategy to Combat Weapons of Mass Destruction
- National Strategy for Biosurveillance
- NIH Strategic Plan and Research Agenda for Medical Countermeasures Against Radiological and Nuclear Threats
- CWMD, Joint Pub 3-40
- Homeland Defense and Support of Civil Authorities Strategy
- Defense Science Board Report on Assessment of Nuclear Monitoring & Verification Technologies, Jan 2014
- Defense Science Board Report on Technology and Innovation Enablers for Superiority in 2030, Oct 2013

CWMD S&T Strategic Goals and Enduring Capabilities

Understand the Environment, Threats & Vulnerabilities

Achieve Comprehensive Situational Awareness in CWMD Domain

Access, integrate, and securely share WMD-related information to support DoD, interagency, and international **operations**, actions, and activities to counter WMD.

Locate, Detect, Characterize and Assess WMD Worldwide

Locate, detect, characterize, and assess chemical, biological, nuclear and radiological threats (or associated signatures) in diverse and sometimes non-permissive environments as well as throughout the WMD pathway.

Provide Technical information to Support Attribution

Accurate, reliable, timely, and defensible information to determine the origin of WMD and enabling materials.

Understand Current and Emerging Threats

Obtain timely insight into legacy and novel technologies, capabilities, intentions, and developmental activities of adversaries to assess WMD threats

Predict Consequences

Forecast US and partner vulnerabilities, the 1st, 2nd, and 3rd order effects of WMD.

Control, Defeat, Disable and/or Dispose WMD Threats

Control WMD

Isolate, intercept, divert, seize & secure WMD and related capabilities

Defeat* WMD

Render nonexistent or interrupt the entire spectrum of WMD development and employment and focus on specific nodes, links and support networks prior to an adversary's acquisition of WMD. Ensure actors of concern are unable to employ WMD and reduce the risk of those capabilities being proliferated, lost or stolen.

Dispose WMD

Partial or full dismantlement of an actor's WMD program and ensure that it cannot be reconstituted Put in form of capability

* Includes Disable

Safeguard the Force and Manage Consequences

Sense CBRN Hazards

Continually provide the information about the CBRN situation at a time and place by detecting, identifying, and quantifying CBRN hazards in air, water, on land, on personnel, equipment or facilities.

Shape Force Commanders' understanding

Characterize the CBRN hazard to the force commander and develop a clear understanding of the current and predicted CBRN situation

Shield Individuals and Equipment

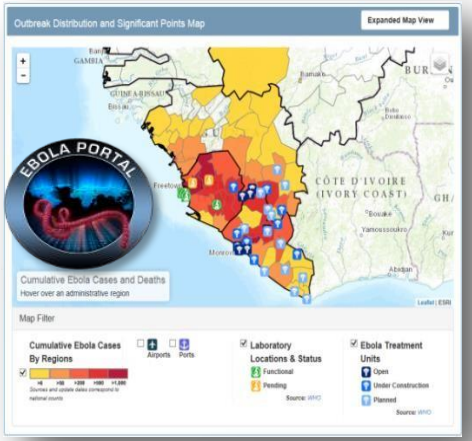
Prevent or reduce individual and collective exposures, applying prophylaxis to prevent or mitigate negative physiological effects, and protecting critical equipment.

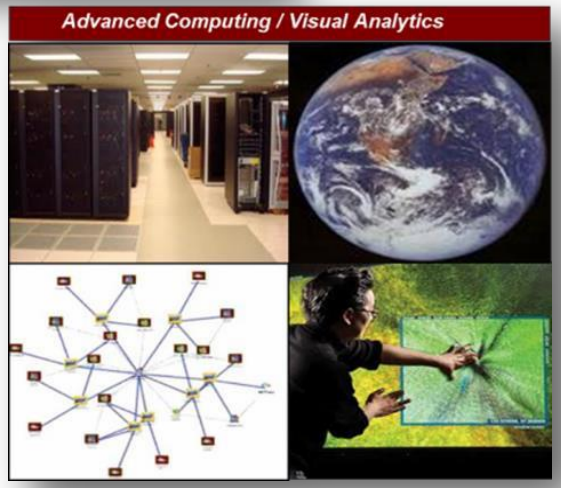
Sustain and Restore Combat Power

Conduct decontamination and medical actions that enable the quick restoration of combat power.

