



INSTITUTE FOR DEFENSE ANALYSES

**Training Community Modeling and
Simulation Business Plan:
2009 Edition**

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About This Publication

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Executive Summary

The purpose of the Training Community Modeling and Simulation Business Plan (TMSBP) is to provide a link between the training requirements and those training needs and gaps that can be accommodated with modeling and simulation (M&S). The training functional stakeholders, as represented in the Training Transformation (T2) Senior Advisory Group (SAG) and Executive Steering Group (ESG), provide the direction, oversight, and coordination for projects and capabilities described in this plan. The intent of this document is to provide a transition that updates the content of the 2007 and 2008 editions of the TMSBP with improvements in training needs and capabilities and to provide a reference document for training and M&S stakeholders' inputs. This 2009 TMSBP provides an incremental update of the previous TMSBP publications. The Training Gaps Analysis Forum (TGAF) hosted by U.S. Joint Forces Command (JFCOM) provides continuing input of training issues and priorities for M&S support for training.

A. Background

During fiscal year 2004, the training community conducted a relatively wide analysis: the Training Capabilities Analysis of Alternatives (TC AoA). The TC AoA listed training gaps (training needs) and an M&S capabilities baseline to fill those gaps. The 2007 TMSBP provided an update of the training needs as they were derived and validated by the TC AoA published in July 2004. The TGAF, with the training stakeholders, updated the initial list of 35 training gaps in November 2008 in a continuing process through Fiscal Year (FY) 2009. The TMSBP progress was also briefed at the Worldwide Joint Training Scheduling Conferences in FY09.

At the TGAF, training stakeholders (the combatant commands (COCOMs), Services, and Defense Agencies) voted to revise the priority order of the original 35 TC AoA training gaps and provided comments on a draft combined list of the top 10 training gaps by providing logical groupings for similar training needs. The training "problem areas" reflect the top TGAF issues and the updated priority order of the 35 training needs. The updated training needs list is linked back to the original 35 TC AoA training gaps. This list of training needs forms a training requirements baseline that is broader than the M&S capabilities tool set can handle, and specific training needs may have to be filled by other

training tools or learning content. A corresponding baseline of training M&S capabilities has been updated from the material provided in the TC AoA Final Report, Chapter V, “Assessing Effectiveness.” This updated baseline detailed those training models and federations identified by the training stakeholders as being relevant to training contained in the most commonly used M&S training federations.

References to the TC AoA are maintained within this document and summarized in Appendix A to ensure continuity and for historic reference. During FY09, the TGAF addressed updates to training needs as well as the vocabulary and terms that have changed since the TC AoA was published in July 2004.

B. Approach

Since training needs and technology are constantly changing, the TMSBP will continue to evolve as a living document. The 2007 TMSBP provided the training community “investment strategies” for participation in the M&S Steering Committee (M&S SC) call for M&S projects submitted by the “communities enabled by M&S.” The intent of future updates of the TMSBP is to further address the mid- to long-term efforts and provide justification for major investments in training capabilities funded by future M&S in future Program Objective Memorandum (POM) submissions.

In a like manner, the 2009 TMSBP will help inform the FY11 programs to enhance training capabilities and also recommend enterprise-level efforts for Department of Defense (DoD) corporate actions. The TMSBP identifies capabilities that the training community can leverage to achieve interoperability, reuse, and efficiencies at the enterprise-level and among the other communities enabled by M&S. The 2009 TMSBP updates the list of priorities, problem areas, training needs, and M&S training capabilities necessary to respond to the changing operational context for DoD forces. The M&S Coordination Office (M&S CO) provided a community business plan guidance document that helped shape this 2009 TMSBP as well as the other six 2009 M&S Business Plans for each of the communities enabled by M&S.

The TMSBP describes the process used by the study team and the training community to analyze those M&S capability improvements that are most needed to enhance joint training. It defines a logical, iterative process that began with the 2004 TC AoA, which analyzed the top training gaps and how the training community developed the final recommended investment strategies to fill those gaps. The process continues through the series of TMSBP updates. This plan leverages the M&S efforts, key enablers, and joint federations previously defined and currently being used in training.

C. Key Findings

- The TC AoA training gaps (needs) have been updated, with the assistance of training stakeholder organizations. Several of the training needs have been addressed during the last 5 years, and new needs have emerged to change the training priorities during FY09.
- Several long-standing training needs previously identified are being progressively corrected by joint and Services development programs, while other functional areas remain as unfunded issues.
- The use of M&S in training continues to evolve and to provide improved training capabilities in preparing forces for operational missions.
- Some projects funded by the M&S SC continue to contribute to training capabilities and to the DoD-wide M&S enterprise.

D. Recommendations

- Continue the update process initiated in FY09 by the Joint M&S TGAF conducted by JFCOM to arrive at formal coordination and validation of training needs at senior leadership levels in each stakeholder organization.
- Continue to update the Office of the Secretary of Defense (OSD)-provided training capabilities, which were used as the start point for 2009 TMSBP capabilities baseline.
- Work to resolve long-standing training issues surfaced by the TGAF, including Integrated Air and Missile Missions (IAMM), Cross-Domain Information Sharing (CDIS), and Integrated Joint Logistics.
- Continue to fund the research and development (R&D) efforts at JFCOM to facilitate support for large joint training exercises. The TGAF identified a series of issues that have been grouped as exercise design and integration.
- The training stakeholders should participate with the Joint Staff (JS) Joint Training Directorate (J7) to formally staff the training problem areas and training needs that serve as an updated requirements baseline for future training M&S efforts.
- Provide increased accommodation of the “live training” needs in the LVC training environments.

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1. Background

1.1 Introduction

The 2009 Training Community Modeling and Simulation Business Plan (TMSBP) was prepared by the Institute for Defense Analyses (IDA) under the “Business Plan for Modeling & Simulation” task, funded by the Modeling and Simulation Steering Committee (M&S SC) for the training community led by the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD(P&R)). The task was executed by the Modeling and Simulation Coordination Office (M&S CO), with oversight from the Director of Readiness and Training Policy and Programs (RT&PP) and the training stakeholders as represented by the Training Transformation (T2) Senior Advisory Group (SAG) and the T2 Executive Steering Group (ESG) members. Training needs and problem areas for this update were provided by the Training Gaps Analysis Forum (TGAF) led by the United States Joint Forces Command (USJFCOM) and briefed at the Worldwide Joint Training and Scheduling Conferences in March and August 2009 and March 2010.

The 2009 TMSBP is an update to the previous documents published for 2007 and 2008. It reflects evolutionary changes in the training needs and modeling and simulation (M&S) capabilities since publication of the 2008 TMSBP and, in particular, the emergence of live, virtual constructive (LVC) training environments. The 2008 TMSBP is “Approved for public release; distribution unlimited” and is available on line and as IDA Document D-3934.

1.2 Business Plan Overview

In 2007, the Department of Defense (DoD) adopted a new strategic vision for DoD M&S. To achieve the goals of that vision, each of the DoD communities enabled by M&S was tasked to develop and maintain updates for community-specific M&S business plans. These community plans were envisioned to promote M&S activities and help achieve DoD-wide, corporate-level, and crosscutting M&S needs and capabilities. The original training community document, the 2007 TMSBP, was published in April 2008, with a revised document—the 2008 TMSBP, released in February 2009—that was “Approved for public release; distribution unlimited.”

The 2008 TMSBP provided a transition document that augmented the content of the 2007 TMSBP with updates in training needs and capabilities. It also provided a coordination document that training and M&S stakeholders could use to solicit comments and corrections in preparation for this 2009 TMSBP document update. Figure 1-1 illustrates how the training community business plans are based on the needs and capabilities analyses of the 2004 TC AoA (see also Appendix A of this document).

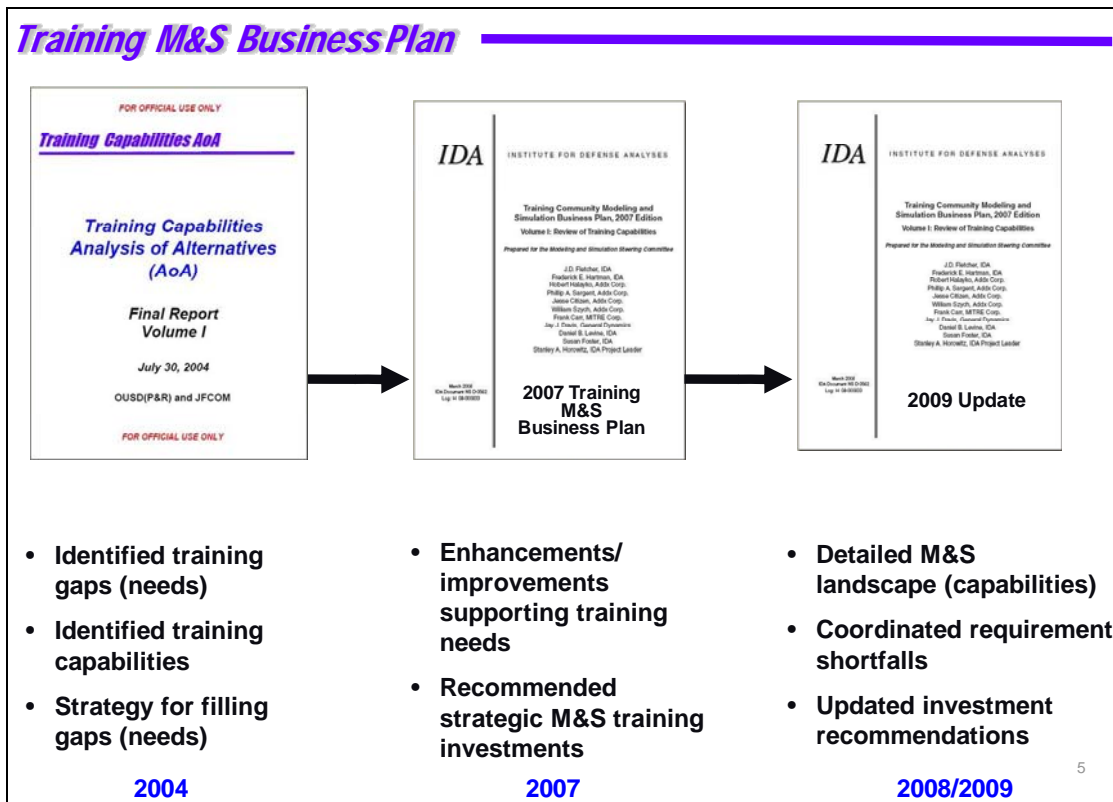


Figure 1-1. TMSBP Updates

The TMSBP publications are iteratively developed to serve as living documents for informing the Office of the Secretary of Defense (OSD) M&S stakeholders about training investment strategies. The 2009 TMSBP is consistent with the M&S CO 2009 Community M&S Business Plan Guidance and follows M&S CO guidance concerning format and content. In 2009, six community plans and input from the newly formed Intelligence Community (IC) will serve collectively to inform the 2010 Department of Defense Modeling and Simulation Corporate and Crosscutting Business Plan (C&CC BP).

The TC AoA observed that operational requirements and training needs are constantly evolving. The objective of the TMSBP is to identify ways to improve and update the M&S contribution with ongoing enhancements for joint training. M&S is a

key part of improving the DoD training capability and includes service-oriented architectures, network-centric data integration, and distributed environments that will allow LVC training capabilities to interoperate seamlessly across a wide spectrum of users and training applications.

This document contributes to training objectives by

- Incorporating a vision of joint training
- Assessing the current M&S capabilities and the gaps between current M&S capabilities and needs
- Describing M&S efforts currently underway to fill the gaps
- Providing a roadmap of management, investment, and technical strategies for identifying new M&S investments designed to help fill any remaining training gaps.

1.3 Oversight Communities

1.3.1 The Training Community

In March 2005, the National Defense Strategy (NDS) directed that military training be transformed in parallel with the ongoing transformation of U.S. forces and missions and established goals for accomplishing this transformation. To carry out these goals, it directed that joint training take the following steps, which are still relevant today:

- Support a broad range of roles and responsibilities in joint, interagency, inter-governmental, and multi-national contexts
- Be flexible and operationally effective
- Be capable of assessing and reporting training readiness for traditional and emerging joint operations
- Employ war games and simulations to multiply the effects of field exercises and experiments.

