Information Systems Science & Technology Capability Area

CBIS 2007 Brief
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JSTO IS S&T CAPO
9 January 2007

Modeling & Simulation / Battlespace Joint Acquisition Responsibilities

Define The Need

SHAPE
CBA Gaps

- Integrated Early Warning
- Battlespace Analysis
- Battlespace Management

Find / Build The Technology

Select, Evaluate & Manage S&T Projects

Technology Transition Agreements

Build The System

- JWARN
- JOEF
- JEM
- T&E
- Other

Acquisition Pull: The Technology Transition Paradigm

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13

Joint Warning and Reporting Network

Increment 1: DT OA •SAVIOR MS "C" IOC FRP FOC

•InterLAN Socket Connection Manager •Shared COP

Increment 2: DT MS "C" OA IOC

•JCID Thin Client Server •JCID on a Chip •Waterborne Transport Models

JWARN Joint Warning and Reporting Network

Joint Effects Model

Block 1: DT OA MS "C" IOC OT → FRP FOC

Rapid Wind & Pressure Calcs around Buildings Improving RUSTIC

Block 2: MS "B" DT OA MS "C" IOCOT → FRP FOC

•GEDIS •Urban Dispersion Model

•Agent Fate •Hazard Prediction w/Nowcasting •CB Source Determination •TIC Source Emissions

•Release and Atmospheric Dispersion of Liquid Agents

•Multiscale Nudging •Mass Consistency Wind Model

•Predicting Effects Due to Infectious/Contagious Diseases

•Waterborne Transport Models

JEM

Joint Operations Effects Federation

•Next Generation Modeling •Internal Modeling for STAFFS

•C-IED •IIMS

Increment 1: MS "B" DT MS "C" IOC FOC Sustainment

EA/OA •Radiological Operational Effects OT

Increment 2: MS "B" MS "C" IOC FOC Sustainment

JOEF

▲ = technology insertion

Acquisition Pull: The Technology Transition Paradigm

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13

Joint Program Manager for Contamination Avoidance

JPM-CA (TBD)

CBRN Software Services

Program Director – Test Equipment Strategy and Support

PDTESS

Performance Evaluation Decon Model for T&E
Performance Evaluation Contamination Avoidance Model

Performance Evaluation COLPRO Model for T&E

Major Defense Acquisition Programs

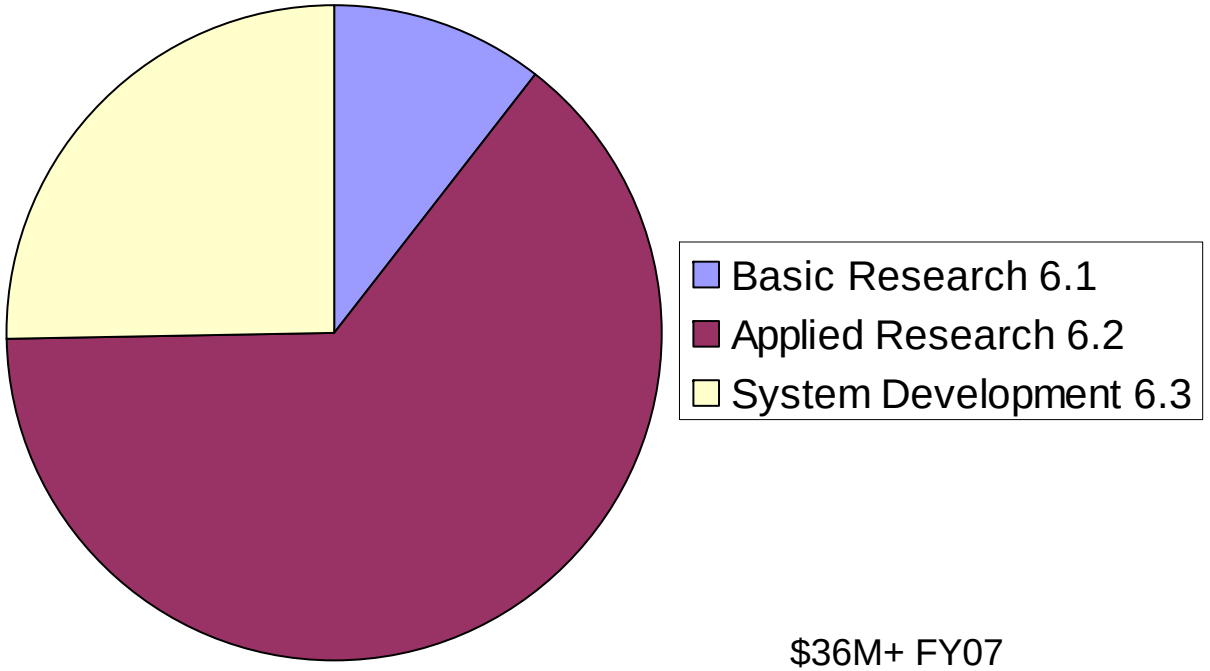
FCS (TBD)