Achieve Comprehensive Situational Awareness in CWMD Domain

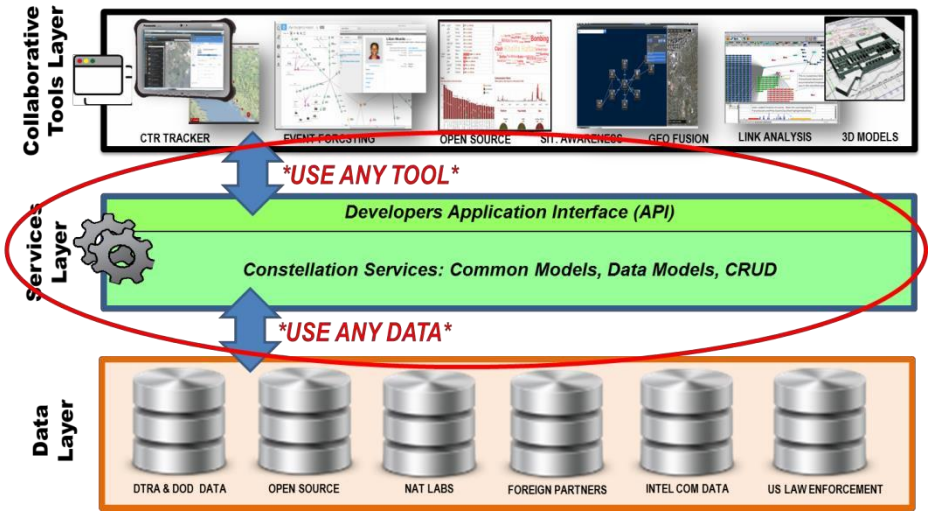
Description: Access, integrate, and securely share WMD-related information to support DoD, interagency, and international operations, actions, and activities to counter WMD.





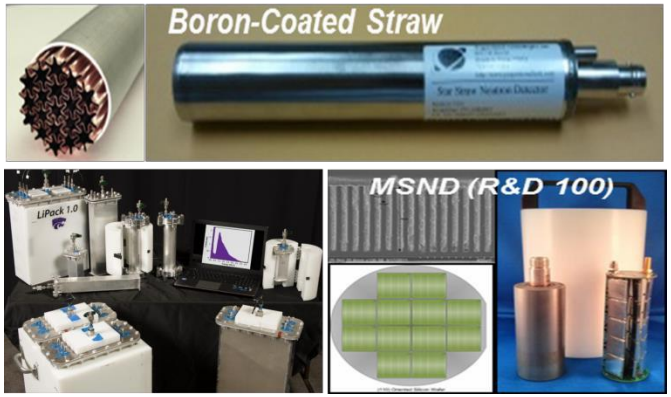
Technical Opportunities

- Access and analysis of large volumes of data and information (including disease surveillance)
- Integrate and represent dynamic and timely view of worldwide WMD and related information
- Exchange information securely across multi-security levels



Provide technical information to support attribution

Description: Locate, detect, characterize, and assess chemical, biological, radiological and nuclear (CBRN) threats, or associated signatures, in diverse and sometimes non-permissive environments as well as throughout the WMD pathway



Alternative approaches to radiation detection
High performance, flexible applications, low cost

Technical Opportunities

- Perform wide area search for CBRN materials and processes
- Detect and characterize acquisition/ development/ use/ deployment of CBRN materials in diverse, operational environments, and throughout the WMD Processing Pathways
- Test to validate capabilities for locating, detecting, characterizing, and assessing CBRN threats (or associated signatures) in diverse and sometimes non-permissive environments as well as throughout the WMD pathway
- CBRN sensors to enable safe and effective local tactical force protection decision making