The T2 program created in 2002 continues to respond to the challenge through its missions to better enable joint operations and the continuous, capabilities-based transformation of the DoD. T2 must have the global presence that will allow training and education to be provided anytime and anywhere to a wide spectrum of training needs and audiences. The February 2006 publication of the Department of Defense Training Transformation Implementation Plan for FY2006–FY2011 describes the following capabilities and enabling technologies for achieving the missions and objectives of the T2 program:

- **Joint Knowledge Development and Distribution Capability (JKDDC).** This T2 capability provides a knowledge management training capability that has real-time reachback between individual warfighters, operational staff, and key information sources. These sources include joint professional military education, data warehouses, and the knowledge management capabilities enabled by the Global Information Grid (GIG).
- **Joint National Training Capability (JNTC).** This T2 capability is primarily focused on building the global LVC training environment for collective training. It is responsible for integrating components of the Joint Live, Virtual, and Constructive Training Environment (JLVC-TE) for leveraging Service capabilities and developments, establishing the connecting communications infrastructure, and sustaining the infrastructure to benefit not only joint training, but also Service Title X training when resources permit.
- **LVC training.** This T2 capability is the integrated LVC training environment enabled by the JNTC. It is designed to create joint warfighting conditions through a networked collection of interoperable training sites and nodes that synthesize personnel, doctrine, and technology to meet the training needs of the combatant commanders (CCDRs) and the Services. The LVC environment melds existing operational and strategic facets of exercises with live forces and with those training in simulators to create a more robust and realistic experience. It supports a wide spectrum of training simulations and tools.
- **Global Knowledge Network.** This T2 capability—an overarching, open-architecture M&S environment—will provide plug-and-play interoperability over a full range of LVC training. It will offer critical elements such as online interactive instruction, comprehensive content repositories, and the emerging GIG.
- **Joint Assessment and Enabling Capability (JAEC).** This T2 capability is responsible for developing an enterprise-level assessment of T2 in coordination with the operative training components. This assessment will be conducted on a continuing basis (vs. performing formal “block assessments” every 2 years).

The training community’s T2 ESG and SAG oversee the development and execution of T2. Their oversight purview is supported by OUSD(P&R) and the RT&PP. This oversight includes the resolution of training issues, all training M&S activities and capabilities, and the allocation, transfer, and execution of all training resources. Figure 1-2 graphically depicts the T2 management and oversight bodies, with relevant stakeholder organizations at each level.

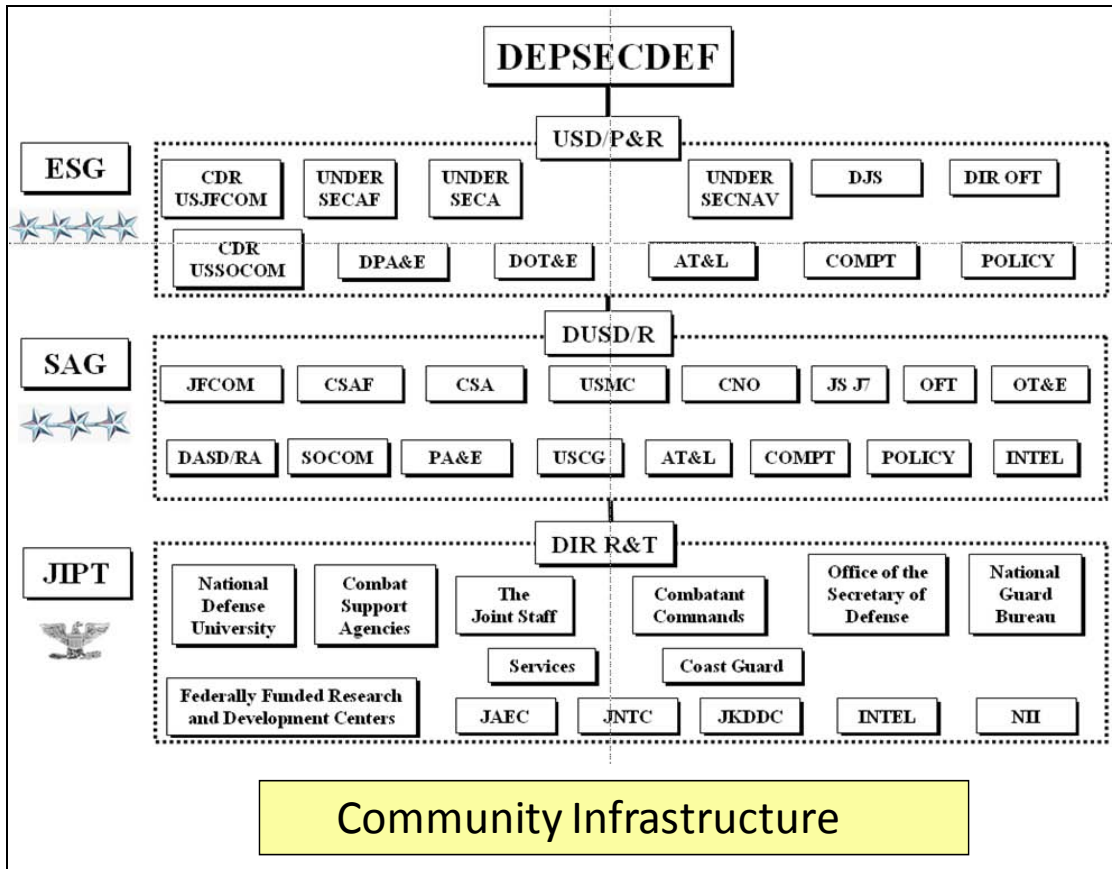


Figure 1-2. T2 Management and Oversight

The T2 Joint Integrated Process Team (JIPT) is the primary forum for providing input to the ESG and SAG and for shaping issues in response to their guidance. The JIPT is chaired by the Director, RT&PP Directorate. The JIPT consists of senior analysts, planners, and action officers from the combatant commands (COCOMs), the Services, the Combat Support Agencies (CSAs), the Joint Staff (JS), and the other DoD staffs and agencies that contribute to DoD T2.

In 2007, the DoD began a new planning approach that has had a profound effect on training practices, processes, and resources. The Guidance for Development of the Force (GDF) and Guidance for Employment of the Force (GEF) were combined with the Joint Strategic Capabilities Plan (JSCP) to provide a comprehensive approach to planning within a resource-constrained environment.

The June 2008 publication of the NDS¹ highlights the importance of training in transforming the U.S. force and working with our international partners: “We must also work with longstanding friends and allies to transform their capabilities. Key to

¹ See <http://www.defenselink.mil/news/2008%20national%20defense%20strategy.pdf>.

transformation is training, education and, where appropriate, the transfer of defense articles to build partner capacity” (p. 16).

The February 5, 2009, edition² of the Strategic Plan for Transforming DoD Training provided an update to the May 8, 2006, edition³ of the document, which had responded to the NDS by calling for the creation of an LVC training environment that would serve as an enabler for transforming U.S. forces and missions: “Provide dynamic, capabilities-based training for the Department of Defense in support of national security requirements across the full range of integrated operations.”⁴

The LVC training environment, as depicted in Figure 1-3, includes the use of M&S systems to create warfighting conditions through a networked collection of interoperable training sites and nodes and interconnected simulations and training tools. The training needs to support this environment are collected from the stakeholders as “issues” on regular basis by the TGAF. The training environment must provide affordable and effective capabilities for training U.S. forces in the joint mission essential tasks (JMETs) and Service mission essential tasks (METs) to meet the needs of the component commanders, Joint Task Force (JTF) staffs, Standing Joint Force Headquarters (SJFHQ), component commands, and the military Services. The ultimate goal in training U.S. joint forces to meet operational performance objectives is to prepare forces for the environments in which they are intended to operate. The LVC training environment provides enhanced training situations and, through the use of the Joint Training Experimentation Network (JTEN), the ability to “train from home station”—as recommended over the last 2 decades but only recently realized on a large scale as the United States prepares its forces for deployment to areas of operation around the globe.

1.3.2 The M&S Community

The TMSBP contributes to the Strategic Vision for DoD Modeling and Simulation,⁵ which includes empowering DoD with the M&S capabilities that effectively and efficiently support the full spectrum of the Department’s activities and operations.

² See http://www.defenselink.mil/prhome/docs/T2_STRAT_PLAN_Final_Feb2009.pdf.

³ See <http://www.t2net.org/downloads/FinalTrainingTransformationStrategic2006.pdf>.

⁴ This statement appears on p. 12 of the 2008 edition and p. 8 of the 2009 edition.

⁵ See <http://www.msco.mil/StrategicVision.html>.

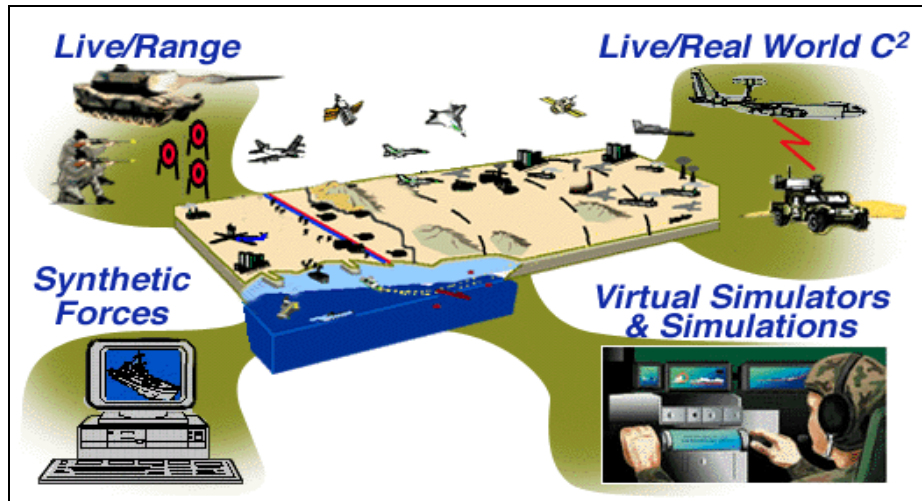


Figure 1-3. The LVC Training Environment

The goals of DoD M&S efforts are to provide

- Standards, architectures, networks, and environments
- Policies at the enterprise level
- Management processes for M&S content and data
- Tools in the form of M&S and authoritative data
- Well-trained people.

In addition to the training community governance processes, Department of Defense Directive (DoDD) 5000.59, DoD Modeling and Simulation (M&S) Management, dated August 8, 2007,⁶ established an M&S SC for oversight and coordination at the department level. A representative designated by the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) chairs the M&S SC, which is comprised of members from the four Services, from the seven DoD M&S-enabled communities, and from the JS representing the COCOMs. The M&S Integrated Process Team (IPT) supports the M&S SC in managing the DoD enterprise activities through the implementation of approved corporate and crosscutting strategies as discussed in the 2008 DoD M&S C&CC BP.⁷ The M&S CO functions under the guidance of the Director Defense Research and Engineering (DDR&E). The office coordinates the Services, the seven communities, the JS, and a large number of M&S projects funded by the M&S SC. The M&S CO serves as an Executive Secretary to the M&S SC and chairs the M&S IPT.

⁶ See <http://www.dtic.mil/whs/directives/corres/pdf/500059p.pdf>.

⁷ See http://www.msco.mil/files/Modeling%20and%20Simulation%20Corporate%20and%20Crosscutting%20Business%20Plan_F.2.pdf.

Figure 1-3 depicts the M&S enterprise governance approach. It is organized by communities designed to support and integrate M&S activities across the department.

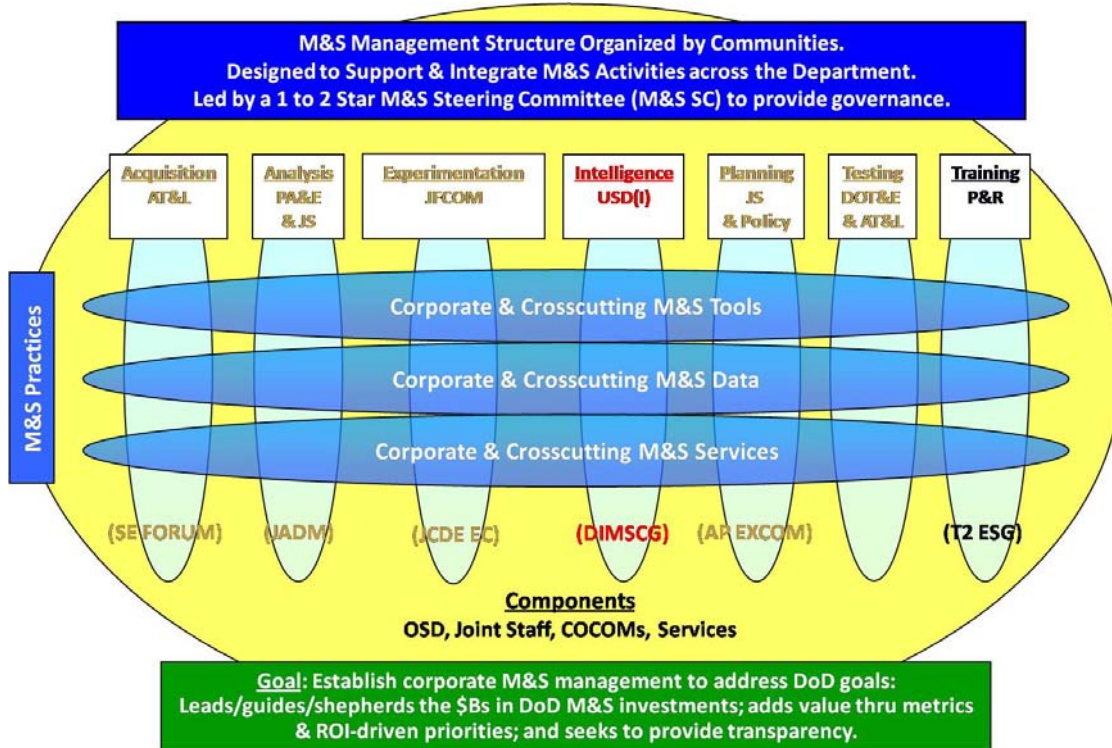


Figure 1-3. M&S Management Structure Organized by Communities

The management goal of DoD’s M&S efforts is to provide “management processes for models, simulations, and data that (1) enable M&S users and developers to easily discover and share M&S capabilities and provide incentives for their use, (2) facilitate the cost-effective and efficient development and use of M&S systems and capabilities, and (3) include practical validation, verification, and accreditation guidelines that vary by application area.” These goals for M&S management are extracted from the Strategic Vision for DoD Modeling and Simulation.⁸

⁸ See <http://www.msco.mil/StrategicVision.html>.

