Chemical Biological Defense Program
Science & Technology

A Look to the Future

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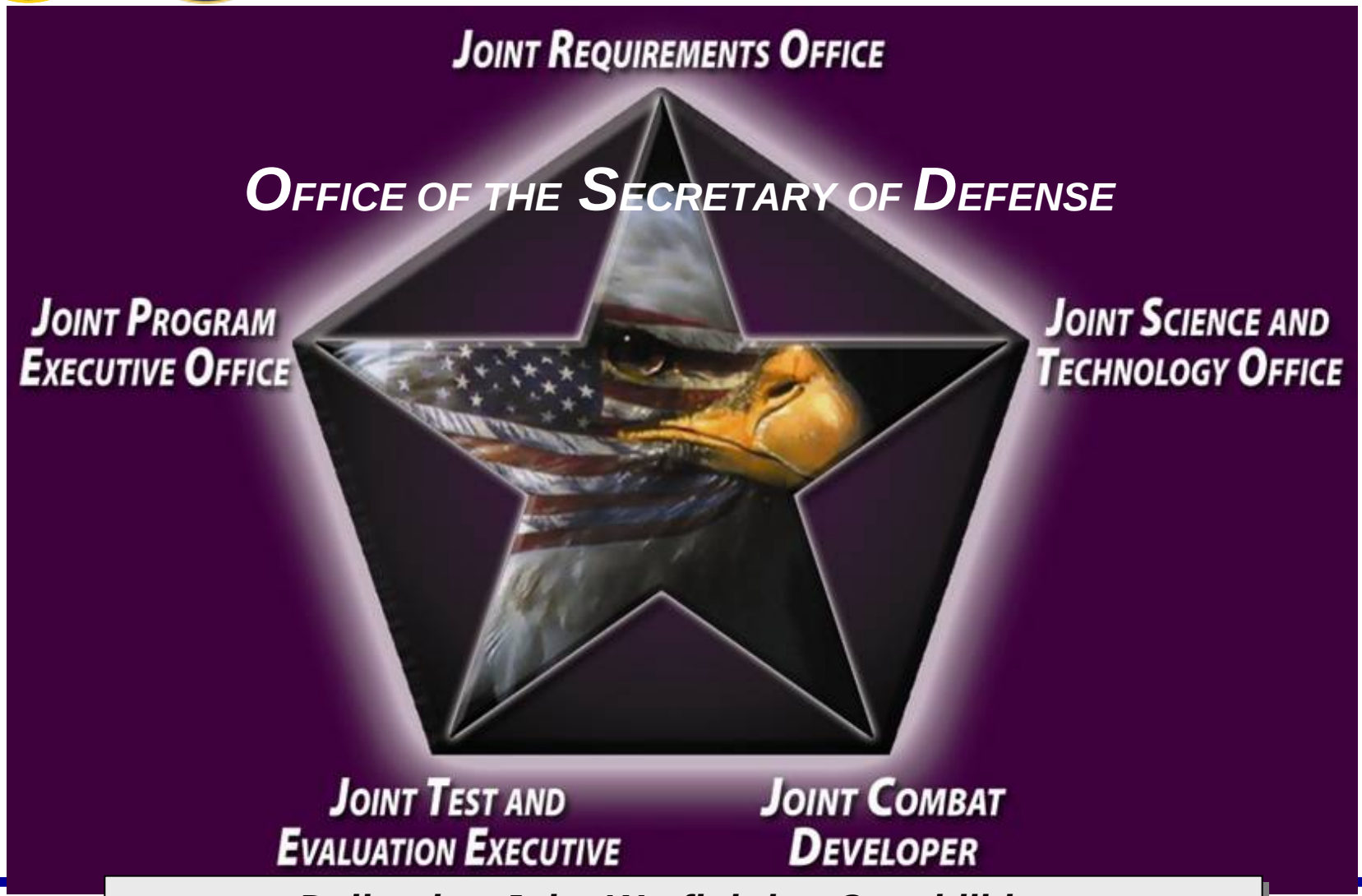
Overview