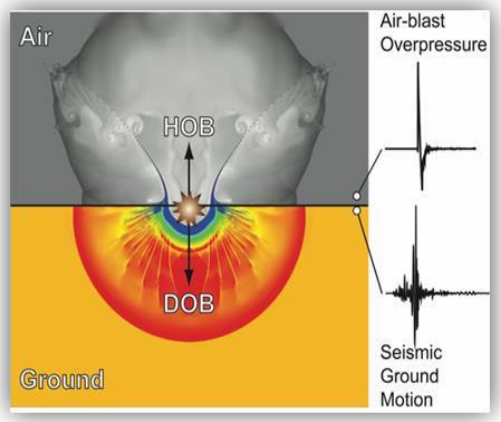
Provide technical information to support attribution

Description: Provide accurate, reliable, timely, and defensible information to determine the origin of WMD and enabling materials

Harvester Particulate Airborne Collection System (PACS). Airborne Debris Collection Following a Nuclear Event

Technical Opportunities

- Rapid sampling and data analysis, in the field if possible, to provide information sufficient for confidently determining source of CBRN materials
- Rapid determination if WMD was on board an intercepted ballistic or cruise missile



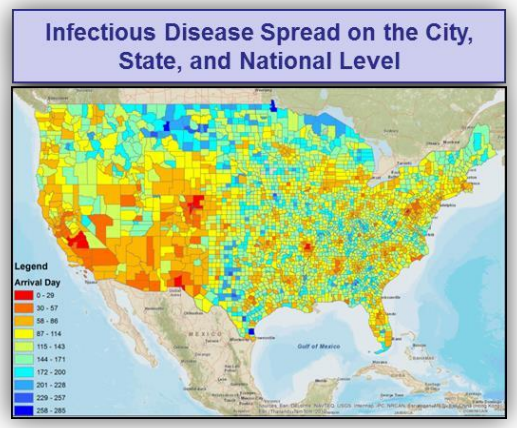
Integrated Yield Determination Tool (IYDT) Software, calculating the Yield of a Nuclear Explosion

Advanced Ground Sample Collection Platform (AGSCP). Collecting Radioactive Debris Following a Nuclear or Radiological Event

DISCREET OCULUS ground-based prompt detection and diagnostics Characterize urban nuclear events

Understand Current and Emerging Threats

Description: Access, integrate and securely share WMD-related information to support DoD, interagency, and international operations, actions, and activities to counter WMD.

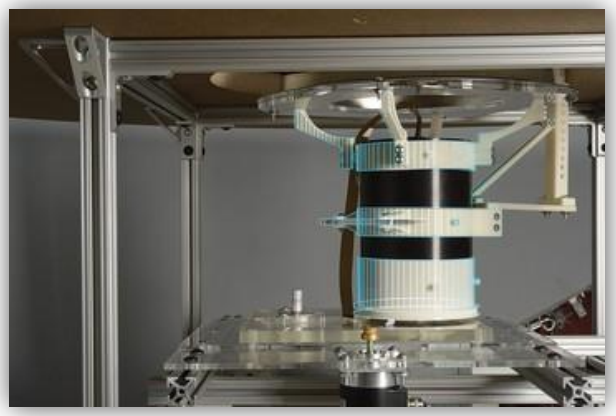


Comprehensive National Incident Management System models the spread of infectious disease by simulating movement, proximity, and interactions between individuals within a geographic region using high-performance computing (HPC).

Technical Opportunities

- Forecasting the impact of current and emerging technology that could significantly impact CWMD missions
- Methods to provide insight on current and future capabilities and intentions of actors of concern