2. Training M&S Major Studies, Events, and Exercises

This section, provided at the request of the M&S CO, presents insights into the training community and indicates to those outside the community the way that training incorporates M&S into ongoing activities. Several studies, events, and exercises were started or carried over in Fiscal Year (FY) 09 to enhance training M&S capabilities. Subsection 2.1 provides a brief synopsis of major studies intended to enhance the way training is delivered to the intended audience. The JLVC Federation is gaining more widespread use to support joint training. Subsection 2.2 provides an example of a large joint, multi-national exercise, Talisman Saber, supported by the JLVC Federation.

2.1 M&S Major Projects

The following summary is a brief outline of major M&S-SC-sponsored projects that have direct application to the M&S enhancement of training environments.

2.1.1 Live, Virtual, and Constructive Architecture Roadmap (LVCAR) Implementation

The LVCAR project is comprised of five separate tasks, as follows:

- Managing the LVC environment
 - Provide direct support to LVCAR project management and government teams
 - Assess LVC management options
 - Maintain situational awareness (SA) of LVCAR execution and activities.
- Architecture-Independent Object Model Components (aka the Joint Composable Object Model (JCOM))
 - Recommend the best long-term approach for reconciling inherent incompatibilities—an approach that incorporates architecture-independent and architecture-dependent features
 - Create a set of recommended architecture-independent object modeling standards and resources
 - Recommend a methodology for reconciling differences between object models.

- LVC architecture convergence design and implementation
 - Assess existing architectures (e.g., Distributed Interactive Simulation (DIS), High Level Architecture (HLA), and Test and Training Enabling Architecture (TENA)) to identify candidates for convergence
 - Examine technical issues related to architecture convergence
 - Determine feasibility and design of convergence
 - Provide feasible options to achieve convergence.
- LVC common gateways and bridges
 - Establish common gateways and bridges
 - Conduct survey of extant gateway and bridge requirements, existing capabilities/technologies, and development efforts
 - Improve gateway and bridge robustness and performance
 - Develop a recommended implementation plan and strategy for the incremental development, testing, and distribution of common gateway(s)/bridge(s).
- Establishing common LVC capabilities – independent system engineering process
 - Describe and document a common, architecture-independent systems engineering process
 - Examine existing architecture-specific process models (e.g., Institute of Electrical and Electronics Engineers (IEEE) 1516.3, IEEE 1278.3, TENA Concept of Operations (CONOPS)) to identify key similarities and differences
 - Develop a recommended common systems engineering process model for all users of distributed simulation
 - Recommend an implementation strategy to employ the common process model.

2.1.2 M&S Community of Interest (COI) Discovery Metadata Update/Adoption

- Adopt the Mission Support Center (MSC) Defense Message System (DMS) through implementer assistance
- Update the MSC DMS
- Coordinate Department of Defense Discovery Metadata Specification (DDMS) extensions with the Defense Information Systems Agency (DISA) and other COIs

- Develop a guide to implement the MSC DMS
- Provide technical support to the establishment and conduct of the MSC DMS Configuration Control Board (CCB).

2.1.3 Updating the Verification, Validation, and Accreditation (VV&A) Recommended Practices Guide (RPG)

- Review the current version of the VV&A RPG
- Incorporate a concrete example to the VV&A RPG and identify potential changes
- Produce a report detailing required changes
- Prepare a publication draft of the revised VV&A RPG
- Facilitate reviews
- Prepare a report detailing basis for any necessary adjudication
- Coordinate related VV&A activities with the North Atlantic Treaty Organization (NATO) Modeling and Simulation Group (NMSG).

2.1.4 High Level Architecture (HLA) Efforts

- Coordinate HLA activities
- Develop an HLA standards representation
- Provide Run-Time Infrastructure (RTI) verification service to the general HLA user community
- Develop Federate compliance test tools
- Revise the HLA Object Model Template (OMT)
- Update the Distributed Simulation Engineering and Execution Process (DSEEP) standard.

2.1.5 Automated M&S Standards Vetting Tool (SVT) and VV&A Documentation Tool (VDT)

- Maintain the DoD Standards Vetting Tool (DSVT) and the DoD VV&A Documentation Tool (DVDT)
 - Maintain an efficient and responsive Help Desk
 - Maintain software and databases
 - Provide hosting and system security.

2.1.6 HLA Testing and Help Desk

- Provide an HLA compliance testing service based on DoD 1.3 and IEEE 1516 HLA standard
- Provide responses to HLA Help Desk queries from the DoD M&S Community and from the broader M&S community
- Participate in the NATO Certification Advisory Group (CeAG) as the U.S. HLA Certification Testing Agent.

2.1.7 The Synthetic Environment Data Representation and Interchange Specification (SEDRIS) Usage Study

- Conduct a SEDRIS study to assess SEDRIS usage across the DoD and help determine the options available for future SEDRIS management
- Study will assess
 - Who is using the SEDRIS standards
 - How those standards are being used (requirements being met)
 - What parts of the SEDRIS standards and associated technologies are being used
 - How the users would be affected if the current SEDRIS development and maintenance activities were curtailed.

2.1.8 Environmental Data Coding Standard (EDCS)/National System for Geospatial Intelligence (NSG) Feature Data Dictionary (NFDD) Harmonization Documentation

- Capture contents of different geospatial data dictionaries into a single database for comparison and analysis
- Compare geospatial feature/entity type, attribute names and definitions, and assess equivalent overlapping terms and definitions between dictionaries
- Develop recommended changes to the NFDD to permit the EDCS to be used to mediate data from NFDD for exchange with other applications and to permit the NFDD to accept data mediated by EDCS from other applications.

2.1.9 Development and Maintenance of M&S Standards to the Joint Training Integration and Evaluation Center (JTIEC)

- Support and participate in NATO-related, DoD-adopted M&S standards
- Maintain an M&S discovery metadata specification
- Maintain the DSVT and the DVDT.

2.1.10 M&S Catalog/Visibility

- Facilitate M&S visibility and usability by implementing publish and subscribe services for M&S metadata across DoD's networks:
 - Improve the metadata foundation
 - Increase the number of source nodes
 - Build the Spiral 2 catalog
 - Document the search and discovery process
 - Establish governance
 - Operate and maintain the catalog.

2.2 JLVC Federation Example

Talisman Saber 09 (TS09) was a distributed training exercise, with elements of the training audiences located in Rhode Island, Florida, Hawaii, and Australia. The JLVC Federation supporting TS09 consisted of federated simulations from multiple locations using HLS and DIS architectures that were also connected to the Australian Defence Training and Experimentation Network (DTEN) and live ranges within Australia. Figure 2.1 shows the geographic setup for TS09.

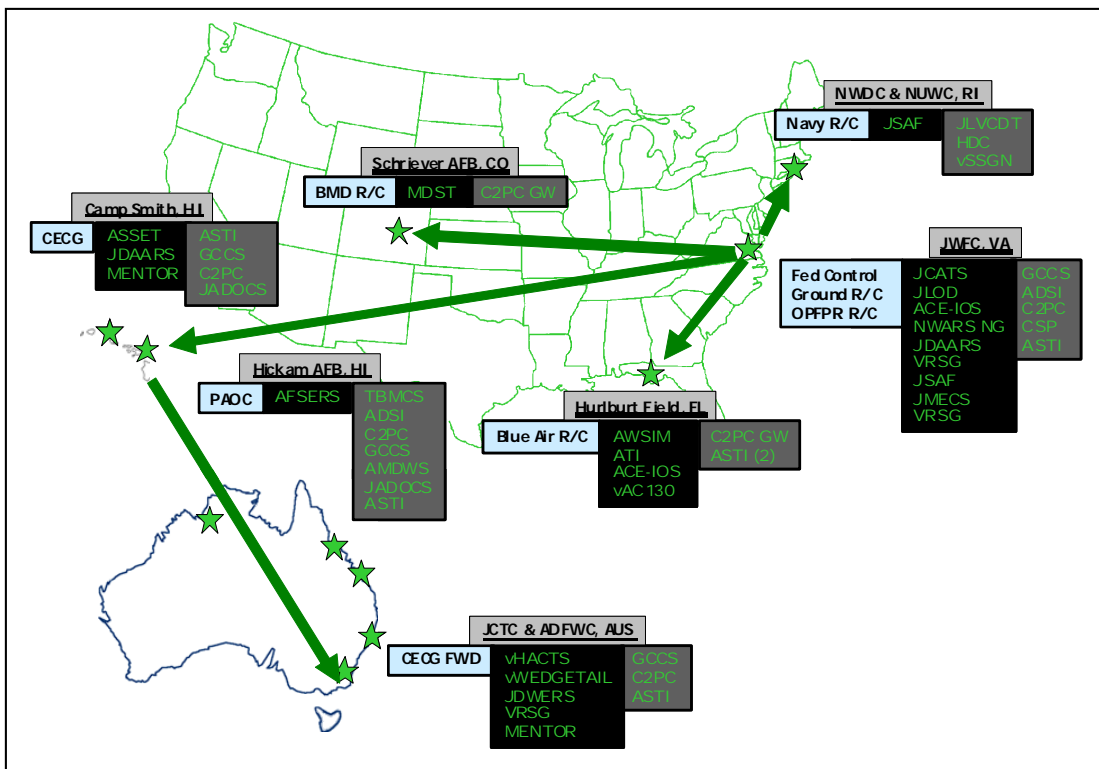


Figure 2-1. Geographic Locations of Simulations, Command, Control, Communications, Computers, and Intelligence (C4I) and Response Cells for TS09

TS09 was a combined/joint Command Post Exercise (CPX)/Field Training Exercise (FTX) that exercised III Marine Expeditionary Force (III MEF) with various Australian air, ground, and naval components as a Combined Task Force (CTF) for certification as a United States Pacific Command (USPACOM) JTF-capable headquarters (HQ). The exercise focused on operational and tactical interoperability through a high-end, medium-intensity scenario that involved LVC forces and included combat operations transitioning into peacekeeping or other post-conflict operations. The JTEN wide area network (WAN) provided transport for M&S clients, Voice over Internet Protocol (VoIP), and Video Teleconference (VTC). The Joint Training Environment (JTE) included the Combined Enterprise Regional Information Exchange (CENTRIX) Four Eyes (CFE) network, which provided a venue for Australian and U.S. forces to train together using a secure network. Figure 2-2 gives information about the different entities that supported TS09.