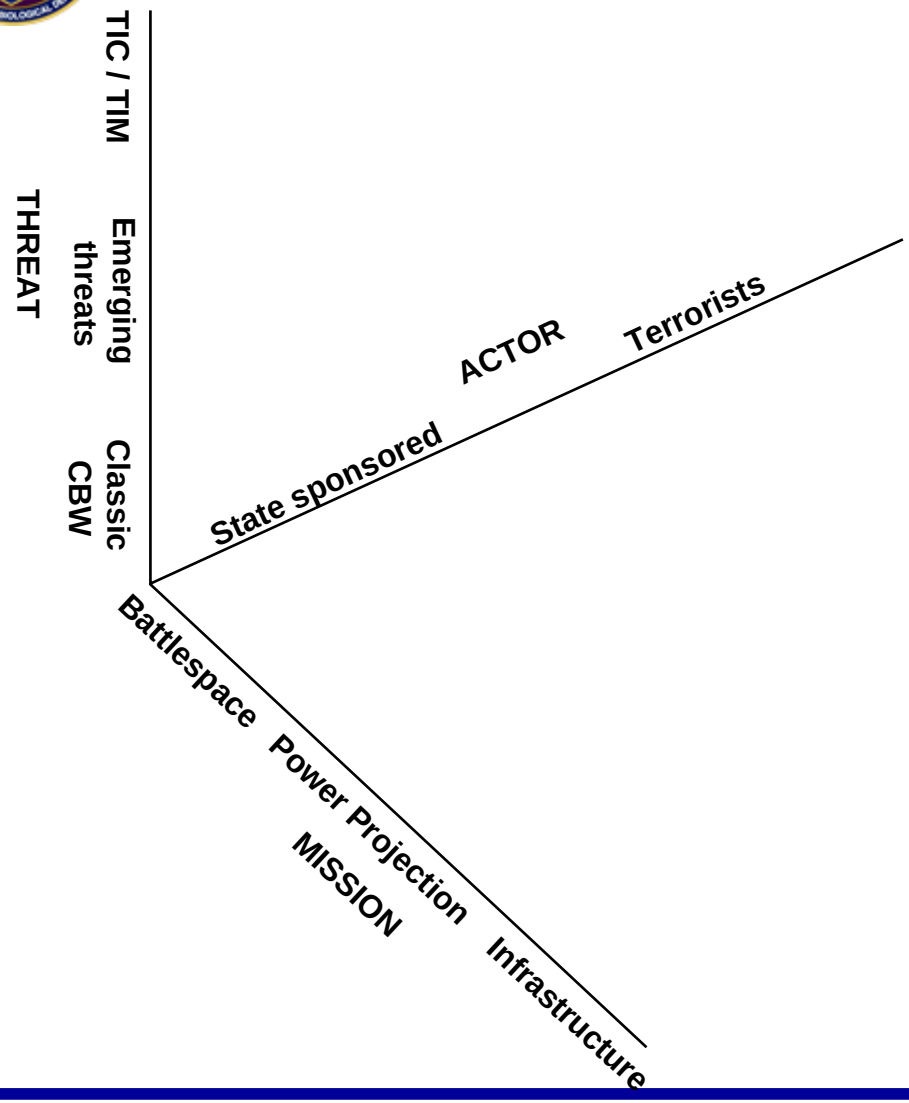
- Background
- Business strategy
- The S&T challenges
- Sustaining S&T
- Conclusions

We are the S&T arm of the CBDP



Delivering Joint Warfighting Capabilities

The CB threats and CBDP mission space are expanding



Our S&T …

Vision

Eliminate chemical and biological warfare agents as a threat to the warfighter

Mission

Develop and sustain a robust, agile, and flexible science and technology program to support chemical and biological defense capability needs