CB Sim Suite

▲ = technology insertion

Information Systems S&T Funding

FY07 Funding Profile



$36M+ FY07
$31M FY08

IS S&T Performer Base

- Aerodyne Research
- Air Force Research Laboratory, Dayton, Ohio
- Air Force Research Laboratory, Rome, New York
- Army Research Laboratory
- Applied Research Associates
- Battelle Memorial Institute
- CFD Research Corporation
- Cubic Corporation
- Defence Science & Technology Laboratory (UK)
- Defense Threat Reduction Agency
- Dugway Proving Ground
- Edgewood Chemical Biological Center
- Hanna Consultants
- Institute for Defense Analyses
- ITT Industries
- Kettering University
- Los Alamos National Laboratory
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Massachusetts Institute of Technology – Lincoln Laboratory
- Natick Soldier Center
- National Center for Atmospheric Research
- National Oceanographic and Atmospheric Administration`
- NAVOCEANO
- Naval Research Laboratory
- Naval Surface Warfare Center, Crane Division
- Naval Surface Warfare Center, Dahlgren Division
- Office of Naval Research
- Pennsylvania State University
- RDECOM
- RiskAware Ltd.
- RTI World
- SAIC
- San Jose State University
- Sandia National Laboratories
- Sentek Consulting
- Sparta, Inc.
- SPAWAR
- Titan
- TRADOC Analysis Center-White Sands Missile Range
- Tyndall Air Force Base
- University at Buffalo
- University of California, Santa Barbara
- University of New Mexico
- University of North Florida
- University of Utah

Industry - DoD Laboratories - Academia - Other Government Laboratories - Not for Profit - International Partners

New Initiatives

- Program is intensely focused on transitions in FY08-FY10
- Cutting edge research will begin in the following areas:
  - TCTI (Transformational Countermeasures Technology Initiative)
    - Nanotechnology
    - Biotechnology
    - Advanced Information Science
    - Cognitive Science
  - Advanced data systems to support sophisticated decision support tools

JSTO IS Taxonomy

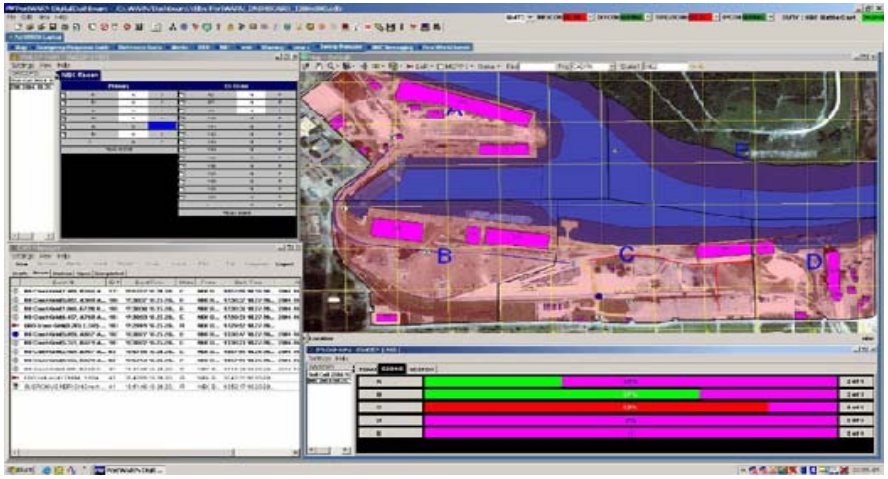
THRUST AREAS	THRUSTS	THRUST MGRS
Network Architectures	Battlespace Management	Ginley
	S&T Data Backbone	Lowenstein
	Rapid Assimilation of Sensor Information Research (RASIR)	Hannan
	Medical Surveillance Systems	Chotani
Hazard and Environmental Modeling	Transport and Dispersion	Fry
	Environmental Science	Hamilton
Simulation, Analysis and Planning	Operations Effects	Fagan
	Decision Support S&T	Miller
	Medical Effects Modeling	Fitzgerald
Systems Performance Modeling	Test and Evaluation Performance Evaluation Models	Sears
	MDAP M&S Support	Zimmerman

CB Defense Battlespace Management Thrust Area

Objective: Develop the science behind collaborative information management technologies for insertion into the Joint Warning and Reporting Network (JWARN) acquisition program.

Description of Effort: Develop configurable battle management modules for data acquisition, sensor integration, early warning and reporting and mission impact to enhance JWARN capabilities.

Benefit to warfighter: Improves integrated early warning and provides a common operating picture (COP) for enhanced decision making.



Major goals/milestones:

Near Term (Through FY09)
- Transition COP to JOEF/JWARN
- Evaluate integration of medical syndromic surveillance

Mid Term (Through FY11)
- Develop and transition next generation technologies and net-centric enterprise integration
- Integrate SDF technologies into CB network

Far Term (FY12 & Beyond)
- High speed data acquisition supporting full spectrum decision support for CB

FY07 Projects:

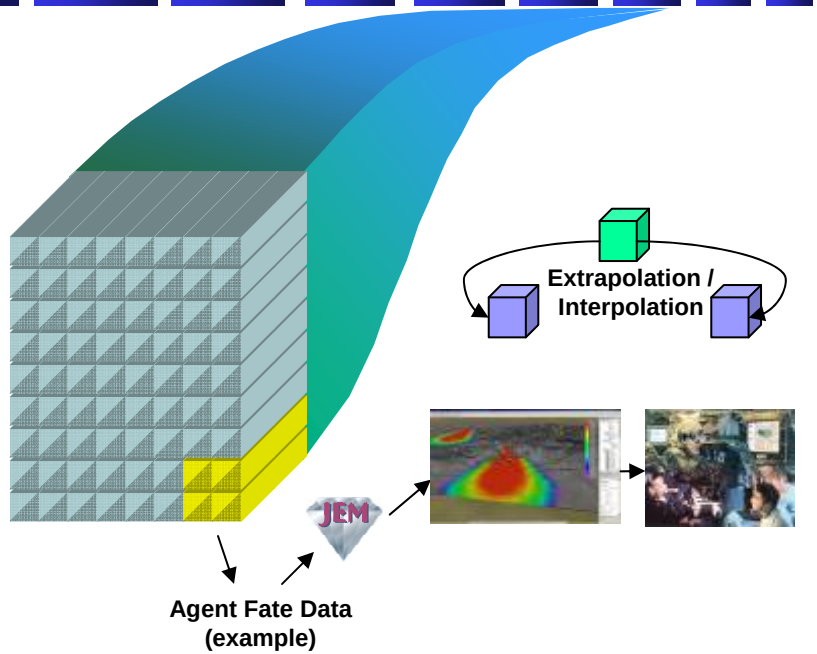
BA05MSB005	Shared Common Operating Picture (COP) for HLS and HLD
BA06MSB102	Inter-LAN Socket Connection Manager (ILSCM)
CO06MSB005	JCID on a Chip
BA07MSB129	Information Interoperability for CBD Battlespace Management
BB06MSB044	Common CBRN Software Services
BA06MSB024	Sensor Alert Verification for Incident Operational Response (SAVIOR)
BB06MSB041	JCID Compliant Thin Server for Sensors
	LG7/ATP-45

CB Validated Interactive Science & Technology Data Backbone

Objective: Fill critical data gaps in the areas of basic science which support the CB Defense Program, & develop a web-based system for storage & access of this CB M&S & IT development data & knowledge.

Description of Effort:
Develop Data Backbone Tables (e.g., Bio agents, Chem agents, TICs/TIMs, Simulants, Substrates, Background materials). Candidate Data Fields/Attributes include Genomics, Proteomics, Persistence, Exposure risks, Signatures, Environmental variables, Dose rate, Vapor pressure, Spectral signature

Benefit to warfighter: The CBD M&S and IT tools that are being planned or developed are critically dependent on data and meta-data in a broad range of areas, including, for example, data describing fundamental physical, biological or chemical science, as well as human medical effects. Data of this kind is critical to the development and operation of these tools, so that its non-availability represents a significant risk to system development/acquisition. However, while data of this kind is of clear interest to M&S and IT system developers, it is of equal or greater importance to operational users (warfighters).



Major goals/milestones:

Near Term (FY06 – FY08)
- Determine scope of effort, begin to identify data structure
- Determine method for Permanently Capturing Data

Mid Term (FY09 – FY11)
- Gather data and populate backbone
- Determine data to be collected and areas of future research

Far Term (FY12 & Beyond)
- Use data for Experimentation and Training, Test and Evaluation, Model Development

Responds to a need pointed out by the General Accounting Office (GAO), in its report dated April 28, 2006:

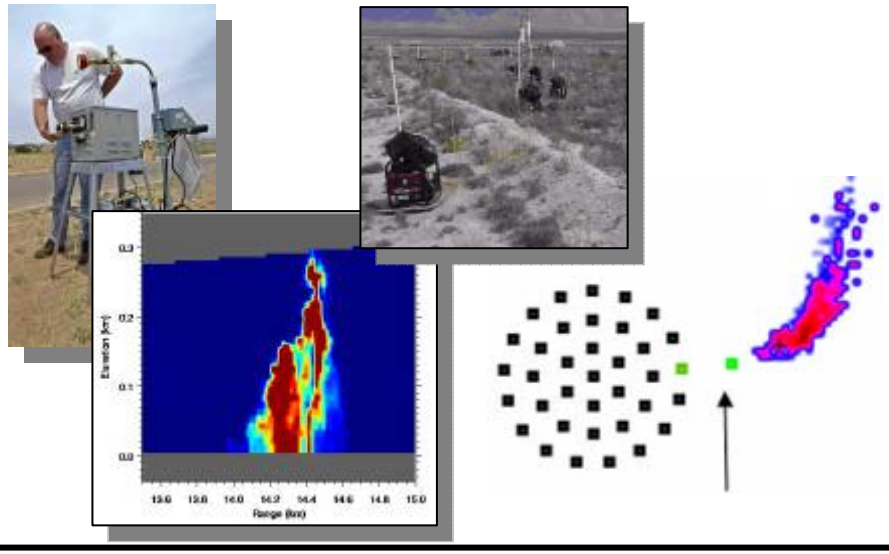
"…develop a centralized database with information about the effects of chemical and biological agents on materials used in weapon systems." This will minimize the risk of unnecessary expenditures on duplicative testing, as well as increase the effectiveness of CB models.

Rapid Assimilation of Sensor Information Research (RASIR)

Objective: Develop scientific techniques for fusing disparate information from multiple sources as part of a technology "push" effort for JEM, JOEF, and JWARN, as well as other identified acquisition programs of record.

Description of Effort: Develop methods to fuse CB sensor information, local meteorology, and environmental data with transport & dispersion (T&D) algorithms for the purpose of source term characterization, hazard prediction refinement, and optimization of sensor networks. This will enhance the capabilities of JEM, JOEF, and JWARN.

Benefit to warfighter: Improves battlespace awareness by identifying source location and movement of environmental hazards through fusing all available information into a well-ordered, manageable system for decision makers.