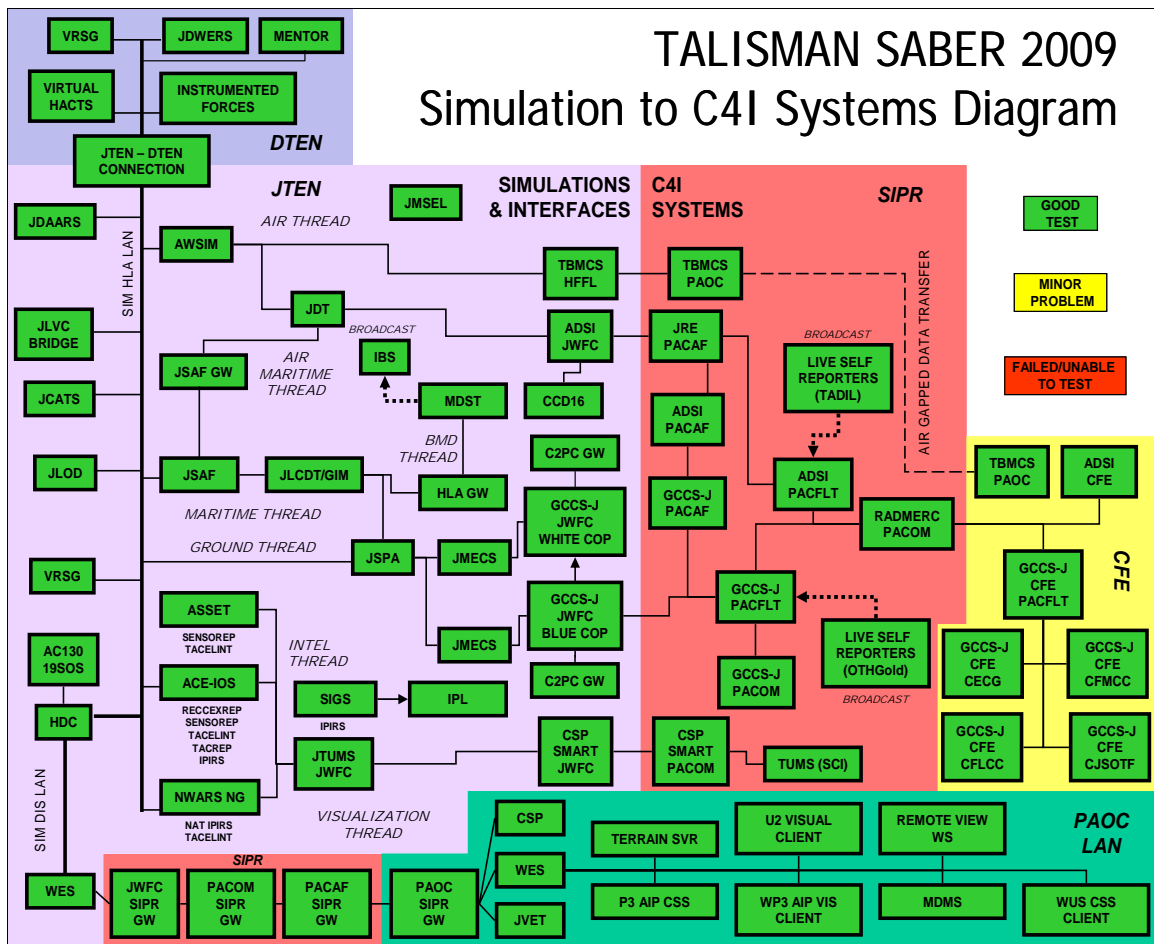


Figure 2.2 Constructive Simulations, Interfaces, C4I, Virtual Simulation, and Networks Supporting TS09

2.2.1 TS09 Training Objectives

The TS09 training objectives were as follows:

- Improve Australian/U.S. combat training, readiness, and interoperability
- Form a CTF, emphasizing joint combined manning within all exercise events
- Conduct a joint and combined CPX, including U.S. led United Nations Security Council Resolution (UNSCR)-authorized CTF HQ and providing command and control (C2) of live forces conducting the linked FTX
- Conduct a combined JLVC FTX designed to advance combined interoperability and operational readiness and improve bi-lateral combined-arms interoperability
- Make tangible progress on improving interoperability and capability to conduct joint and combined operations with Australia (a priority)
- Use USPACOM SJFHQ as a means to improve CTF operations
- Integrate live forces into the exercise design and maximize working interoperability and coordination issues
- Conduct an ongoing in-progress CTF Peace Enforcement Operation, culminating with planned transfer of authority from the CTF to a United Nations (UN) Force HQ Peacekeeping Operations Force
- Provide C2 to combined forces deploying into the Combined/Joint Operations Area (CJOA)
- Provide logistical oversight/support to all CJOA forces and improve combined logistical interoperability.

2.2.2 Joint Tasks Trained in TS09

TS09 provided training for a wide range of joint tasks, which included

- OP 1.1 Conduct Operational Movement
- OP 1.2 Conduct Operational Maneuver and Force Positioning
- OP 2.1 Establish the Joint Force Intelligence Enterprise
- OP 2.2 Conduct Intelligence Staff Operations
- OP 3.1 Conduct Joint Force Targeting
- OP 4.4 Coordinate Support for Forces in the Joint Operations Area
- OP 4.5 Manage Logistic Support in the Joint Operations Area
- OP 5.1 Acquire and Communicate Operational-Level Information and Maintain Status

- OP 5.3 Prepare Plans and Orders
- OP 5.4 Command Subordinate Operational Forces
- OP 5.5 Establish, Organize, and Operate a Joint Force Headquarters
- OP 5.6 Coordinate Operational Information Operations (IO)
- OP 5.7 Coordinate and Integrate Joint/Multi-national and Interagency Support
- OP 6.2 Provide Protection for Operational Forces, Means, and Noncombatants
- OP 7.3 Conduct Security Cooperation and Partner Activities Operations in Joint Operations Area (JOA).

2.2.3 TS09 Summary

TS09 provides an example of interoperability and reuse within the training community, which routinely conducts complex exercises connecting training audiences and simulation systems at various locations around the world. The training community leverages many systems between Services, agencies, and other organizations that meet stated training needs. However, critical gaps remain unfilled because of the need to continue to compose training faster by obtaining and sharing data and by integrating systems faster, conduct training with less overhead and fiscal resources, and increase the realism of the training experience. Several current training needs and problem areas are addressed in this training event. The Cross-Domain Information Sharing (CDIS) issues are most obvious when training with the Australian forces. The ability to connect the Australian DTEN to the U.S. JTEN demonstrates a significant step forward in the ability to train seamlessly with our multi-national coalition partners.

3. Assessment Approach

The first step for improving M&S to support training is to recognize the deficiencies in joint training—the gaps between the current capabilities and the ultimate goals—that resulted from the needs analysis. The goals are determined by analyzing the requirements of the operational forces and, from these requirements, deriving the training needs based on priorities within each of the stakeholder organizations. Current capabilities are determined from the list of existing M&S capabilities. The M&S training gaps are the difference between the goals and current capabilities.

3.1 Gaps Determination Process

The 2009 TMSBP assessment process is a refinement of the TC AoA and begins with a requirements analysis, which then drives the training needs (see Figure 3-1). A parallel effort establishes a capabilities “baseline” to provide a set of training federations and the simulations and tools needed to support those training events and activities.

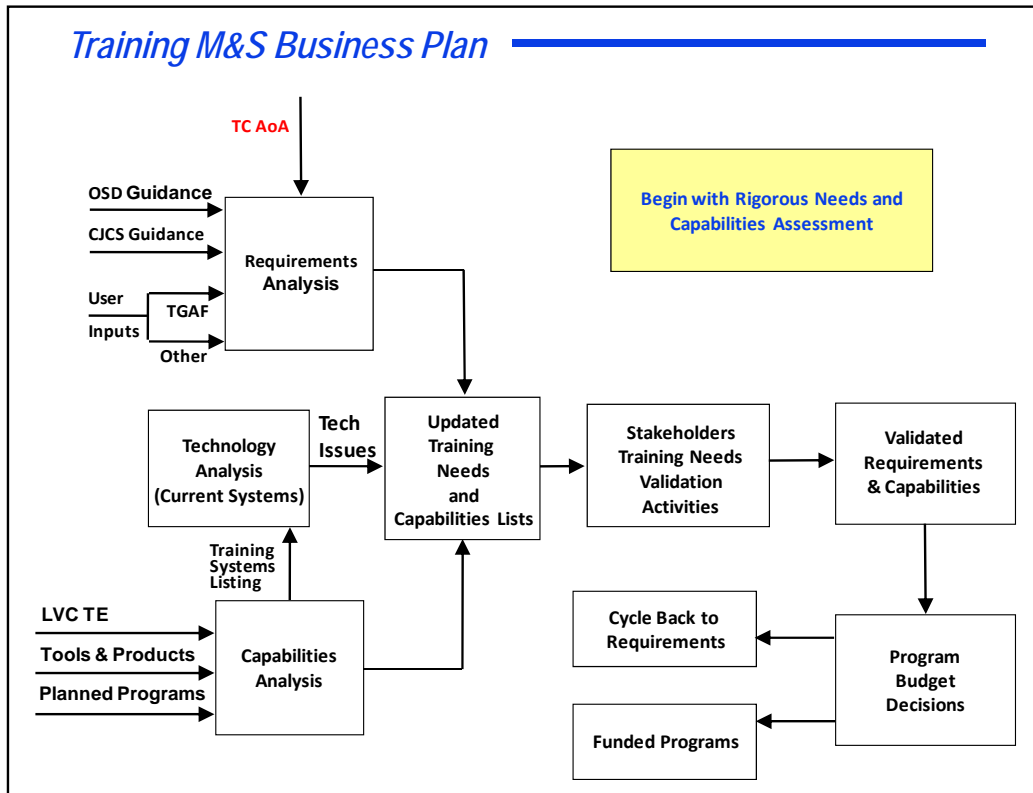


Figure 3-1. Training M&S Gaps Update Process

Note for Figure 3-1: TC AoA refers to the 2004 Training Capabilities Analysis of Alternatives.

The updated training needs are compared to existing capabilities, and the resulting differences are considered to be training M&S gaps. The update process included input from training stakeholders in the TGAF, first convened at the Joint Forces Command (JFCOM) in November 2008 and continued through electronic coordination and VTC meetings during 2009. The stakeholder issues were presented and refined at the TGAF. The group updated the traditional TC AoA training gaps, which were then grouped into 10 Joint Training Enterprise (JTE) problem areas and given new priority ordering. The updated list of 35 training needs forms the basis for the 2009 TMSBP needs assessment.

3.2 The 2004 TC AoA Needs Assessment

The foundation of the training community's analysis of needs and capabilities stemmed from the 2004 TC AoA's analysis of joint and Service training. The TC AoA analyzed the ability to meet joint training needs, as determined from the following sources:

- JMETS identified by the COCOMs and Services.
- Higher level guidance and directives, such as the Quadrennial Defense Review (QDR) (the updated list now includes the GDF, the GEF, and the Chairman's list of High-Interest Training Issues (HITIs)). The HITIs are listed and defined in the Chairman of the Joint Chiefs of Staff (CJCS) Notice 3500.01, 2009–2010 Chairman's Joint Training Guidance, dated 8 September 2008.⁹
- Training requirements and capabilities identified by the Joint Training Requirements Group (JTRG). The JTRG is now known as the TGAF.
- The Requirements/Alternatives Business Game and the Senior Steering Group (SSG) meeting conducted in January 2004.
- Data gathered by the JFCOM and the Services.

The AoA study team initially defined 13 gaps between training capabilities and requirements. These gaps were reviewed further by a "Tiger Team" of people from the JS Joint Training Directorate (J7), the COCOMs, and the Services. This review led to an expansion of the gaps to 35. Table 3-1 lists these 35 gaps in order of decreasing priority as determined by the Tiger Team.¹⁰

⁹ See http://www.dtic.mil/cjcs_directives/cdata/unlimit/n350001.pdf.

¹⁰ The Tiger Team divided the gaps into two tiers. Tier I comprised the first 30 gaps, which were identified as transformational, influenced Program Objective Memorandum (POM) 2006, and received initial or increased funding. Tier II comprised the remaining five gaps, which were judged deserving of support at their current levels and increases in funding as needed beginning in FY08.

Table 3-1. Training Gaps Identified by the 2004 TC AoA

Gap No.	Gap Description
1	Train JTF staffs (includes need for Individual joint training)
2	Train SJFHQ staff (includes need for Individual joint training)
3	Train on crisis action planning (CAP) and deployments
4	Provide faster/higher fidelity mission rehearsal
5	Train forces on joint urban operations (JUO)
6	Train forces on IO (including information warfare, computer network exploitation, computer network defense, and computer network attack)
7	Train forces in a Joint Interagency Intergovernmental, Multi-national (JIIM) environment (including IC participants)
8	Provide homeland defense training
9	Provide multi-command missile defense training
10	Train forces in enemy chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) exploitation and destruction
11	Train to operate in CBRNE environments
12	Train on effects-based planning and effects-based operations (EBO)
13	Train theater/strategic forces to conduct C4I operations using the Collaborative Information Environment (CIE)
14	Train forces on realistic logistics requirements (including reception, staging, onward movement, and integration (RSOI))
15	Practice Active Component (AC)/Reserve Component (RC) integration and mobilization training
16	Train forces on stability and support operations (SASO)
17	Train forces on military assistance to civilian authorities operations
18	Train Special Operations Forces (SOF) and conventional forces for integrated operations
19	Train forces (operational and tactical level) to use national intelligence systems
20	Train routinely with the Joint Operation Planning and Execution System (JOPES)
21	Train routinely with new adaptive planning and deployment systems
22	Train the IC as they fight (including all levels as a tactical participant)
23	Train the Joint Interagency Coordination Group (JIACG)
24	Train staff to coordinate personnel recovery operations (PRO)
25	Train Global Ballistic Missile Defense (GBMD)
26	Conduct global strike training
27	Train critical infrastructure protection (CIP)
28	Operations/intelligence center training, integration, and command education
29	Strategic information assurance
30	Continuity of Operations (COOP)
31	Train on operational systems (dedicated bandwidth)
32	Train on consequence management (CM) operations
33	Provide special operations crisis action procedures training
34	Provide the IC SOF-specific training at the operational level
35	Plan, coordinate, and practice mission assurance

4. Training M&S Needs Assessment

This section presents an assessment of training needs as updated by the TGAF and indicates the priorities for enhancements in M&S capabilities. The needs assessment is based on the 35 gaps originally identified by the 2004 TC AoA, which were updated by the training stakeholders in 2009. Table 4-1 compares the updated list and the original list. Subsection 4.1 lists the JTE top 10 problem areas. In Subsection 4.2, the problem areas are described in more detail and are associated with their respective training needs.