We are organized by capability areas

Medical Science & Technology

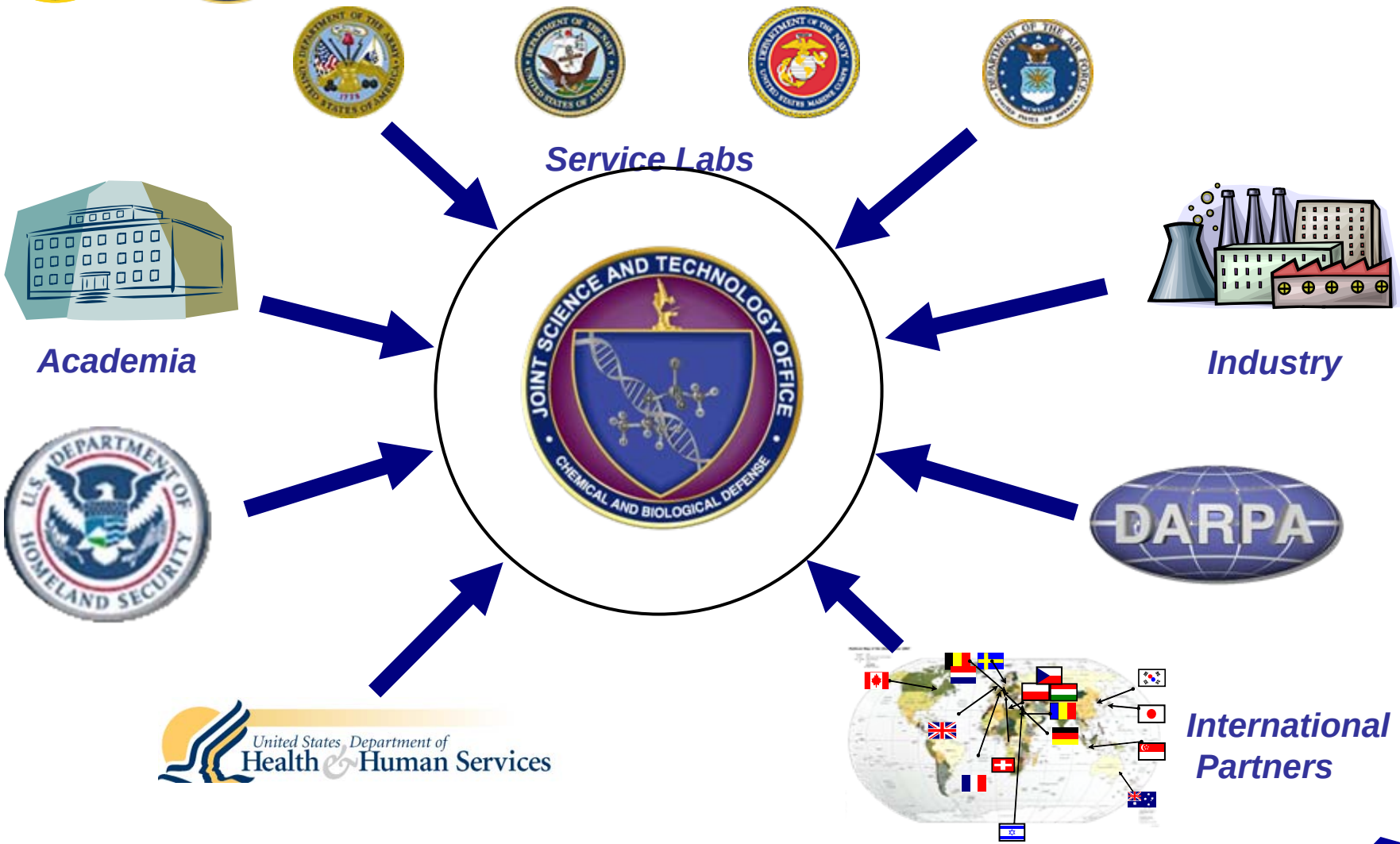
- Pretreatments
- Therapeutics
- Diagnostics
- Emerging Threats
- Medical Radiological Defense
- TMTI

Physical Science & Technology

- Detection
- Protection
- Decontamination
- Modeling & Simulation
- Threat Agent Science

Applied Technology

Leveraging the best in class from across the spectrum of performers



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CBDP S&T is…

- Technically challenging
  - Exceedingly high customer expectations
  - No "silver bullet" solutions
- Scientifically diverse
  - Numerous and disparate disciplines
  - Distinct chemical and biological solutions

DoD has placed significant emphasis on RDT&E

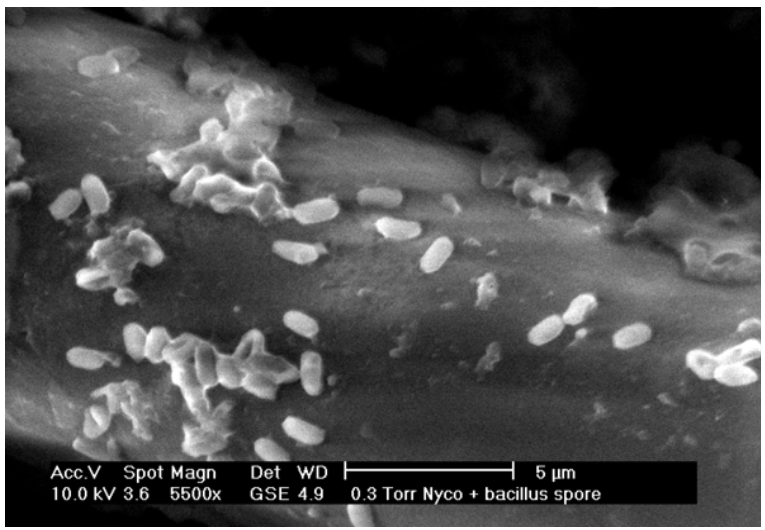
- Enhanced Planning Process (EPP)
- Quadrennial Defense Review (QDR)
- OSD FY08-FY13 POM guidance