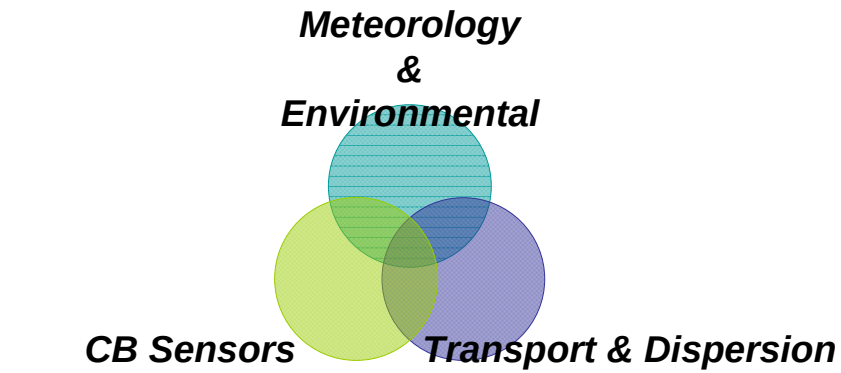


Major goals/milestones:

Near Term (Through FY09)
- Inauguration of SDF-related technologies
- Conduct field trial for V&V of developmental SDF algorithms

Mid Term (Through FY11)
- Transition validated source determination tool
- Transition validated hazard refinement capability
- Transition validated sensor placement tool

Far Term (FY12 & Beyond)
- Develop capability to continuously refine and update contamination footprint through assimilation of limited and disparate information into meteorological and T&D models.



JWARN Joint Warning and Reporting Network

JEM

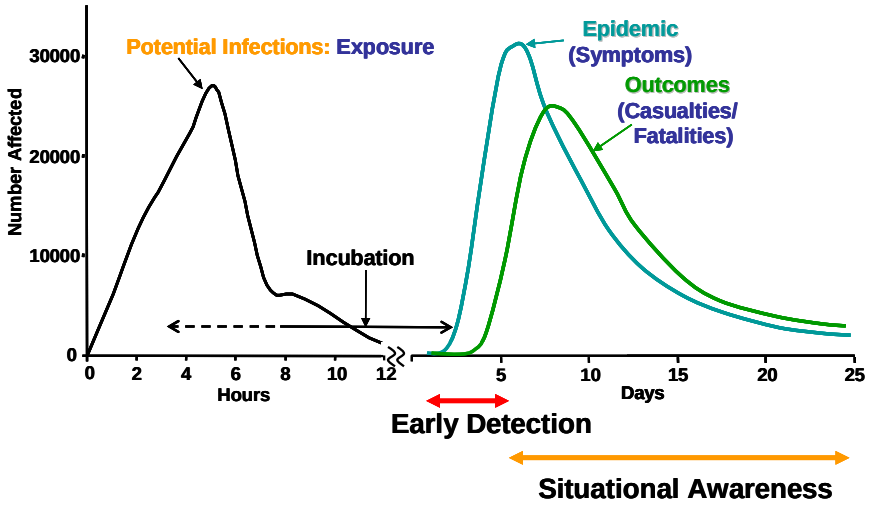
JOEF

Medical Surveillance Systems Thrust Area

Objective: Combine modeling & simulation, medical surveillance, early warning detection and real-time epidemiology to develop technologies and models that can identify anomalies related to infectious diseases in warfighter (and civilian populations if data is available) in-theater using bio-surveillance and early detection models.

Description of Effort: Embark on novel technologies as well as evaluate, validate, support and assist in integration of existing initiatives.

Benefit to warfighter: Minimize warfighter casualty due to infectious diseases, in particular biological WMDs.



Major goals/milestones:

Near Term (Through FY09)

- **Provide a well-founded model for casualty estimates in JEM involving infectious/contagious diseases, both bioagent-induced and naturally occurring.**

Mid Term (Through FY11)

- **Provide models for syndromic surveillance, disease epidemiology, casualty estimation, and prediction of human performance in hazard environments.**
- **Furnish capability to model infectious/contagious diseases, both bioagent-induced and naturally occurring.**
- **Provide capability of casualty estimation (morbidity & mortality) due to CBR agents.**

Far Term (FY12 & Beyond)

- **Provide capability to rapidly and accurately (high sensitivity & specificity) model infectious/contagious diseases, both bioagent-induced and naturally occurring.**
- **Provide comprehensive medical test and evaluation model.**

FY07 Projects:

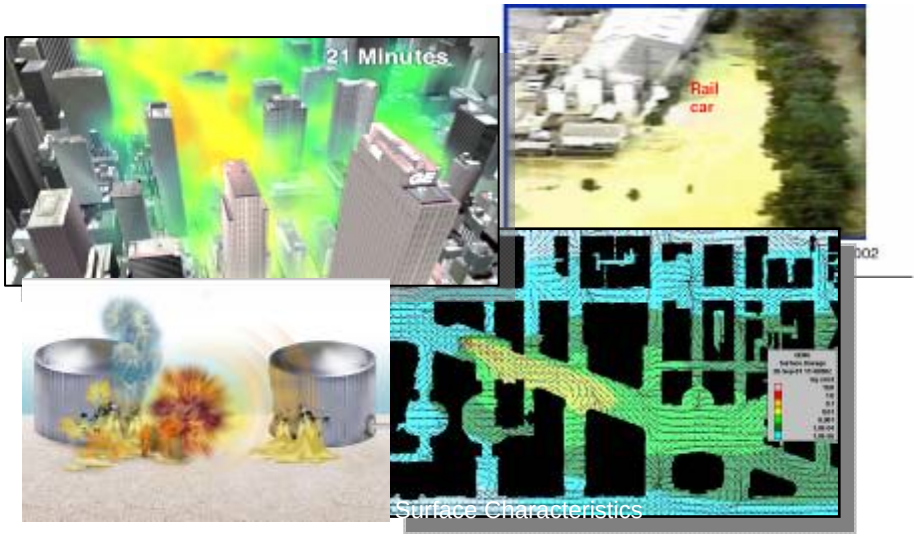
BO07MSB001	Comparison of Existing Medical Surveillance Models
BO07MSB002	Infectious Disease Analysis Capability (IDAC)
CB07MSB100	Predicting Effects Due to Infectious/Contagious Diseases for JEM