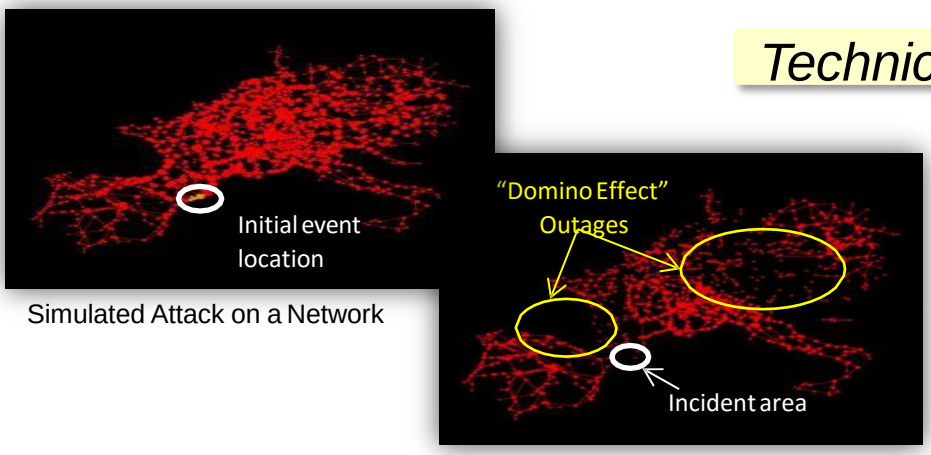
Additive Manufacturing (e.g. 3D Printer)



Unmanned Ariel Vehicle (UAV)

Predict consequences

Description: Forecast US and partner vulnerabilities, the 1st, 2nd, and 3rd order effects of WMD



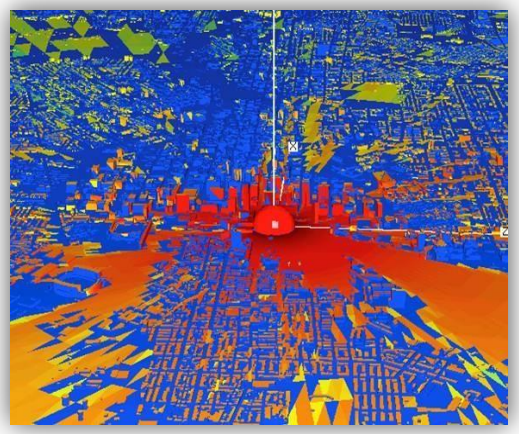
Simulated Attack on a Network

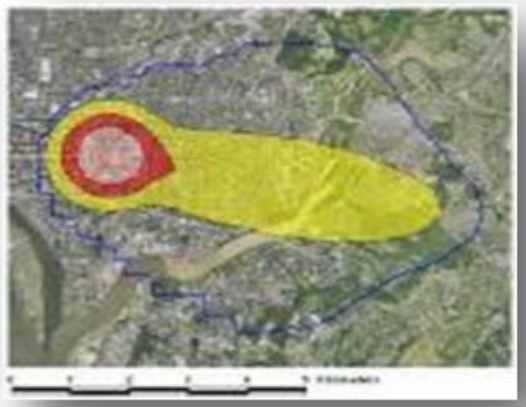
Cascading Damage Extends Far Beyond Initial Event Location

Technical Opportunities

- Predict, with high confidence levels, the effects of one or more CBRN event (including EMP) on personnel, equipment and infrastructure and patterns of life
- Assess the effectiveness of defeat actions & post attack defeat

Consequence of Execution Tools. Predicting Collateral Damage from Weapons Strikes





Hazard Characterization and Prediction

Control WMD Threats

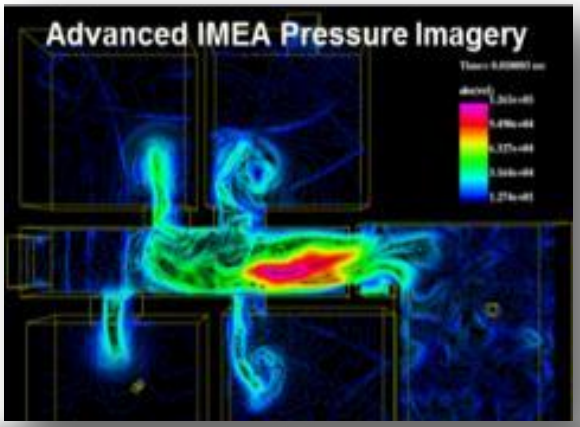
Description: Isolate, intercept, divert, seize & secure WMD and related capabilities.