QDR - Countering WMD remains a DoD priority

- Future program direction
  - "…fund a $1.5 billion initiative over the next five years to develop broad-spectrum medical countermeasures against the threat of genetically engineered bio-terror agents."
  - "Additional initiatives will include developing advanced detection and deterrent technologies and facilitating full-scale civil-military exercises to improve interagency planning for complex homeland security contingencies."
- Form domestic and international partnerships
  - "Close cooperation with these partners in the long war on terrorism, as well as in efforts to counter WMD proliferation and other non-traditional threats, ensures the continuing need for these alliances and for improving their capabilities."
  - "…establishment of a National BioDefense Campus at Fort Detrick, Maryland – with the U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) and the Defense Intelligence Agency's Armed Forces Medical Intelligence Center (AFMIC) at its core – to improve cooperation among agencies conducting research and development of medical biological defenses."
- Need for high quality personnel
  - "Finally, the Department must effectively compete with the civilian sector for high-quality personnel. … a new Human Capital Strategy for the Department,…"

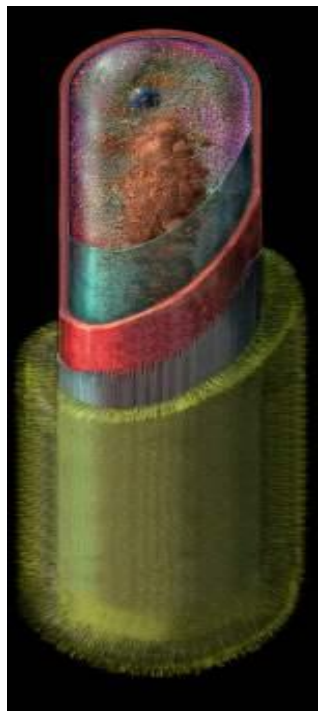
S&T investment strategy

- Fully fund highest priority S&T gaps
- Burdensharing
- Technology watch



BG Spores collecting on an anti-microbial fiber

Anthrax cell



Plasmid

Cytoplasm+RNA +Proteins

DNA

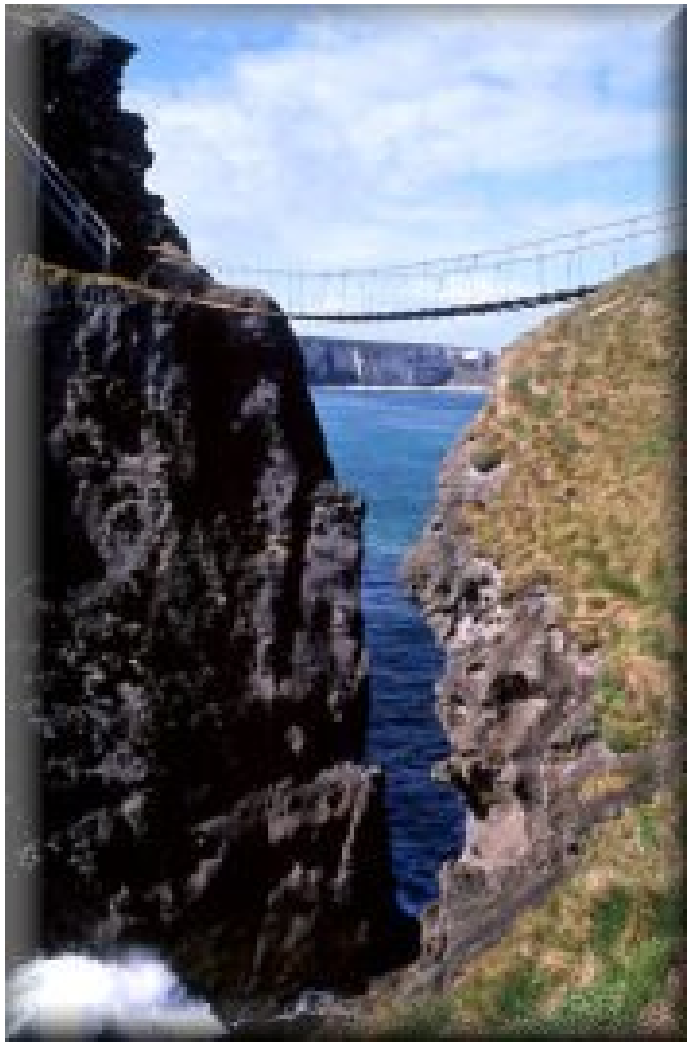
Plasma Membrane

Cell Wall

S-Layer (proteins)