CB Advanced Transport and Dispersion Modeling Thrust Area

Objective: Improve battlespace awareness by accurately predicting hazardous material releases and their atmospheric transport and dispersion (T&D). CB Sources, Urban and terrain effects and building interiors are modeled.

Description of Effort: Develop methods and tools incorporating Geospatial data (terrain/urban) and toxic industrial chemical models for dense gas, two-phase flow and pressurized liquids.

Benefit to warfighter: Improves battlespace awareness by integrating T&D with Geospatial data and developing source models to enhance the capabilities of acquisition programs of record.



Major goals/milestones:

Near Term (Through FY09)

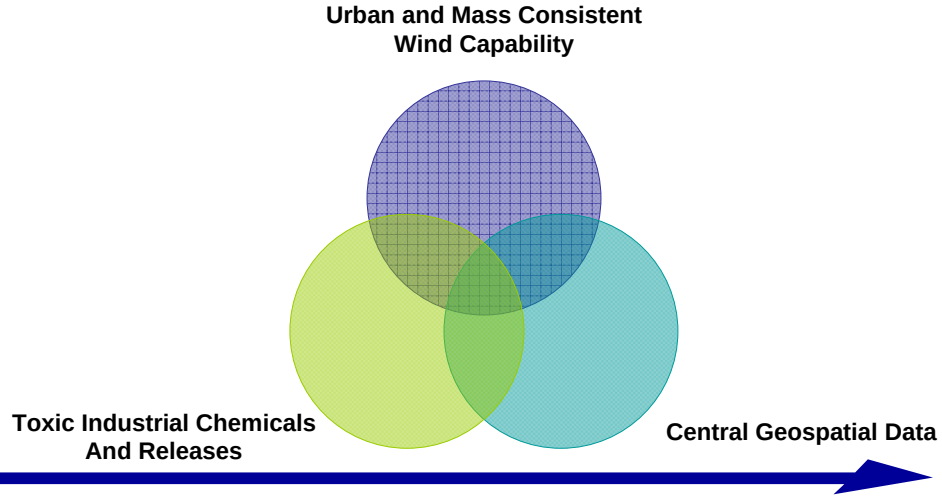
- Improve Geospatial information interface and toxic industrial chemical and release models and atmospheric chemistry.

Mid Term (Through FY11)

- Centralized Geospatial data interface. Incorporate building interior dispersion.

Far Term (FY12 & Beyond)

- Capability to rapidly and accurately model T&D at high resolution in a multitude of environments.

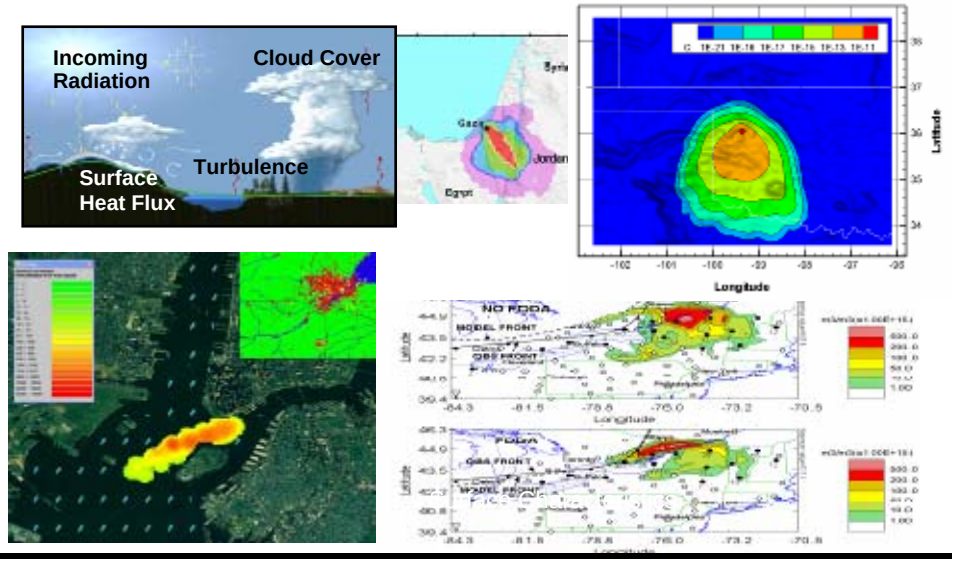


CB Environmental Sciences Thrust Area

Objective: To provide environmental databases and modeling capabilities in order to accurately depict and predict the state of the environment through the use of data assimilation and ensemble methods.

Description of Effort: Develop algorithms and tools to predict T&D for all potential environments including high altitude, urban, coastal, complex terrain, and waterborne domains. Integrate T&D applications with meteorological and other environmental information to enhance chem/bio acquisition programs of record.