Technical Opportunities

- Separate components that together could (and likely would) otherwise be employed by an actor to create a WMD (Isolate)
- Shift an adversary's resources (e.g. time, materiel, financial) away from the pursuit of WMD acquisition (Divert)
- Gain control or possession and transport WMD or related materials such that it is no longer available for use, transfer or loss of control by an actor. (Seize and Secure; WMD Interdiction; includes Sensing)

Defeat WMD Threats

Description: Render nonexistent or interrupt the entire spectrum of WMD development and employment and focus on specific nodes, links and support networks prior to an adversary's acquisition of WMD.



Technical Opportunities

- Lengthen the amount of time it takes for an actor to gain access to WMD, or interrupt any portion of an actor's pathway to WMD acquisition
- Render nonexistent the related nodes, links, or supporting networks prior to an adversary's acquisition of WMD.

- Render biological & chemical agent harmless.
- Assess the effectiveness of defeat and/or disable actions and post attack defeat
- Test the ability to defeat and/or disable WMD threats
- Reduce the potential harm or consequences of a WMD should it be employed.


WACS on the US Army RQ-7B Shadow

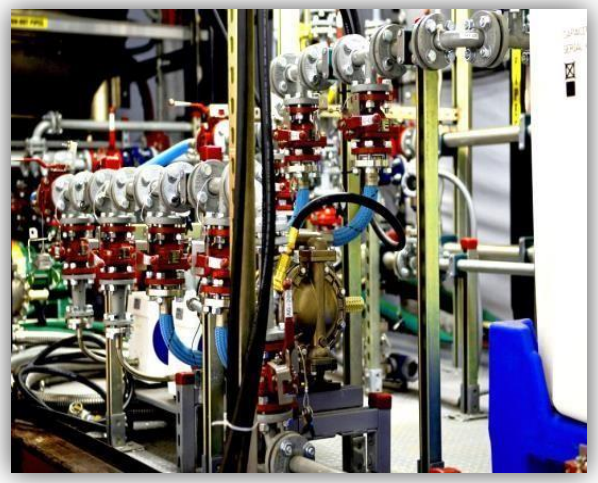
Dispose WMD Threats

Description: Partial or full dismantlement of WMD program.

The Field Deployable Hydrolysis System. Developed in only five months, and was deployed on the CAPE RAY and destroyed 600MT of Syrian chemical weapons in 42 days (2014).

Technical Opportunities

- Decrease or eliminate the production methods, materials, stockpiles and technical infrastructures on an actor's WMD program
- Eliminate WMD materials on locations with little or no collateral damage
- Establish practices to ensure that a WMD program will not be reconstituted



Sense CBRN Hazards

Description: Provide the information about the CBRN situation at a time and place by detecting, identifying, and quantifying CBRN hazards in air, water, on land, on personnel, equipment or facilities.

Field Forward Diagnostics

Point-of-Need Diagnostics in Relevant Environments

Technical Opportunities

- Chemical Detection capability for hazards other than vapor, capability for Low Volatility Agents, Toxic Industrial Materials and early warning
- Biological Detection capability of detect to warn, field identification capability, expeditionary detection, and reduced burden of logistical supportability
- Expeditionary Analytics to analyze and identify unknown samples, portability, and protocol standardization
- Medical Diagnostics to include portability “far forward,” FDA-cleared diagnostics (toxins/chemical/radiological hazards), and Long specimen preparation times
- Radiological Detection to characterize (detect, identify, and/or quantify) radiological hazards and materials

Shape Force Commanders' Understanding

Description: Characterize the CBRN hazard to the force commander and develop a clear understanding of the current and predicted CBRN situation.

Real Time Sensor Integration

Force-on-force Simulations

New capabilities enhanced military operations

Technical Opportunities

- Decision Analysis and Management to accurately model all CBRN hazard categories and decision support to model impacts of hazards on operations
- Integrating modeling products with evolving user's command and control host systems, and Interoperability between military and civilian health surveillance systems
- CBRN Warning and Reporting with automated means to disseminate timely sensor warnings, Networked sensor monitoring capability, and near real time CBRN-related surveillance information between military and civilian systems

Shield Individuals and Equipment

Description: Prevent or reduce individual and collective exposures, applying prophylaxis to prevent or mitigate negative physiological effects, and protecting critical equipment.