Capsule (poly-D -glutamic acid)

Supporting programs of record



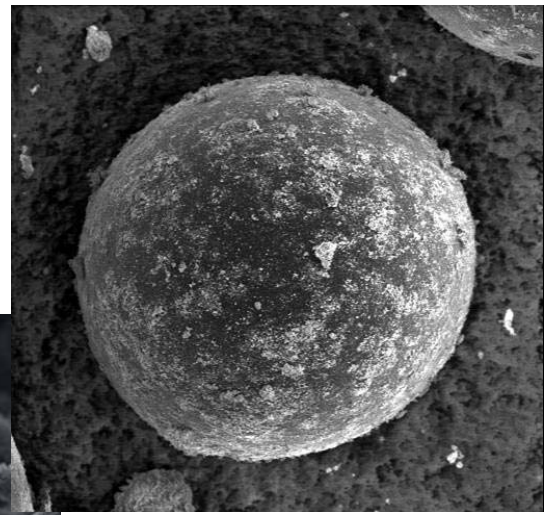
Bridging the “valley of death” between S&T and advanced development

- Evolutionary advancements align w programs of record
- 35 Technology Transition Agreeme
- Relatively low risk technology

Shift towards revolutionary improvements

- New science
- Interdisciplinary teams
- Non-traditional performers
- Risk tolerant

a carbon sphere doped with a reactive nanoscale metal oxide component



a nanofibrous web surface-coated with a nanoscale adsorbent + catalyst

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Our S&T challenges

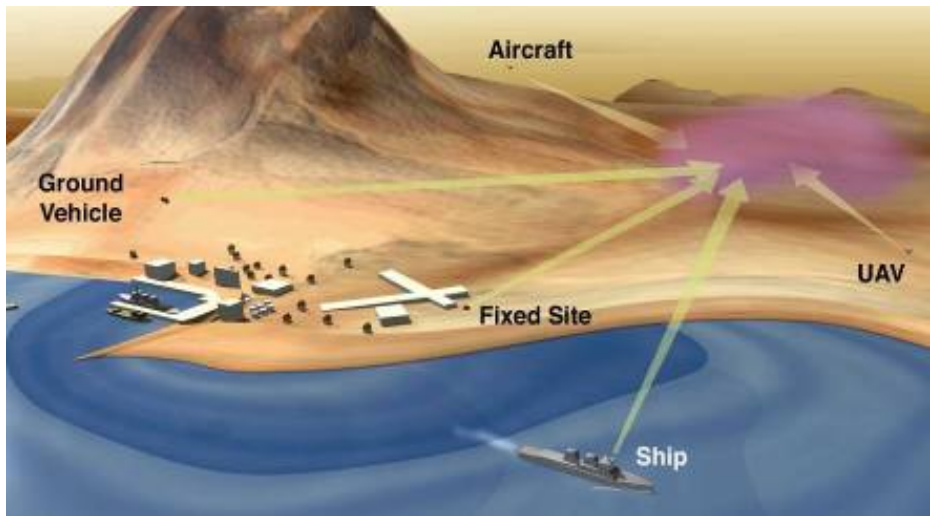
- Earliest warning
  - Detection
  - Medical diagnostics
  - Information dissemination

- Broad spectrum medical countermeasures
  - Pretreatment
  - Therapeutics

- “How clean is safe?”
  - Decontamination
  - Low-Level toxicology
  - Environmental fate of agent

Detection

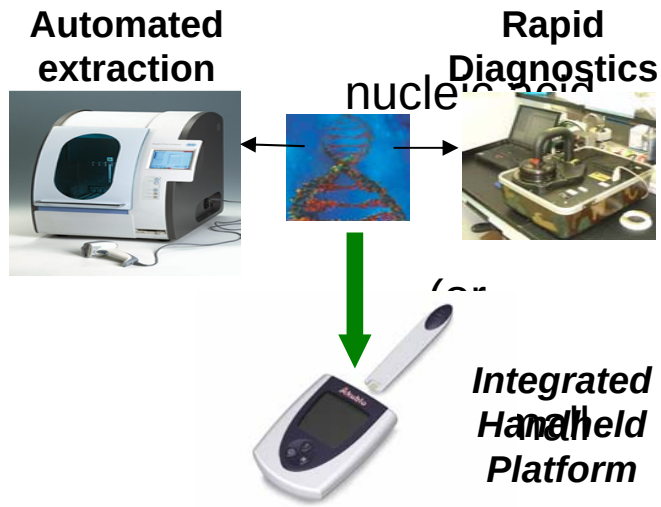
- Current Efforts
  - Explore terahertz spectroscopy for detection
  - Investigate laser-induced millimeter wave fluorescence for better bio discrimination
  - Exploit Semiconductor Ultra Violet Optical Sources (SUVOS) being developed by DARPA for the detection of bio agent aerosols.
- Challenges
  - Signatures from “non-traditional” regions of the electromagnetic spectrum
  - Techniques and algorithms for discriminating signatures from a complex background