Benefit to warfighter: Improves battlespace awareness by accurately representing the environment and quantifying the uncertainty due to the release of hazardous substances.

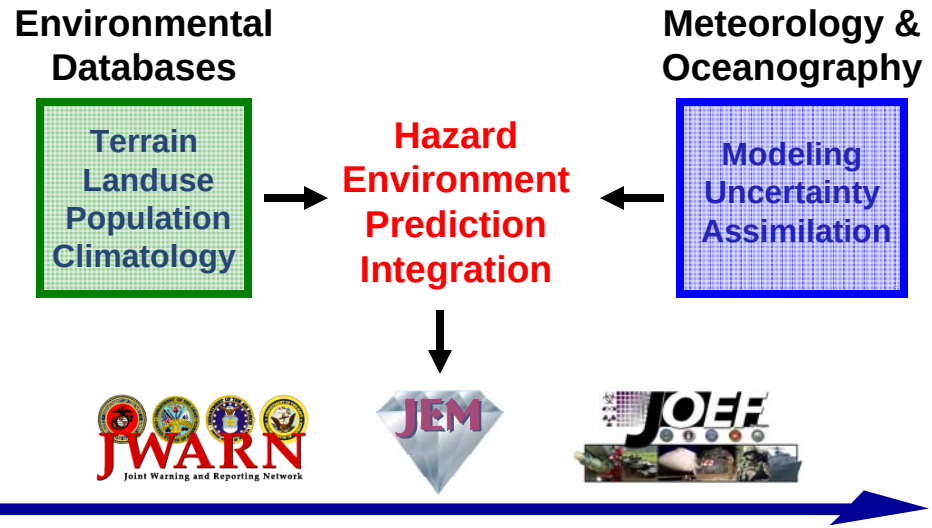


Major goals/milestones:

Near Term (Through FY09)
- Update climatology, terrain, and population databases
- Improve atmospheric boundary layer modeling
- Initial waterborne transport capability

Mid Term (Through FY11)
- Initial high altitude modeling capability in JEM
- Comprehensive Secondary Effects Module transitioned
- T&D modeling uncertainty quantification

Far Term (FY12 & Beyond)
- Capability to rapidly and accurately model T&D at high-resolution and in a multitude of environments. Coupled meteorological, T&D and CB modeling capability for hazard prediction.



CB Warfare Effects on Operations Thrust Area

Objective: Develop the science behind the modeling and simulation of operations in a CB environment at fixed facilities as well as mobile operations for insertion into the Joint Operational Effects Federation (JOEF) acquisition program.

Description of Effort: Develop the tools and modules for modeling operations of airfields, ports, depots, combat units and support personnel, e.g. medical and logistics, for planning and vulnerability analysis in a CB environment to enhance JOEF capabilities. Provide the Combatant Commanders the ability in a CBRNE attack, near real-time Alternative Course of Actions for tactical planning, crisis response, medical/non-medical consequence management with associate probabilities of success and impacts to operations/mission. Asymmetrical warfare and non-conventional weapons responses during full spectrum warfare and peacekeeping/nation building.

Benefit to warfighter: Improves battlespace management by providing tools in which decision makers plan, simulate and execute operations.

Major goals/milestones:

Near Term (Through FY09)

- **APOD impact model transition to JOEF**
- **CBR effects integrated into selected tactical maneuver model**
- **Integrate capabilities from Consequence Assessment Tool Set (CATS) into JOEF**

Mid Term (Through FY11)

- **CBR effects integrated into theater and campaign-level models/simulations**

Far Term (FY12 & Beyond)

- **Federate fully integrated with data backbone**

FY07 Projects:

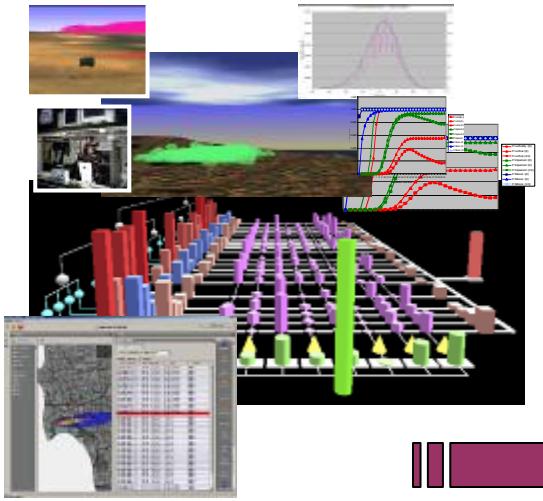
BA05MSB030	CB System Military Worth Assessment Toolkit
BA05MSB052	Next Generation Model of CB Effects on Military Operations
BA06MSB016	Internal Modeling Capability for STAFFS
BA06MSB025	Rapid Mission Impact Assessment Tool
CA06MSB090	Improvements in Chemical, Biological and Radiological (CBR) Operational Effects Modeling Tools and Methods
BB06MSB051	Automated CBRN Data Import/Export Tool
BB05MSB011	CB Effects on Operations: Impact Assessment Tool
BB06MSB017	CBRN in Tactical and Theatre Level Simulation
BB06MSB021	IMPACT Framework

CBDP Decision Support Tools & Methodologies Thrust Area

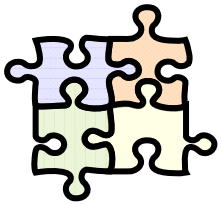
Objective: Develop the science behind tools for decision making and human knowledge management across the CB Defense Program. These tools will be maintained as part of JSTO's full suite of capabilities.