Antibiotics & Vaccines that can be readily available for urgent epidemic events

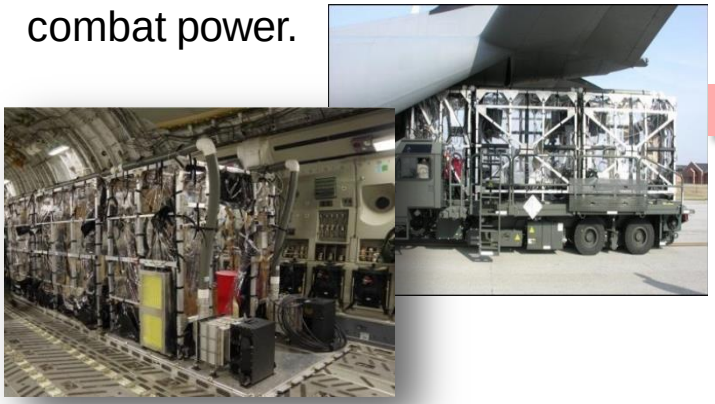
Radiation Hardened Microelectronics protect space systems from cosmic rays, and critical military systems from nuclear-blast related electromagnetic pulse (EMP)

Technical Opportunities

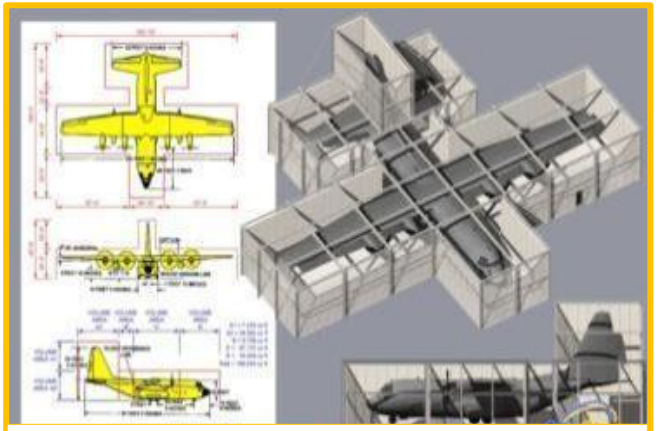
- Respiratory & Ocular Protection capability to include protection against TIMs and compatibility with aircrew mission sets. Percutaneous protection capability with no or limited physiological burden and protection against aerosols
- Chemical prophylaxes for chemical warfare agents, pre-treatment applications and non-invasive delivery methods
- Expeditionary Collective Protection as a small, lightweight capability
- Biological & Radiological prophylaxes capability for broad-spectrum vaccines (e.g. toxin vaccines), and ones against the effects of radiological hazards using MCM
- Economical approaches to operate critical systems effectively in radiation / harsh environment

Sustain and Restore Combat Power

Description: Conduct decontamination and medical actions that enable the quick restoration of combat power.



Transport Isolation System, Safely transport Ebola Virus Disease patients, or other highly infectious patients on military cargo aircraft.



Joint Biological Aircraft Decontamination System

Technical Opportunities

- Decontamination of personal equipment, weapons, vehicles, ships, facilities, sensitive equipment and hazardous waste
- Chemical therapeutics for non-traditional agent treatments
- Biological therapeutics for anti-viral and antitoxin treatments, and against drug-resistant diseases
- Radiological therapeutics for individuals adversely affected by ionizing hazards

Areas to be considered as part of "Health Assessment"

DoD Strategy for Countering WMD – June 2014

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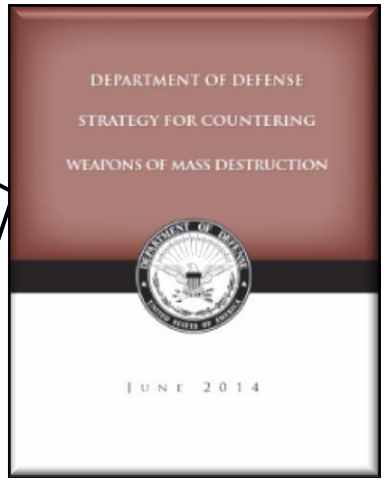
Mitigate, Sustain, Support