4.1 The Top 10 Problem Areas

The training stakeholders identified the top 10 JTE problem areas (along with their associated training needs). These problem areas were regarded as high-priority targets for funding. These 10 problem areas are as follows:

- Integrated Air and Missile Missions (IAMM)
- Exercise Design and Integration (EDI)
- Cross-Domain Information Sharing (CDIS)
- Integrated Joint Logistics
- Joint Task Force (JTF) Training
- Irregular Warfare (IW) and Political, Military, Economic, Social, Infrastructure, and Information (PMESII)
- Integrated Special Operations Forces (SOF)
- Intelligence Training: Strategic to Tactical
- Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives (CBRNE) Environment
- Integrated Homeland Defense and Consequence Management (CM) Missions.

4.2 Training Needs

Each problem area has one or more associated training needs. This section describes the problem areas and addresses the training needs associated with each one.

Table 4.1 Training Needs Comparison

2009	AoA	Training Needs
1	1	Train CJTFs
2	7	Train forces in a JIIM environment (including Intelligence)
3	4	Provide faster/higher fidelity mission rehearsal
4	3	Train for CAP and deployments
5	2	Train SJFHQ
6	14	Train forces on realistic logistics, including RSOI and sustainment of the force, including retrograde operations
7	9	Provide multi-command Ballistic Missile Defense System (BMDS) training
8	6	Train forces on IO (including information warfare, computer network exploitation, computer network defense, and computer network attack)
9	16	Train forces on SASO
10	18	Train SOF and conventional forces for integrated operations
11	22	Train the IC as they fight
12	11	Train to operate in a CBRNE environment
13	5	Train forces for JUO
14	17	Train forces on DSCA
15	8	Provide homeland defense training
16	20	Train routinely with JOPES
17	12	Train on IW
18	13	Train theater/strategic force to conduct C4I operations using the CIE
19	21	Train routinely with new adaptive planning and deployment systems
20	23	Train the JIACG
21	25	Train for GBMD
22	10	Train forces in enemy CBRNE exploitation and destruction
23	19	Train forces (operational and tactical level) to use the national intelligence system
24	26	Conduct global strike training
25	24	Train staff to coordinate PRO
26	27	Train for CIP
27	28	Operations/intelligence center training, integration, and command education
28	31	Train on operational C2 systems and networks (dedicated bandwidth)
29	15	Train for integration and mobilization of ACs and RCs
30	32	Train on CM operations
31	30	COOP
32	29	Train forces on strategic information assurance
33	33	Provide crisis action procedures training
34	34	Provide the IC SOF-specific training at the operational level
35	–	Train forces on all missile missions
–	35	Plan, coordinate, and practice mission assurance

4.2.1 IAMM

The Strategic Command (STRATCOM) and the North American Aerospace Defense Command/Northern Command (NORAD/NORTHCOM) do not have the required models of sensors to stimulate C2 systems that allow training of IAMMs at all levels and consistent with operations. The end-to-end information flows and decision processes required to replicate air and missile defense (AMD) cannot be created in training simulations. Existing simulations are engineering centric, crew specific, uncoordinated, and not interoperable and do not support training in the multi-command, operational AMD missions.

4.2.1.1 Provide Multi-Command BMDS Training

To conduct multi-command BMDS training, we have to provide an environment for training of the target audience at three levels:

- Element-level (operation and sustainment of the element)
- COCOM level (employment and command oversight of the BMDS)
- National level leadership (high-level policy).

BMDS training should focus on the following areas:

- **Threat.** Country and regional-specific ballistic missile defense (BMD) threats, order of battle (OOB), and operational procedures
- **Policy and procedures.** BMD guidance, planning assumptions, and tactics, techniques, and procedures (TTP)
- **Weapons and sensors.** Capabilities and limitations, weapons system availability and reliability, and employment considerations
- **C2.** Command relationships, planning tools, communications modes for planning coordination, C2 systems availability and reliability, SA
- **Sustainment.** Maintenance, logistics, mobility, and supportability.

4.2.1.2 Train for GBMD

GBMD is becoming more important as several countries appear to be continuing their quest for ballistic missile capability. To address that threat, we must develop an environment for GBMD training that focuses on

- Integration of the BMDS
- Offensive/defensive integration

- Knowledge of the command, control, and communications (C3) for the BMDS elements
- Understanding of asset management procedures, including interpretation of outage reports
- Planning responsibilities for STRATCOM
- Execution responsibilities for the regional CCDRs.

Training should include planning assumptions and rules of engagement (ROE) for BMD, shot doctrine, and the integration of theater missile defense and national missile defense into a GBMD.

4.2.1.3 Conduct Global Strike Training

Develop an environment for global strike training that focuses on

- Planning and collaboration between geographic combatant commanders (GCCs), component staffs, CSAs, and other U.S. Government agencies required to plan and integrate global strike missions with other operations
- Deliberate planning and CAP processes
- Developing an understanding of process relationships and proficiency in defining, planning, coordinating, and executing a global strike in operational environments, while supporting broader national strategy and objectives.

4.2.1.4 Train on Operational C2 Systems and Networks (Dedicated Bandwidth)

Train on operational C2 systems/networks using dedicated training bandwidth to

- Integrate DoD training tools with operational air and missile C2 systems
- Stimulate operational C2 systems wherever possible
- Develop keyboard-video-mouse solutions when missions dictate that operational C2 systems remain segregated
- Implement the capability to train air and missile mission operators at their operational positions.

4.2.1.5 Train Forces on All Missile Missions

Provide an environment for the training target audience at all tiers of training that covers all areas of the missile mission:

- Integrated Tactical Warning and Attack Assessment (ITW/AA)
- BMDS

- AMD
- Theater missile warning (TMW).

The environment for training must

- Display critical missile information that will enable decision making via certified display systems
- Display critical missile flight information from all sensors
- Display sufficient data to allow timely and unambiguous assessments
- Display accurate operational fidelity, equal to real-world system performance that matches continuing software and system spiral upgrades.

4.2.2 EDI

Today's simulations are difficult to develop, maintain, operate, and set up for given training events. Typical exercises require 150–200 personnel to operate the models. Event preparation and testing alone can run as high as \$1M per exercise. No investment plan is currently in place to improve the efficiency of models and to them official programs of record. Large training events need simpler tools that support exercise design/integration and scenario generators, with low overhead.

4.2.2.1 Provide Faster/Higher Fidelity Mission Rehearsal

Develop an environment that allows for rapid database development and shortened JELC training.

The simulation will

- Maintain a common synthetic natural environment (SNE) (terrain skin, feature data, and targets) among all federate simulations
- Maintain a common scenario database (e.g., OOB data) among all federate simulations
- Maintain a common civil environment database (e.g., civil infrastructure, political, cultural, and economic data) among all federate simulations
- Be capable of rapid database development (e.g., SNE, scenario, and civil environment) within 96 hours, using 8 qualified database builders for a unified-endavor-sized joint event
- Possess a distributed, Web-based database build capability
- Have the ability to merge the separately developed portions of a database

- Have the ability to access and import data from standardized databases, such as the Modern Integrated Database (MIDB) and Conventional Forces Database (CFDB)
- Be interoperable with the JOPES or its follow-on adaptive planning and deployment system
- Possess a common tool set that automates or semi-automates the 5-phase JELC cycle
- Provide training based on the Joint Requirements Oversight Council (JROC)-approved ROMO specified by the Operation Plan/Operation Order (OPLAN/OPORD) for which the mission rehearsal is required
- Identify the portion of the plan for rehearsal
- Select appropriate rehearsal techniques for staffs and organizations.

Training should

- Incorporate approved individual and unit joint training standards
- Schedule the training support resources (e.g., observer-trainers, models/simulations, and ranges/maneuver areas)
- Establish a “Red Cell” that accurately reflects the military doctrine, political-military approaches, and current capabilities of the belligerent forces.

Provide an assessment plan to

- Determine individual and unit readiness to execute the standards for tasks that support the OPLAN/OPORD
- Identify mission-capability shortfalls
- Plan and conduct corrective individual and unit training to achieve required standards and minimize mission risk.

4.2.3 CDIS

Interagency, intergovernmental, and coalition M&S capabilities are not integrated with our national training capabilities. The lack of coordination between our secure systems and the inability to reliably connect to our secure systems waste valuable resources, result in a lack of interoperability, and inhibit our ability to create common operational problems with which to train our partners. This shortfall has dramatic impact on manning, on communications and interoperability, on common techniques and procedures, and other training requirements. We do not have a unified CDIS solution that allows us to integrate our training partners seamlessly. This situation precludes developing partner

capacity and conducting interagency and coalition exercises with realistic information exchange.

4.2.3.1 Train Forces in a JIIM Environment (Including Intelligence)

Develop an environment to conduct JIIM training that

- Provides for the development of an integrated military-interagency (U.S. and international) strategy
- Establishes integration mechanisms at strategic, operational, and tactical levels to provide leadership, procedures, forum/purpose, and location for conducting interagency coordination
- Integrates
 - Department of State and Embassy Country Team political agendas
 - Manning structure
 - Procedures
 - Relationships with host and neighboring countries and all appropriate regional and international organizations and activities
- Develops common approaches for
 - Military force deployment
 - Lodgment and employment
 - Transition/redeployment
 - Handover to local/host government control.

4.2.3.2 Train Forces on IO (Including IW, Computer Network Exploitation, Computer Network Defense, and Computer Network Attack)

Develop an environment for training staffs, components, and individuals across the range of IO including information assurance, information warfare, and special IO that comprise

- Offensive IO including
 - Operations Security (OPSEC)
 - Deception operations
 - Psychological Operations (PSYOP)
 - EW
 - Physical attack
 - Computer network attack

- Defensive IO
 - OPSEC
 - Physical security
 - Counterdeception
 - Counterpropaganda
 - Counterintelligence.

Training should stress

- Planning and coordination between joint HQ, component staffs, and other U.S. Government departments and agencies required to integrate IO with other portions of operations and campaign plans
- Deliberate and CAP processes and JFCOM operations
- Understanding processes and developing proficiency in defining, planning, coordinating, and executing IO in a complex operational environment while supporting broader national strategy and objectives
- Establishing and coordinating roles, policies, and procedures for IO cells at joint force commander (JFC) level.

4.2.3.3 Train Theater/Strategic Force To Conduct C4I Operations Using a CIE

Provide a cross-domain solution (CDS) training environment for COCOM and JTF HQ that

- Facilitates information and knowledge exchange among members of the joint force and its supporting and supported organizations across the ROMO
- Is enabled by high-speed connectivity and electronic collaborative tools.

Training should emphasize

- Achieving decision superiority by providing commanders and staffs of all participating HQ the ability to share information and ideas so planning times can be reduced
- Integrated technical systems that permit supporting staffs separated by geography and organizational boundaries to collectively develop, refine, and direct implementation of plans and directives
- Use of the GIG as an information management and dissemination backbone.

4.2.3.4 Train the JIACG

The Rescue Coordination Centers (RCCs), Joint Interagency Training Specialists (JIATS), and non-DoD Agency JIACG staffs need to develop an environment to provide training for the

- **Military staff.** This training should include an understanding of
 - The non-DoD agency culture
 - Non-DoD agency core competencies
 - Non-DoD agency capabilities
 - How non-DoD agency capabilities link to RCC capabilities necessary for mission accomplishment
- **Non-DoD agency staff.** This training should include an understanding of
 - The military culture
 - The capabilities of the military force
 - Deliberate planning, CAP, and effects-based planning and EBO
 - How to integrate non-DoD agency capabilities into planning and operations.

4.2.3.5 Train Forces on Strategic Information Assurance

Provide an environment in which staffs are able to train on the development and execution of plans, policies, and procedures for providing, protecting, and restoring strategic information assurance during the planning and execution of operations, concentrating on the following areas:

- **Availability.** Assured access by authorized users
- **Integrity.** Protection from unauthorized change
- **Identification and authentication.** Verification of originators
- **Confidentiality.** Protection from unauthorized disclosure
- **Non-repudiation.** Undeniable proof of participation.