Detect and identify biological threats at standoff distances

Diagnostics

- Current Efforts
  - Developing nucleic acid and antigen detection assays and reagents
  - Assessing resequencing technology for rapid identification of emergent/genetically engineered bio agents
  - Establishing standards for DoD developed and immunodiagnostic assays
- Challenges
  - Biological sample viability at room temperature above) for up to seven days
  - Integrated platform for nucleic acid, protein molecule toxin diagnostics
  - Simple, small, and integrated sample processing and testing platforms
  - Assays for early (pre-symptomatic) markers of exposure
  - Rapid diagnostic tests to identify antibiotic resistance markers

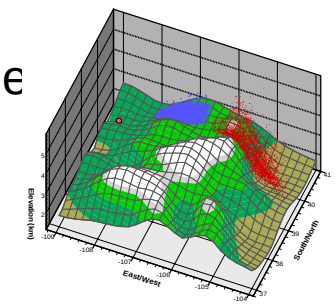


Portable and deployable diagnostic capabilities, easy to operate, and with minimal logistical requirements

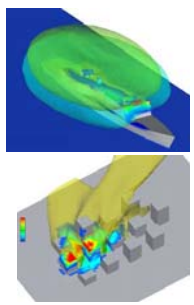
Battlespace Awareness

- Current Efforts
  - Developing computational fluid dynamic (CFD) libraries for a particle transport model to provide rapid and high resolution analysis around buildings and ships
  - Developing techniques to use high-resolution radar data to improve wind fields for models
  - Providing automatic source term estimation using data from either sensors or observations
- Challenges
  - Intelligent “network centric” sensor arrays
  - Improved CBRN hazard prediction on comple urban terrain

CFD Model



Ship and Urban Visualization



Reliable, automated warning in a common operating picture across the theater

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Pretreatments

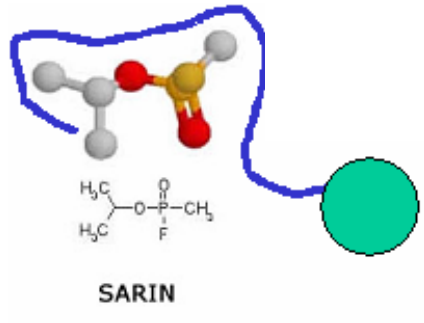
- Current Efforts
  - Evaluating select target antigens in various vaccine platforms for immunogenicity, safety, efficacy, and minimal dosing
  - Combining current products into one
  - formulation for a straight recombinant vaccine (multiagent vaccines)
  - Evaluating molecular/genetic platforms

- Challenges
  - DNA platforms for rapid vaccine development
  - Vaccines that are adaptable to emerging threats
  - Better understanding of human immune mechanisms
  - Broad spectrum medical prophylaxis and countermeasures against all nerve agents

Single vaccines against multiple biological agents
Rapid drug development

Therapeutics

- Current Efforts
  - Identifying intersecting targets for intervention including common mechanisms of pathogenesis, common host responses, common housekeeping functions
  - Identifying and characterizing a candidate broad-spectrum nerve agent reactivator to replace the current reactivator (oxime) in nerve agent therapy
- Challenges
  - Broad spectrum therapeutics for diverse/emerging threats
  - New technologies and methods to accelerate FDA licensure of new products
  - Minimal systemic, neurological, ocular, and cutaneous injury due to chemical threat agent exposure
  - Develop novel new interventions/approaches
  - Leverage and adapt technologies developed for other purposes

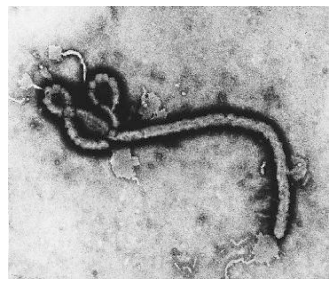


Nuclease-Resistant
DNA Aptamers with 3'-Caps
Bind & Neutralize
G & V Agents

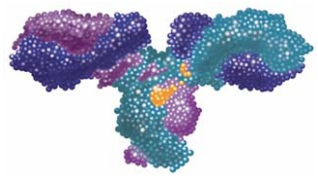
Effective countermeasures against bio warfare agents
Multi-agent therapeutic technologies