Synchronization of the Community

CWMD Test Support National
CWMD Technical Reachback
Enabling technologies

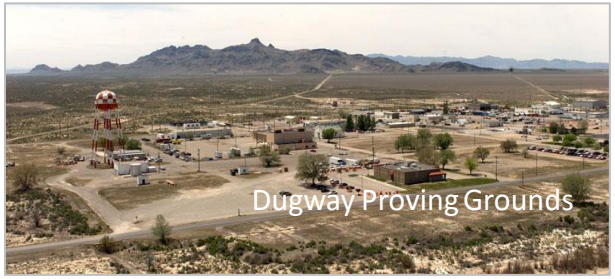
Expertise across DTRA, across DoD, DOE, government laboratories, industry, FFRDCs, UARCs, and academia

Strategic partnerships with Joint Staff and CCMDs, Services,. Interagency, and key foreign partners and allies

CWMD S&T Community Leverages DoD's Unique and World's Class Capabilities

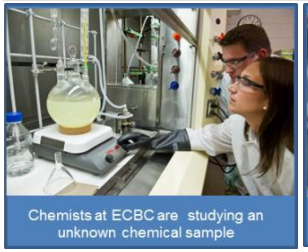
Recapitalization/Modernization of DoD Laboratory facilities/ equipment is providing unparalleled R&D capabilities

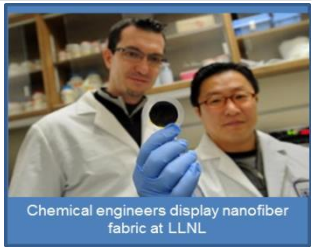
DoD Test Ranges and specialized equipment enabling DT&E for most of CWMD portfolio



DoD laboratories and test ranges provide the cutting-edge capabilities, flexibility, and agility the CWMD S&T community requires to address current and emergent threats.

DoD CWMD S&T investments fund hundreds of CBRN scientists and engineers with unique expertise/experience not readily available in the private sector


Chemists at ECBC are studying an unknown chemical sample


Chemical engineers display nanofiber fabric at LLNL


Scientist weighs aluminum powder for an energetics project in laboratory at NSWC.


Scientists are conducting BSL-4 training at USAMRIID

DoD CWMD S&T workforce morale faces many of the same challenges as broader S&T community. Inconsistent application of policies for attendance/participation in scientific conferences a significant concern for S&E seeking to maintain currency in their field. Declining budgets a concern for S&E seeking to advance new ideas and initiatives.