The training should

- Stress current applicable information
- Examine and develop an understanding of the planning and coordination between joint HQ, component staff, and other U.S. Government departments and agencies required to embed information assurance into all operations and campaign plans

- Contain three types of activities (initial orientation, advanced, and reinforcement)
- Be conducted by knowledgeable individuals.

4.2.4 Integrated Joint Logistics

Logistics training models do not fully support simulation of the full, integrated, realistic logistics process. This lack of support adversely affects the training value associated with COCOM and Service logistics training capabilities that replicate the ITV of “factory-to-foxhole” end-to-end logistics force flow, deployment, distribution, sustainment, and retrograde operations.

4.2.4.1 Train for CAP and Deployments

Develop an environment for CAP training that provides for

- Developing an understanding of and proficiency in the execution of the CAP process
- Communicating CAP products to appropriate entities
- Applying established collaborative planning technologies.

Deployment training related to CAP should center on processes and procedures for developing and executing a Time-Phased Force and Deployment Data List (TPFDDL) and/or Request for Forces (RFF) documents.

4.2.4.2 Train Forces on Realistic Logistics, Including RSOI, and Sustainment of the Force, Including Retrograde Operations

Train to balance logistics planning and execution with CCDRs’ priorities in support of operational requirements. Sustain the force during long-term execution to include joint deployment and distribution operations. Develop an environment that enables commands to assess plans, policies, and procedures continually. Train and integrate lessons learned to improve logistics readiness while employing the three overarching principles CCDRs consider in joint logistics planning and execution including joint reception, staging, onward movement, and integration (JRSOI) operations: unity of command, and synchronization and balance.

- **Unity of command.** Responsibility of the CCDR of the theater into which the deploying force flows. The CCDR adjusts resources based on the deployment flow into the theater, controls the movement of forces in the area of responsibility (AOR), provides support to personnel arriving into the theater, and centrally coordinates the efforts of key players in the JRSOI process.

- **Synchronization.** Occurs when the right units, equipment, supplies, and capabilities arrive in order at the appropriate locations. Supporting activities coordinate so that force deployment tempo, planning, and execution are uninterrupted. Synchronized flow expedites the buildup of mission capability and avoids saturation at nodes and along lines of communication, thus enhancing survivability.
- **Balance.** Managing the time-phased force and deployment data (TPFDD) flow. The flow through the inter-theater pipeline and the intra-theater distribution network must be regulated and integrated to allow a continuous and controlled flow of forces and supplies.

Example: Fourth phase of deployment planning includes JRSOI consisting of

- Receiving personnel, supplies, and equipment
- Assembling them into units at designated staging sites
- Moving these units to a destination within the JOA or AOR
- Integrating these units into a mission-ready joint force.

This planning should include Retrograde Operations.

4.2.4.3 Train Routinely With JOPEs

Develop training that simulates Continental United States (CONUS) and Outside of the Continental United States (OCONUS) environments, with appropriate information technologies to train JS, COCOM, JTF and Service component staffs in the basic elements of JOPEs (publications and documents, the operation planning process and dedicated Information Technology (IT) support system) for deliberate planning, adaptive planning, and CAP processes. The goal of the training is to develop required proficiency in the tasks required by JOPEs.

Training should emphasize

- The individual and staff activities required to execute each of the doctrinally approved phases of deliberate planning, adaptive planning, and CAP processes
- Development of plans—OPLAN, Functional Plan (FUNCPLAN), Concept of Operations Plan (CONPLAN), and Transportation Community and System Preservation (TCSP) and execution of OPORDs—for each of the JSCP-tasked missions
- Force, support, and transportation planning in the development, refinement, and implementation of TPFDD and force module deployment processes.

4.2.4.4 Train Routinely With New Adaptive Planning and Deployment System

Provide an environment for the Joint Planning and Execution Community (JPEC) to conduct training on the four-phased process to project the force:

- Predeployment activities
- Movement to and activities at the port of embarkation (POE)
- Movement to the port of debarkation (POD)
- JROSI that integrates the actions of the following activities or entities:
 - Defense Transportation System (DTS)
 - Global Transportation Network (GTN)
 - Joint Flow and Analysis System for Transportation (JFAST)
 - Global Command and Control System (GCCS)
 - Global Combat Support System (GCSS)
 - JOPES
 - Transportation Coordinator's Automated Information for Movement System II (TC-AIMS II)
 - Joint Force Requirements Generator (JFRG).

Training should target the elimination of

- Imbalance of mission requirements and sustainment needs based on available lift (transportation)
- Costly (time and money), last-minute changes that affect force closure and waste limited transportation assets
- Lost or complex ITV
- Inaccurate baseline data for redeployment planning
- Underuse of allocated strategic transportation
- Distribution and sustainment of forces.

4.2.5 JTF Training

With the ever-increasing importance of jointness at the tactical level, more traditional COCOM and Service exercises require significant joint enablers (functional HQ, higher HQ, cross-Service participation, interagency participation, and coalition participation, and so forth). Vertically integrated training events also require multiple echelons to stress the full flow of information and decision making. Today's simulations do not support the full range of activities for these types of exercises, which require large exercise

control groups and hundreds of role players per exercise. Current models do not possess the necessary representations of joint C2 intelligence, surveillance, and reconnaissance (ISR) enablers that are needed to support home-station training environments in joint TTP.

4.2.5.1 Train CJTF

Develop an environment that allows for CJTF training centered on joint and coalition and multi-national doctrine and procedures, including

- Policies, processes, and procedures for Joint Manning Document (JMD) maintenance
 - Initial stand-up of the organization and replacement of trained and experienced members
- JTF staff information management
 - Organizing, collecting, and processing Commander's Critical Information Requirements (CCIRs)
 - Forming and managing boards, bureaus, centers, and cells that translate information into knowledge
 - Integrating and using IT systems that enable data collection and information processing
- Rehearsal of
 - Individual and team job skills
 - Collective staff C2 tasks
 - Component command staffs' planning and the execution of operational mission requirements.

4.2.5.2 Train SJFHQ

Develop an environment that allows replication of the COCOM, Service Component, and SJFHQ staff processes, procedures, and materiel capabilities to support the implementation of each of the three SJFHQ employment options:

- SJFHQ employment as a mission HQ
- SJFHQ integration of personnel, processes, and materiel into the force structure of a Service Component HQ to execute the mission from a JTF organization structure
- SJFHQ operation from COCOM HQ to support forward-deployed Service Component/JTF HQ.

SJFHQ training should include

- Joint command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) integration planning, policies, and procedures
- SJFHQ and JTF staff information management planning, policies, and procedures, including organizing, collecting, and processing CCIRs
- Formation and management of boards, bureaus, and centers that translate information into knowledge
- Integration and use of IT systems that enable data collection and information processing.

4.2.5.3 Train Forces (Operational and Tactical Level) to Use the National Intelligence System

Provide training environments that simulate JS, COCOM, JTF, Service component, and CSA HQ and deployment units across the ROMO supported by access to national-level intelligence systems and products to facilitate execution of assigned tasks and missions.

Training should emphasize

- Knowledge of requirements and application of capabilities for operations in peacetime to provide national leadership the information needed to realize national goals and objectives and military leadership the information needed to accomplish missions and implement the national security strategy
- Knowledge of requirements and application of capabilities for operations in war to identify the adversary's capabilities and centers of gravity, to project probable courses of action (COAs), and to assist in planning friendly force employment
- Knowledge of requirements and application of capabilities for Operations Other Than War (OOTW) to provide assessments that help the JFC decide which forces to deploy; when, how, and where to deploy these forces; and how to employ these forces in a manner that accomplishes the mission at the lowest human and political cost.

4.2.5.4 Train for Integration and Mobilization of ACs and RCs

Develop an environment that allows RC forces and staff augmentees to integrate effectively into joint and Service component staffs:

- Develop policies, processes, and procedures to support RC-unique training schedules to link with joint/Service training opportunities

- Improve methods for conducting AC/RC integration training (Mobile Training Teams (MTTs), Distance Learning (DL), and so forth)
- Integrate the manpower support structure, with visibility from COCOM through Service AC/RC units to individuals with joint experience
- Incorporate more joint training in RC units and individual training cycles.

4.2.5.5 Provide Crisis Action Procedures Training

Develop an environment for crisis action procedures training that provides for

- Developing an understanding of and proficiency in the execution of the crisis action procedures process
- Communicating crisis action procedures products to appropriate entities
- Applying established collaborative planning technologies.

Training related to crisis action procedures should focus on development of a COA/coordination of efforts across the appropriate entities and the approval process.

4.2.6 IW and PMESII

The training community lacks a robust M&S capability to accurately represent the human dimension in the JTE that fully represents and analyzes IW across the range of tactical, operational, and strategic levels of warfare. As a result, it cannot effectively simulate and train in an LVC environment or inform decisions concerning operations within the IW environment.

4.2.6.1 Train Forces on SASO

Simulate an environment for Military Operations Other Than War (MOOTW) directed at the conduct of SASO. Stability operations are envisioned to be joint, inter-agency, and multi-national operations to provide

- Security
- Initial humanitarian assistance
- Limited governance
- Restoration of essential public services
- Other reconstruction assistance.

4.2.6.2 Train Forces for JUO

Develop an environment in which forces can train in urban environments characterized by a concentration of structures, facilities, and populations that are the economic, political, and cultural focus of the surrounding area.

Operations may include

- Civil-military operations
- Strong media presence and public affairs involvement
- Interagency operations
- Involvement of multi-national, coalition, and non-governmental organization (NGOs)
- Legal planning and oversight responsibilities
- Combat.

Training will emphasize the

- Isolated, non-linear, compartmented, and vertical nature of operations
- Psychological effects of close combat
- Integration of special weapons and special procedures for other weapons employed in close proximity to combatants and non-combatants
- Unique demands on the logistical system, including increased numbers and types of casualties
- Increased ammunition consumption rates
- Restricted mobility corridor
- Warfighting decision demands on the individual and decentralized small unit execution.

4.2.6.3 Train on IW

Simulate a range of environments to train for any of the missions described in the ROMO—from humanitarian relief and peacekeeping operations to enforcement operations and conventional war.

Training should emphasize

- The processes supported by tools and accomplished by people in organizational settings that focus on planning, executing, and assessing military activities for effects produced rather than attacking targets or dealing with objectives

- Use of all military, economic, political, and informational resources to change the perception and intentions of a belligerent force
- A high-level systems' perspective and the ability to understand, trace, and anticipate direct and indirect effects of a specific action as the effects course through the enemy's PMESII.

4.2.7 Integrated SOF

A low-overhead M&S training capability is required to support functional/collective joint special operations task force (JSOTF) battle staff and individual level training in a controlled environment in support of mission preparation and rehearsal. In addition, the M&S capability must be exportable to allow SOF C2 HQ elements, with exceptionally high operational tempo, the capability to train at and away from home station.

4.2.7.1 Train SOF and Conventional Forces for Integrated Operations

Develop a training environment in which the joint planning process and execution of these plans integrate and deconflict maneuvers in the battlespace (air, land, and sea) for simultaneous operations by SOF and conventional forces.

Training should emphasize

- Exercising command relationships between the JFC and the JSOTF
- Training the Special Operations Liaison Element (SOLE) to focus on conventional forces coordination processes and how SOF missions can be integrated seamlessly while maintaining the sensitive nature of the missions
- Exposing JFC staff to the requirements and procedures of the JSOTF
- Coordinating requirements and procedures to accomplish joint close air support (JCAS) training and mission rehearsal when SOF are used to support conventional forces to complete the close air support (CAS) "kill chain."

4.2.7.2 Train Staff To Coordinate PRO

Develop a training environment for planning and executing operations that combine the Services' capabilities with various other joint capabilities and for assisting in what is an uncertain operational environment with a low- to medium-threat risk. Elements from all sectors of the joint forces are employed, for example

- Search and Rescue (SAR)
- Combat Search and Rescue (CSAR)
- Joint Combat Search and Rescue (JCSAR)
- Non-conventional Assisted Recovery (NAR).

4.2.8 Intelligence Training: Strategic to Tactical

Currently, no clear strategy exists for a joint M&S intelligence training capability. Due to funding constraints, no new, innovative capabilities are being considered to replace the Service legacy training models that are being retired. A severe degradation of M&S intelligence training capabilities will occur until new models that replicate the joint operational environment are developed and implemented.

4.2.8.1 Train the IC as They Fight

Provide training environments that simulate JS, COCOM, JTF, Service component, and CSA HQ and deployment units across the ROMO, enabled by high-speed connectivity and electronic collaborative tools for comprehensive execution of the intelligence cycle.