Transformational Medical Technologies Initiative (TMTI)

- Current Efforts
  - TMTI goal is to conduct vigorous medical research to develop broad-spectrum medical countermeasures against emerging biological threat agents
  - Program targeted for countermeasures against two classes of agents: Hemorrhagic fever viruses and Intracellular bacterial pathogens
  - TMTI offerors announced; contracts to be awarded



- Challenges
  - Identify & leverage most promising technologies in the development pipeline for rapid transition to advanced development
  - Develop counter-measure products that are regulatory compliant, robust, and highly effective at a reasonable cost.



TMTI represents a novel technology and acquisition experiment

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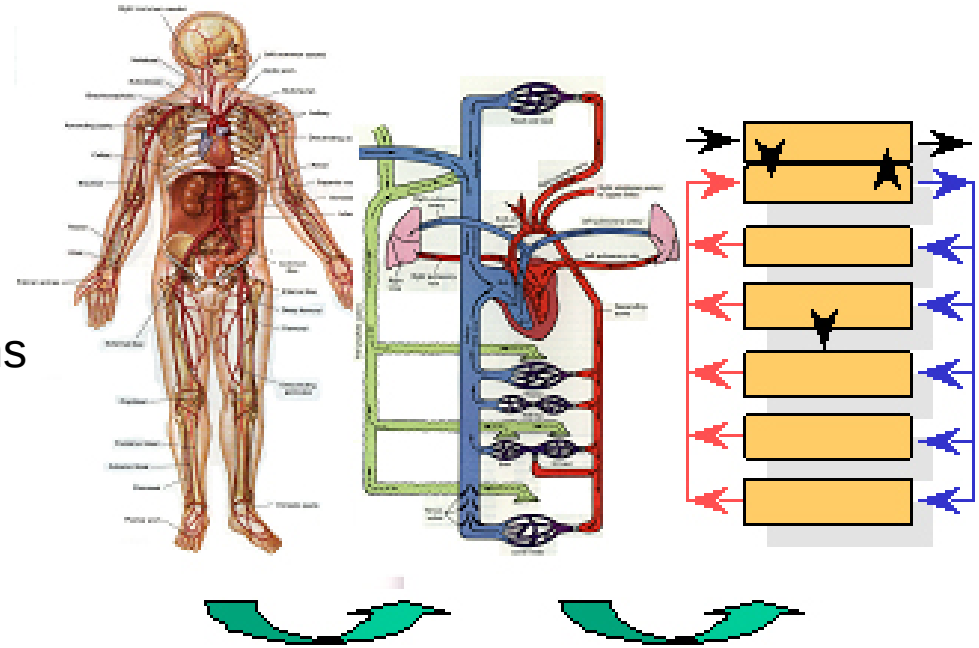
Decontamination

- Current Efforts
  - Modeling quantum-chemical agent/adsorbent Interactions
  - Studying surface chemistry of vaporous H_2O_2 and ClO_2
  - Developing solvent soluble decontaminating enzymes
  - Aerosolizing activated H_2O_2 for decontamination of aircraft interiors
- Challenges
  - Removal or detoxification of chemical agents bound in porous matrices
  - Smaller quantities and fewer varieties of decontaminants required
  - Detection of residual agent on surface and vapors below toxicological thresholds to validate successful decon in the field

Effective, non-corrosive decontaminants for sensitive equipment, vehicles, and building interiors