Description of Effort: Develop the tools and modules for investment/portfolio decision support, virtual prototyping, knowledge management and emerging technology exploration for inclusion into the JSTO program.

Benefit to warfighter: Improves the quality of the products, technologies and capabilities supplied to the warfighter at a reasonable cost.



Improved RDA Process



Community data resources

Major goals/milestones:

Near Term (Through FY09):

- **Develop decision support tools for CB investment portfolio.**
- **Identify revolutionary technologies and opportunities in data backbone efforts.**

Mid Term (Through FY11):

- **Fully assess virtual prototyping capabilities, provide full support to efforts focusing on revolutionary concepts.**
- **Determine data to be collected and areas of future research.**

Far Term (Through FY15):

- **Become fully immersed in CB virtual environment to support test and training.**
- **High speed data acquisition supporting full spectrum decision support for CB.**

FY07 Projects:

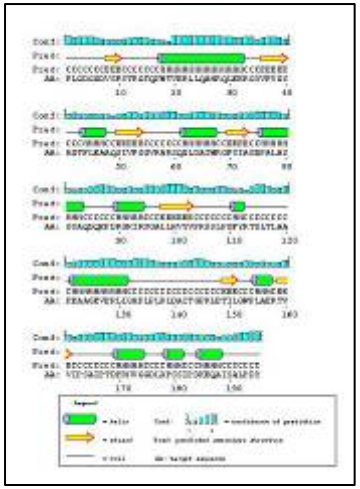
BA05MSB062	Analytic Capabilities Development
BO05MSB070	Multivariate Decision Support Tool for CB Defense
CA06MSB037	CB Simulation Suite
BA05MSB030	CB System Military Worth Toolkit
BA07MSB087	Investment Planning and Analysis Tool

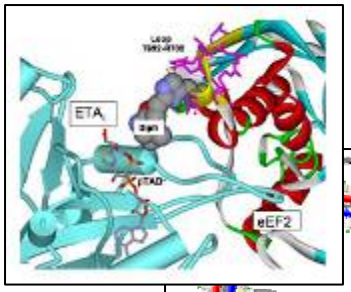
Medical Effects Modeling Thrust Area

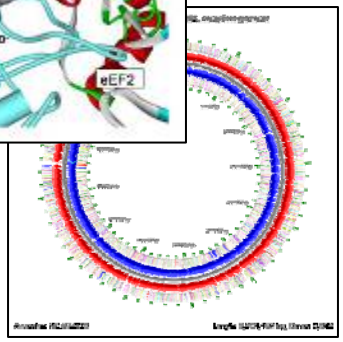
Objective: Provide models for syndromic surveillance, disease epidemiology, casualty estimation, and prediction of human performance in hazard environments.

Description of Effort: Develop the tools and modules to provide syndromic surveillance, disease epidemiology, casualty estimation, and prediction of human performance in hazard environments for the Joint Operational Effects Federation (JOEF).

Benefit to warfighter: Provide increased awareness of medical impacts on warfighters to decision makers to allow for informed planning.







Major goals/milestones:

Near Term (FY07 – FY09)

- **Transition NBC Crest to JOEF**
- **Medical Automation and Support Tools**

Mid Term (FY09 – FY11)

- **Provide models for syndromic surveillance, disease epidemiology, casualty estimation, and prediction of human performance in hazard environments**

Far Term (FY12 & Beyond)

- **Investigate genomic and proteomic modeling within the human body in order to investigate agent pathology**
- **Perform modeling to enable predictive pharmacology and toxicology for therapeutic purposes**

FY07 Projects:

CB06MSB095	NBC CREST Transition to JPM-IS
CB06MSB096	Medical Modeling of Particle Size Effects for Inhalation Hazards
CB07MSB100	Predicting Effects Due to Infectious/Contagious Diseases for JEM

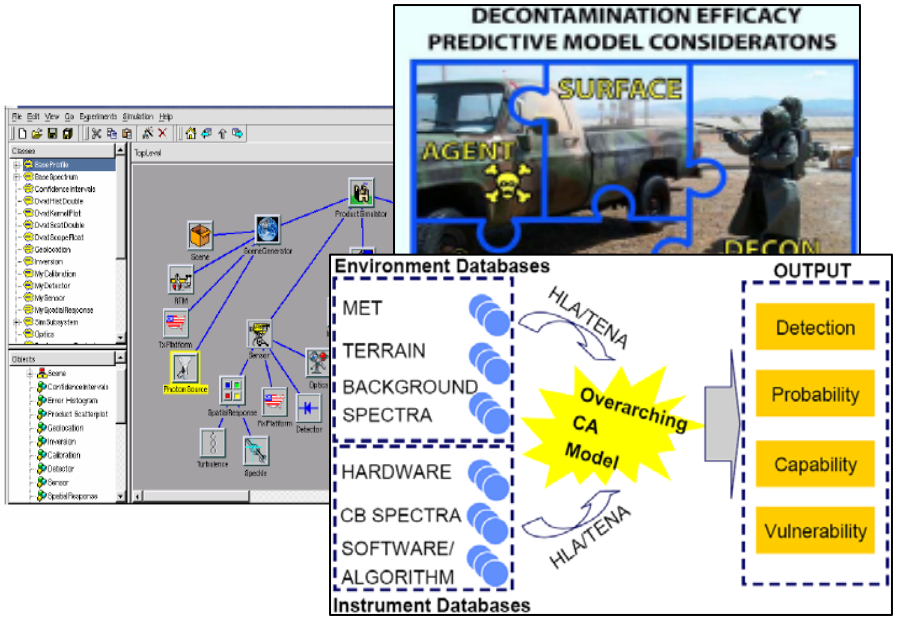
CB Test & Evaluation (T&E) Modeling & Simulation Thrust Area

Objective: Develop the science behind the modeling and simulation tools that assist the T&E community in evaluating CB technologies.