Training should emphasize

- Knowledge of requirements and application of capabilities for operations in peacetime to provide national leadership the information needed to realize national goals and objectives and military leadership the information needed to accomplish missions and implement the national security strategy
- Knowledge of requirements and application of capabilities for operations in war to identify the adversary's capabilities and centers of gravity, project probable COAs, and assist in planning friendly force employment
- Knowledge of requirements and application of capabilities for OOTW to provide assessments that help the JFC decide which forces to deploy; when, how, and where to deploy them; and how to employ them in a manner that accomplishes the mission at lowest human and political cost.

4.2.8.2 Operations/Intelligence Center Training, Integration, and Command Education

Provide an environment in which integrated operations and intelligence battle staffs are able to train in the application of collaborative and effects-based planning/processes during adaptive and predictive planning.

Training should be focused on developing staff proficiency for

- Accessing current/real-time information and products
- Collaborative analysis processes
- Dissemination of information throughout a command and to subordinates by redundant means.

4.2.8.3 Provide the IC SOF-Specific Training at the Operational Level

Develop an environment for the IC to use the SOF-specific intelligence products that provide for

- Developing an understanding of and proficiency in the integration of the SOF-specific products into the intelligence process
- Communicating SOF intelligence products to appropriate entities
- Applying established collaborative sharing technologies.

4.2.9 CBRNE Environment

The Joint Effects Model (JEM) and Joint Warning and Reporting Network (JWARN) have begun fielding to COCOMS and Services but are not integrated into the JNTC LVC environment, which prevents their inclusion in distributed training events. No capability exists to conduct realistic, unit-level, tactical training that includes and simulates current detectors and protective equipment. Emerging joint training capabilities can be used in non-CBRNE scenario events, offering a high potential for cross-use in improvised explosive device (IED), SOF, and homeland security training environments.

4.2.9.1 Train to Operate in CBRNE Environment

Simulate CONUS and OCONUS environments across the ROMO that replicate adversary and own-force CBRNE capabilities and adversary military force structure to plan and employ CBRNE weapons. Support CBRNE training for applicable JS, COCOM, JTF, Service component, CSA HQ, and state National Guard and RC forces.

Training should emphasize the

- Integration of U.S. national, international, interagency, joint and Service military intelligence and assessment resources to identify adversary intentions and plans to employ CBRNE weapons
- Avoidance of CBRNE hazards: contamination, protection of individuals and units from unavoidable CBRNE hazards, and decontamination to restore operational capability of the force
- Sustainability, survivability, flexibility, and responsiveness of logistics forces throughout the area of operations
- Maintenance of the health of essential civilian workforce members who are supporting military operations
- Integration of military capabilities with those of the local public health services, including those of host nations, if applicable.

4.2.9.2 Train Forces in Enemy CBRNE Exploitation and Destruction

Simulate CONUS and OCONUS environments across the ROMO that replicate adversary and own-force CBRNE capabilities and adversary military force structure to plan and employ CBRNE weapons. Support CBRNE exploitation and destruction training for applicable JS, COCOM, JTF, Service component, CSA HQ, and state National Guard and RC forces.

Training should emphasize the

- Integration of U.S. national, international, interagency, joint and Service military intelligence and assessment resources to identify adversary intentions and plans to employ CBRNE weapons
- Development and execution of integrated military-agency plans to interdict, isolate, destroy, or mitigate the effects of CBRNE weapons.

4.2.10 Integrated Homeland Defense and CM Missions

The DoD community currently lacks the means to train with first responders on emerging missions regarding homeland security and CM.

4.2.10.1 Train Forces on DSCA

Develop environments for training in the planning and execution of DSCA in support of disaster relief (natural and man-made), military assistance for civil disturbances, and military assistance to law enforcement agencies within the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and U.S. possessions and territories.

Training should emphasize the

- Notification, rehearsal, movement, employment, and redeployment of military resources used to assist civil authorities as directed by and consistent with applicable law, Presidential Directives, and Executive Orders
- Appropriate coordination, planning, and immediate action taken by a DoD Component or military commander to save lives, prevent human suffering, or mitigate great property damage under imminently serious conditions
- Assessment of legality, lethality, risk, cost, readiness, and appropriateness for use of specific military resources in a civil environment in support of a federal lead agency.

4.2.10.2 Provide Homeland Defense Training

Develop an environment in which staffs and components of joint forces and government agencies (federal, state, and local) can conduct training to execute tasks and missions in support of homeland defense.

This training may include

- Understanding and applying
 - National Homeland Security policy and strategy
 - National Homeland Security plans
 - DoD policy, strategy, and plans
 - The interagency process and players (the Federal Bureau of Investigation (FBI), the Federal Emergency Management Agency (FEMA), the United States Northern Command (USNORTHCOM), and so forth)
- Establishing C2 relationships and support requirements
- Planning and execution of missions within the confines of legal limits under
 - Insurrection
 - Posse comitatus (i.e., power of the county)¹¹
 - Military support for civilian law enforcement agencies.

4.2.10.3 Train for CIP

Develop an environment to provide training in tasks associated with the CIP life cycle:

- Mission analysis and assessment
 - Identification of critical warfighting systems and assets
 - Dependency analysis
 - Vulnerability and risk assessment
- Reporting and monitoring (including indications and warnings)
- Remediation and mitigation methods
- Response requirements

¹¹ Posse comitatus or sheriff's posse is the common-law authority of a county sheriff or other law officer to conscript any able-bodied males to assist him in keeping the peace or to pursue and arrest a felon.

- Reconstitution of the infrastructures, information, and physical mission-critical capabilities essential to the execution of the National Military Strategy (NMS). This reconstitution includes the ability to
 - Plan
 - Mobilize
 - Deploy
 - Sustain military operations
 - Transition to post conflict operations.

These infrastructure elements include

- DoD
- U.S. commercial, public, and private sectors
- Foreign commercial, public, and private sectors
- Host nations' commercial, public, and private sectors.

Examples include

- Financial services
- Energy delivery
- Emergency services
- IT and communications infrastructure and access.

4.2.10.4 Train on CM Operations

Train to those measures taken to protect public health and safety:

- Restoring essential government services
- Providing emergency relief to governments, businesses, and individuals affected by the consequences of a CBRNE event or a man-made or natural disaster.

For domestic CM, the primary authority to respond rests with the states. The federal government should provide assistance as required.

4.2.10.5 COOP

Simulate an environment in which joint forces and federal departments/agencies are implementing COOP plans, deploying pre-designated personnel and leadership at alternate sites, and performing essential functions at those locations.

Critical tasks may include

- Establishing an operational capability at an alternate facility
- Implementing succession and delegation-of-authority plans
- Demonstrating an interoperable communications capability
- Demonstrating redundant communications capabilities
- Demonstrating the ability to access vital information, intelligence, and forces needed to conduct essential functions from remote locations.

The training regimen should include test and exercise of COOP actions at regular intervals and incorporate COOP exercise events and training in conjunction with command exercises.

4.3 TGAF Training Problem Areas and M&S Gaps

The TGAF updated the content of the original 35 TC AoA training gaps and placed them in new priority order. The list was also renamed as “training needs” since it does not reflect the M&S gaps as discussed in subsequent sections of this document. The updated training needs were grouped into 10 areas that were determined to have similar functional content. The TGAF process, issues and problem areas are discussed in more detail in the following section. The list of 2008 TMSBP training M&S gaps, plus other gaps from the TGAF issues presented by the training stakeholders, is included in Table 4-2, which outlines the training needs and appropriate M&S gaps that relate to those needs. Section 5 provides content and context for the list of JTE problem areas and training needs. Section 6 discusses the list of 29 training M&S gaps and places them in the context of the wider M&S communities’ DoD-wide enterprise level gaps. Finally, in Section 7, the training gaps are related back to the 2008 TMSBP Investment Strategies and the list of projects to help fill the M&S gaps by training community efforts and through funding provided by the M&S SC from the DoD-wide M&S funding program element (PE).

Table 4-2. Updated Training M&S Gaps¹²

JTE Problem Areas	2009 Training Needs	M&S Gaps
1. Integrated Air and Missile Missions (IAMM)	(7) Provide multi-command ballistic missile defense system (BMDS) training (21) Train for GBMD (24) Conduct global strike training (28) Train on operational C2 systems and networks (dedicated bandwidth) (35) Train forces on all missile missions	1. Air and missile defense (AMD) representations to simulate and stimulate real-world, dynamic systems in training 2. Air mission exercises in a multi-echelon, multi-domain LVC environment 3. Stimulations of real-world display systems with portable, scalable, dynamic, affordable capabilities
2. Exercise Design and Integration (EDI)	(3) Provide faster/higher fidelity mission rehearsal	4. Common object model 5. Rapid correlated terrain data 6. Rapid scenario-based individual and small-team training 7. Operational environments 8. Units and electronic order of battle (EOB) 9. Common general-purpose interface 10. Modular, tailorable JLVC Federation to support both large exercises and home-station training 11. Low-overhead, easy-to-operate JLVC capability for individual and collective applications 12. Shortened joint event life cycle (JELC) and more quickly trained individuals and small teams 13. Data and specification of common procedures for initializing data for simulations
3. Cross-Domain Information Sharing (CDIS)	(2) Train forces in a Joint Interagency Intergovernmental, Multi-national (JIIM) environment (including intelligence) (8) Train forces on IO (including information warfare, computer network exploitation, computer network defense, and computer network attack) (18) Train theater/strategic force to conduct C4I operations using the CIE (20) Train the JIACG (32) Train forces on strategic information assurance	14. Cross-domain and multi-national information sharing 15. IO, including information warfare, cyber network exploitation, and defense and attack 16. Network warfare – net centric environments, including cyber 17. Electronic warfare (EW) and information warfare 18. Ability to share command and control, intelligence, surveillance, and reconnaissance (C2ISR) data and training environment data with coalition partners at different activity levels 19. Secure network interface structure

¹² See Note at the end of Table 4-2.

Table 4-2. Updated Training M&S Gaps (Continued)

JTE Problem Areas	2009 Training Needs	M&S Gaps
4. Integrated Joint Logistics	(4) Train for CAP and deployments (6) Train forces on realistic logistics, including RSOI and sustainment of the force, including retrograde operations (16) Train routinely with JOPES (19) Train routinely with new adaptive planning and deployment systems	20. Logistics and infrastructure representations across a full range of military operations (ROMO), including humanitarian relief and peacekeeping 21. Representations to allow end-to-end In-Transit Visibility (ITV) by maintaining Transportation Control Number (TCN) integrity 22. Support the United States Transportation Command (USTRANSCOM) migration to Integrated Data Environment (IDE)/Global Transportation Network (GTN) Convergence (IGC) 23. Enhanced force flow capabilities, including retrograde operations
5. Joint Task Force (JTF) Training	(1) Train Combined Joint Task Forces (CJTFs) (5) Train SJFHQ (23) Train forces (operational and tactical level) to use the national intelligence system (29) Train for integration and mobilization of ACs and RCs (33) Provide crisis action procedures training	24. Integrated JTF training 25. Second-order effects for planning and operations, including humanitarian relief, peacekeeping, law enforcement, insurgency, and conventional war
6. Irregular Warfare (IW) and Political, Military, Economic, Social, Infrastructure, and Information (PMESII)	(9) Train forces on SASO (13) Train forces for JUO (17) Train on IW	26. Mission environment – economic, diplomatic, political, and indigenous civilian 27. Mission environment – medical, public health, and related
7. Integrated Special Operations Forces (SOF)	(10) Train SOF and conventional forces for integrated operations (25) Train staff to coordinate PRO	
8. Intelligence Training: Strategic to Tactical	(11) Train the IC as they fight (27) Operations/intelligence center training, integration, and command education (34) Provide the IC SOF-specific training at the operational level	28. Human Intelligence (HUMINT)

Table 4-2. Updated Training M&S Gaps (Continued)

JTE Problem Areas	2009 Training Needs	M&S Gaps
9. Chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) Environment	(12) Train to operate in a CBRNE environment (22) Train forces in enemy CBRNE exploitation and destruction	29. CBRNE detection and effects environment
10. Integrated Homeland Defense and Consequence Management (CM) Missions	(14) Train forces on Defense Support to Civil Authorities (DSCA) (15) Provide homeland defense training (26) Train for CIP (30) Train on CM operations (31) COOP	

Note for Table 4-2: The numbers (e.g., (7), (16)) in the **2009 Training Needs** column refer to the numbers in column 1 of Table 4-1. The numbers (e.g., 1., 2., 3. → 29.) in the **M&S Gaps** column refer to the 29 M&S gaps mentioned in this document.