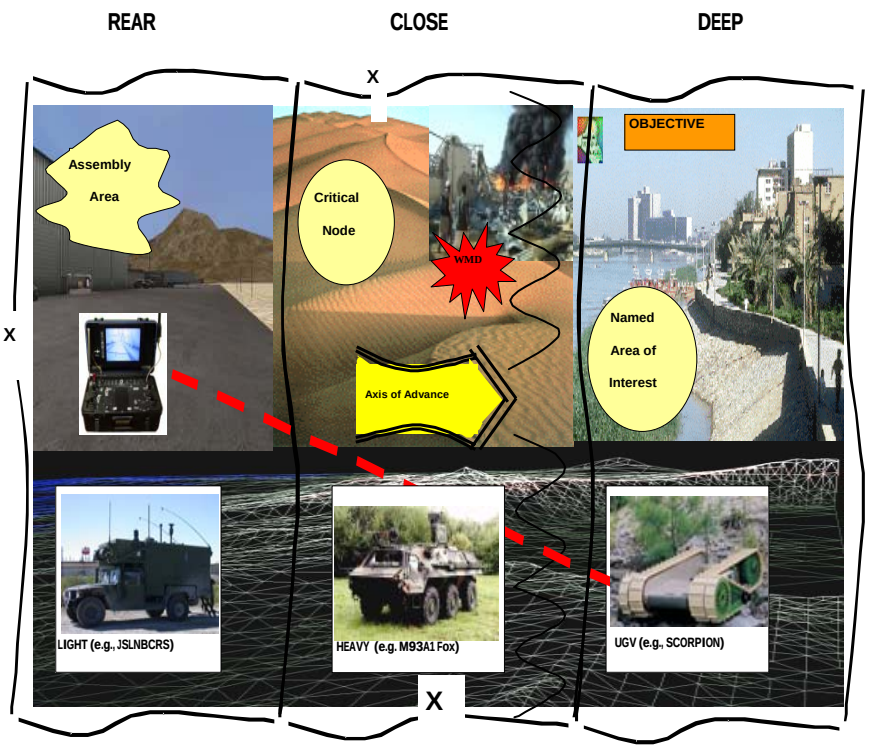
Threat Agent Science

- Current Efforts
  - Studying toxicological effects low levels of exposure to agents
  - Researching environmental fate of agent
- Challenges
  - Better fundamental understanding of CB agents
    - Physical and chemical properties
    - Fundamental interactions with other materials and environment
    - Pathological and toxicological properties
    - Exploitable signatures

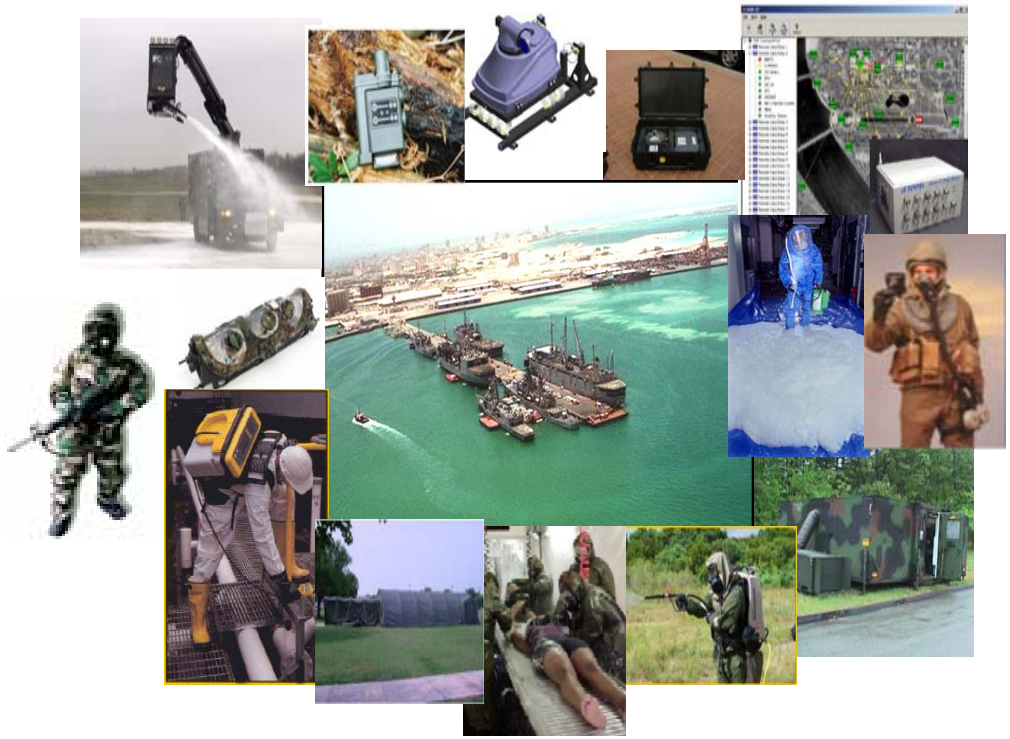


Improved CONOPS and a better understanding of CB-relevant science

Technology integrated through joint experimentation



Chemical Biological Radiological Nuclear Unmanned Ground Reconnaissance (CUGR) ACTD



Contamination Avoidance at Seaports of Debarkation (CASPOD)

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Sustaining and improving S&T capability

- Intellectual capital
- Physical infrastructure

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We are…

- Improving business strategy
- Bridging the “valley of death” between S&T and advanced development
- Emphasizing revolutionary technology
- Sustaining and improving S&T capability