Key S&T Partners

Understand the Environment, Threats, and Vulnerabilities

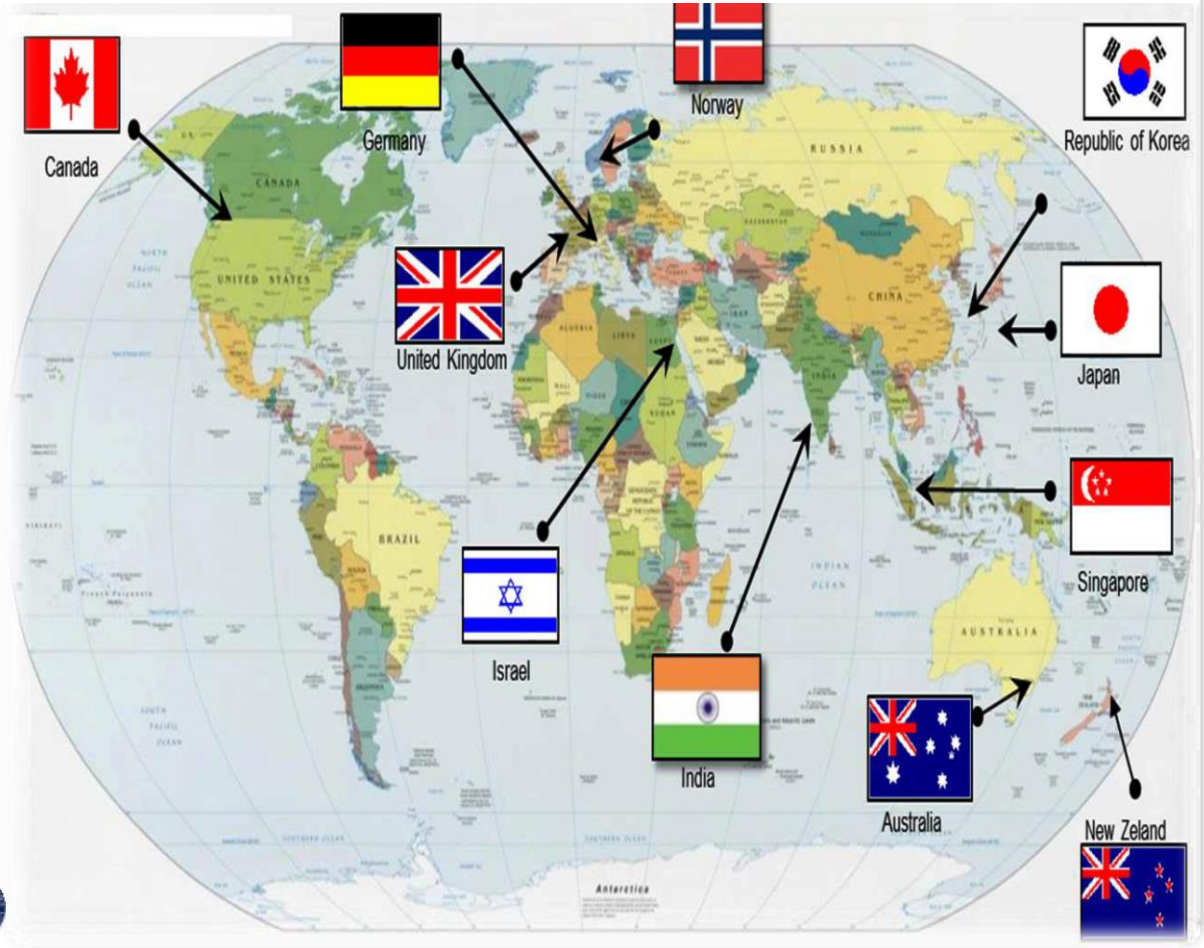
- Forensics and attribution
- Situational Awareness
- Hazard assessment
- Data analytics
- Location and detection
- Technology forecasting

Control, Defeat, Disable, and Dispose of WMD Threats

- Agent defeat
- Nuclear technologies
- Pathway defeat tools
- Isolation and transport
- Test and Evaluation

Safeguard the Force and Manage Consequences

- Medical countermeasures
- Biosurveillance
- Environmental detection
- Diagnostics
- Animal models
- Threat agent characterization
- Decontamination
- Remediation/Restoration



Preparing for the Future

- **Basic research investment to address some of the most fundamental challenges facing the community**
  - Modeling and simulation
  - Detection of WMD materials
  - Accelerating access to forensics data
  - Synthetic biology

- **Engaging DARPA to explore high-risk, high-payoff concepts**
  - Nuclear detection
  - Chemical elimination
  - Advanced analytics
  - Diagnostics and therapeutic development
  - Compartmented programs

Summary

- **Well coordinated S&T programs addressing the most important technical challenges in support of DoD's CWMD Strategy**
  - ~90% of program is executed by DTRA and CBDP through DTRA
  - Strong connections with the operational communities (e.g. COCOMs)
  - Solid interagency and international partnerships
- **CWMD S&T COI Roadmap identifies significant S&T gaps, affirming the broad and difficult set of challenges in the CWMD field**
  - Technical as well as fiscal impediments to addressing all gaps
  - Diversity of problems makes trades challenging
- **Significant opportunities for progress by leveraging work within other COIs and DARPA**
  - Focus capabilities and technologies of other COIs into the context of addressing CWMD hard problems
- **Health of the community is currently sound, but fragile**
  - Unique infrastructure and workforce magnify DoD's pervasive issues of sustainment, maintenance of technical currency, and innovation