Description of Effort: Develop an integrated CBD toolkit for the test and evaluation of emerging CBD commodities, compatible with all IS programs of record. The toolkit will:

- Support product test and evaluation in light of other CBD products' performance and capabilities,
- Integrate Commodity Area Models in ColPro, IP, CA, and Decon into one toolkit with information passing smoothly between individual commodity models,
- Seamlessly integrate output from JEM regarding agent dispersion and deposition and JWARN NBC detector/sensor data,
- Provide performance information to JOEF and/or the Unit Mission Testing Model, and
- Enable rapid insertion of product test data as it becomes available, from any accredited source, for up-to-date, enhanced commodity models

Benefit to warfighter: Support quality developmental and operational testing of JPEO end items.



Major goals/milestones:

Near Term (Through FY09)

- Development of commodity area models

Mid Term (Through FY11)

- Continue development and transition of T&E models

Far Term (FY12 & Beyond)

- Development of comprehensive medical T&E model

FY07 Projects:

CA06MSB414	Overarching Contamination Avoidance Model for Test and Evaluation
CA06MSB424	CREATIVE Decontamination Efficacy Prediction Model
CA06MSB427	Overarching Collective Protection (COLPRO) Model for Test and Evaluation
	Overarching Individual Protection (IP) Model Feasibility Study

Customers:

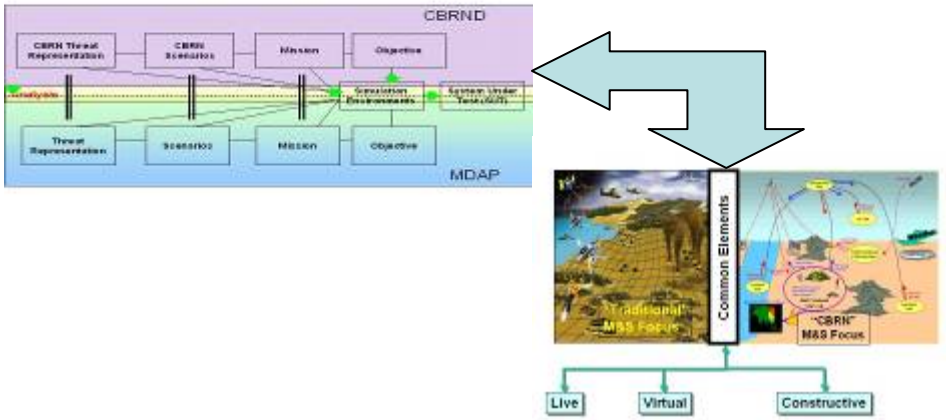
MDAP M&S S&T Thrust Area

Objective: To develop and transition supporting CB M&S for MDAP, and acquisition programs using M&S or M&S programs developing capabilities in support of acquisition.

Description of Effort: Develop the supporting tools and techniques needed to integrate CBRN M&S capabilities to acquisition programs (e.g., Future Combat Systems) using M&S or M&S programs. The scope of this thrust area is in support of acquisition programs that have a CB survivability requirement or KPP.

Benefit to warfighter: Provide coherent CB representation to acquisition programs using M&S or M&S programs

Approach:



Near-Term Projects:

- **Near Term (FY07 – FY08)**
  - **•Transition of CB Sim-Suite to OOS**
  - **•Participate with Simulation Interoperability Standards Organization Study Group on Live, Virtual, Constructive Architecture Interoperability**
  - **•Coordination with JPEO CBD Future Systems Team**

Challenges:

- **Interoperability between CBR M&S and non-CBR M&S**
  - **•Challenge lies in performance, validation, and "fidelity"**

Potential Project Areas:

- **MDAP Areas**
  - **•Future Combat Systems (FCS)**
  - **•Expeditionary Fighting Vehicle**
  - **•Littoral Combat Ship (LCS)**
  - **•DD(X)**
  - **•Amphibious Assault Ship (LHA(R))**
  - **•Aircraft Carrier (CVN21)**
  - **•Joint High Speed Vehicle (JHSV)**
  - **•Joint Maritime Assault Connector (JMAC)**
  - **•Maritime Pre-positioning Force (Future)**
  - **•Joint Strike Fighter (JSF)**
  - **•Theater High Altitude Defense (THAAD)**
  - **•Comprehensive Force Protection Initiative (CFPI)**

IS S&T Basic Science

Technology Push:

- Centralize investment in basic research (6.1)
- Identify and exploit technology opportunities
- Identify and respond to new and emerging threats
- Maintain a robust technology base: knowledge, research capabilities, and test and evaluation methodologies

FY07 Projects:

AO06MSB001	Relationship of Boundary Layer Winds to Soil Moisture & Cloud Properties
AO06MSB002	Link Equations of Motion for Terrestrial and Space Environments
AO06MSB003	Blending CB Dispersion Forecasts and Sensor Data
AO06MSB004	Turbulence in the Stable Boundary Layer