5. Training M&S Capabilities Assessment

Note: *In this document, the use of the term “capabilities” has been limited to include training tools and the models, simulations, simulators, C4I adapters, and interfaces to enable and support the full scope of military training exercises, events, and activities.*

This section addresses M&S data and services used by the training community for cross-community information sharing. It contains an updated list of training capabilities. This list breaks out the major training federations by constructive training simulations, virtual simulators, and C4I and by the interfaces and gateways necessary to support the different training federations. The detailed listing, by category, is found in a series of tables at the end of this section and provides an update to the capabilities baseline originally introduced in the 2004 TC AoA. The updated list of capabilities includes the interfaces and stimulators used in our large training federations and the traditional listing of virtual and constructive simulations.

5.1 Training Activities

The training community must ensure that the deploying forces are trained for operations before these forces arrive at their destination and that learning continues while the forces are employed in AOR. To conduct joint operations across all campaign phases and operations, CCDRs must have well-trained individuals, units, and staffs. Among the M&S capabilities needed to facilitate these needs are

- Rapid scenario generation for geospatial, force structure, readiness, weather, intelligence, logistics, and other relevant scenario-specific data
- The ability to interface with—and train on—real-world C4ISR systems
- Standardized interfaces that enable the systems to access the LVC training environments
- The ability to train in multi-level, secure environments for interagency and multi-national events.

5.2 Functions

In building the JLVC-TE, the JNTC employs M&S to create and integrate the live (real people in real locations using real equipment), virtual (real people in simulators), and constructive (real people and simulated entities in a simulated environment) training

environments. The JLVC-TE creates joint warfighting conditions through a networked collection of interoperable training sites and nodes that synthesize personnel, doctrine, and technology to meet the training requirements of CCDRs and the Services. The LVC environment melds existing operational and strategic facets of exercises with live forces to create a more robust and realistic experience. It strives for realistic combat training by using adaptive and credible opposing forces (OPFORs), establishing common ground truth, and providing high-quality feedback. Events include (1) Service-to-Service training to improve interoperability and joint operations (horizontal training), (2) strategic-to-tactical joint training to improve vertical command integration (vertical training), (3) enhancement of existing joint exercises to address joint interoperability training in a joint context (integrated training), and (4) a dedicated JTE to train to specific warfighting capabilities and complex joint tasks (functional training). Training is enhanced through experimentation and testing and by extending joint training globally into local training venues of the total force. The larger DoD M&S community has historically discussed M&S capabilities in the context of three categories: M&S tools, M&S data, and M&S services. The following subsections use that framework to identify the broad training capabilities.

5.3 M&S Tools

Note: *For this document, M&S tools are defined as the development, management, and use of software that enables the creation and execution of simulated environments and the analysis of the simulation results.*

A series of initiatives have been undertaken by the COCOMs and Services in the years following the 2004 TC AoA. JFCOM has provided several significant enhancements and M&S products in the last 5 years, some of which are highlighted below. The following list of capabilities has been updated in this 2009 TMSBP:

- **JTEN.** The JTEN is a global network that provides the persistent backbone and connectivity for the LVC simulation components to support a wide spectrum of joint and Service training requirements.
- **JLVC federation.** The JLVC federation is focused on seamlessly integrating constructive entity-level stimuli with virtual and live simulations and simulators in a near-real-time SNE. This federation provides a multi-echelon, distributed JTE that comprises entity-level models and simulations with representations of Service combat, intelligence, and logistic systems, including Conflict and Tactical Simulation (CATS), Joint Semi-Automated Forces (JSAF), Air Warfare Simulation (AWSIM), Air and Space Collaborative Environment Information Operations Suite (ACE-IOS), Tactical

Simulation (TACSIM), National Wargaming Simulation – Next Generation (NWARS-NG), and Joint Deployment Logistics Model (JDLM). The federation enables the integration of virtual simulators and live range instrumentation to support training of COCOM staff and Service components, down to tactical units and individual/crew trainers. The JLVC federation is gaining more widespread use to support joint training.

- **Joint Multi-Resolution Model (JMRM) federation.** The JMRM is a composable federation that uses the Joint Theater Level Simulation (JTLS) and the Joint Conflict and Tactical Simulation (JCATS) as the “core” models in the federation. The JMRM’s name and capability are derived from the need to provide high-level aggregation simulations to support the JTF-level training and entity-level representations to simulate the tactical force components of the JTF. The JMRM provides a low-cost, low-overhead operational staff training capability combined with the high-resolution, tactical-level-training JTLS and JCATS. Use of the JMRM is primarily limited to NATO training. USJFCOM and other COCOMs use JTLS as a low-overhead capability for JTF training.

5.4 M&S Data

Note: *For this document, M&S data are defined as a representation of real-world facts or concepts in a format that can be used by M&S.*

The use of data is extremely important for M&S-supported training. A labor-intensive but important step in the training process is the ability to generate the scenario rapidly so that realistic training can be conducted. Several DoD initiatives are underway to enable net-centric data integration in a Service-oriented architecture (SOA) that will be supported by the Net-Centric Enterprise Services (NCES) program of the GIG. The cross-community work of the Joint Data Alternatives (JDA) Study, which was completed in October 2007, and the follow-on JDA effort is discussed in other sections of this 2009 TMSBP update.

The JDA Study identified several alternative methods for handling data resources for the M&S community in a net-centric environment. The study identified the anticipated actions needed to implement the net-centric data strategy to support a shared data environment that leveraged GIG and DISA programs. Among the training community data efforts are the following:

- **Defense Readiness Reporting System (DRRS).** The DRRS is an automated system developed to establish a mission-focused, capabilities-based, common framework that provides the CCDRs, military Services, Joint Chiefs of Staff (JCS), and other key DoD users the data-driven environment and tools

needed to evaluate, in near-real time, the readiness and capability of U.S. Armed Forces to carry out assigned and potential tasks. The DRRS will be the authoritative data source for the JMETS and potentially for unit and force structure data for use in the Joint Training System (JTS) and for building scenarios for training M&S applications.

- **Joint Training Data Services (JTDS).** The JTDS demonstrations continue to provide solutions to important data issues for joint and Service training events. The JTDS is a Web-based set of scenario-generation and data tools that address enterprise-wide training data challenges. It provides for the definition, design, development, and support of an integrated system for identifying, collecting, manipulating, capturing, storing, and retrieving geospatial/environmental (physical, natural, forces, OOB, target, intelligence, visual, and so forth) data. The JTDS has reduced the time and the cost of data preparation for training events and allows scenarios to be reused in support of short-notice mission rehearsals.
- **JDA Study.** The thrust of the JDA effort was to inform the multiple communities enabled by M&S of the relevant issues as DoD moves to the future of net-centric data strategies supporting the GIG and related DISA programs. The purpose of the JDA Study, which was supported and funded by the M&S SC, was to identify recommended methods for handling data resources for the DoD M&S community in a net-centric environment and identify anticipated actions needed to implement the net-centric data strategy to support a shared data environment. This effort complements the separate training-funded data efforts undertaken in the JTDS and Joint Rapid Scenario Generation (JRSG) programs.

The JDA Study team gathered multiple communities enabled by M&S to discover evidence of prior and current M&S data efforts, defined the scope of the implied and explicit gaps in the area of simulation data interoperability, and documented a set of crosscutting use cases for data applicability to support M&S core capabilities across multiple functional applications. The JDA Study team produced several discrete and stand-alone deliverables. For a full list of deliverables, see the JDA final report. These deliverables are individual documents that, when considered in the whole, represent the study team's final report products. The JDA library of documents was considered relevant research material for this 2009 TMSBP.

- **Joint Training Information Management System (JTIMS).** The JTIMS is a Web-based system designed to provide automated support in the application of the JTS in joint, agency, and Service training programs.

5.5 M&S Services

Additional training community activities enhance the work performed by the training components. The following list of shows some of the M&S services provided to the joint training community:

- Increasing the shared capabilities and reuse
- Focusing greater visibility on M&S requirements
- Integrating M&S requirements
- Sharing community and component successes
- Conducting effective and efficient VV&A for M&S
- Heightening the availability of M&S resources, best practices, and supporting tools
- Developing education programs coordinated and integrated across DoD.

Consistent with the theme of constantly evolving threats and needs, the training community has continued to improve the suite of capabilities for conducting joint training. The 2004 TC AoA identified models and federations that the Services, JFCOM, and the IC regarded as relevant to joint training requirements. As discussed previously, the operational and training needs and the technologies as captured in the TC AoA are constantly evolving. The training community has progressed from the early capabilities baseline and now includes many of the desired capabilities. However, much remains to be done (e.g., providing robust simulations to capture the integrated air and missile missions for training, CDIS, and joint logistics) in several important functional areas in the long term.

5.6 Updated Training Capabilities Baseline

In 2008 and 2009, the OSD JAEC office undertook an update of the TC AoA capabilities base case to produce a “Capabilities Landscape.” That work expanded from the previous list of constructive simulations to include the virtual simulators and the C4I capabilities needed to enable a more robust play of these functions during training exercises. The C4I M&S representations, stimulations, and interfaces are an important aspect of training in support of large training exercises.

The federations that currently form the training capabilities baseline (with the Sponsors in parentheses) include the

- JLVC federation (Joint)
- JMRRM federation (Joint)
- Entity Resolution Federation (ERF) (U.S. Army)
- Multi-Resolution Federation (MRF) (U.S. Army)
- Air and Space Cyber Constructive Environment (ASCCE) (United States Air Force (USAF))
- Distributed Mission Operations Center (DMOC) (USAF)¹³
- Navy Continuous Training Environment (NCTE) (U.S. Navy)
- Marine Corps Federation (MCFED) (United States Marine Corps (USMC))
- Deployable Virtual Training Environment (DVTE) (USMC)
- Joint Training Support Center (JTSC) (SOF).¹⁴

These primary training federations have been decomposed in Tables 5-1 to 5-9 to indicate the detailed constructive simulations, virtual simulators, and C4I simulators and devices that are included in each.¹⁵ Refer to Appendix B of this document for a short description of these federations.

This section provides an expanded capabilities listing that indicates tangible progress to achieve many of the early capabilities goals as described in the 2004 TC AoA and updated training needs assessments.

¹³ The DMOC is not a training federation but a training center (located at Kirtland Air Force Base (AFB)) that develops and supports tactical-level synthetic battlespace events for combat air forces.

¹⁴ The JTSC is not a federation in the same sense as the others listed. It is an independent training facility and network that provides C4I capabilities.

¹⁵ In Tables 5-1–5-9, A = Army, AF = Air Force, J = Joint, MC = Marine Corps, N = Navy, and SOC = Special Operations Command.

Table 5-1. Constructive Simulations

Sponsor	Product	Purpose	JLVC (J)	JMRM (J)	ERF (A)	MRF (A)	ASCEE (AF)	NCTE (N)	McFED (MC)	DVTE (MC)	DMOG (AF)	JTSC (SOCOM)
NSA	ACRES	SIGINT modeling										
AF	ASCCE-IOS	Air intelligence										
	ASSET	ELINT simulation										
Navy	ATLOS	Propagation										
AF	AWSIM	Air power										
MC	CACCTUS	Ground maneuver-entity										
Army	CB Sim Suite	CBRNE effects										
Army	CBS	Maneuver-aggregate										
Army	EADSIM	Air, missile, space warfare										
Army	FIRESIM	Artillery										
AF	GEG	GPS environment generator										
Army	IEWPT	Intelligence model										
Joint	JCATS	Joint maneuver-entity										
Joint	JLOD	Wrap around										
Army	JNEM	Non-kinetic										
Navy	JSAF	Maritime power										
Joint	JTLS	Joint maneuver-aggregate										
Army	LOGFED/JDLM	Logistics simulation model										
MDA	MDST	Missile defense										
	ModSAF	Entry-level maneuver										
MC	MTWS	Amphibious operations										
AF	MUSE/AFSERS	UAV										
AF	NGTS	High-fidelity constructive aircraft										
NRO	NWARS NG	National intelligence										
Army	OneSAF	Ground maneuver-entity										
Army	OTB	Support mission planning and rehearsal, and DL										
MDA	RE	Threat ballistic missile flyout										
Navy	RESA	Naval power										
MC	Shadow UAV	UAV										
AF	SSG	Space OOB										
Army	TACSIM	Ground Intelligence										
MC	VBS2	Ground maneuver-entity										
N/A	VRSG	Visuals										
Army	WARSIM	Ground maneuver-aggregate										
Army	WIM	Intelligence model										


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Table 5-2. C4I Interfaces See Note 1

Sponsor	Product	Purpose	JLVC (J)	JMRM (J)	ERF (A)	MRF (A)	ASCEE (AF)	NCTE (N)	McFED (MC)	DVTE (MC)	DMOC (AF)	JTSC (SOCOM)
AF	ASCCE-CSI	C2-to-constructive interface										
Navy	C4I gateway	OTH-Gold interface										
Army	eTSIU	EAD constructive message translator										
Army	EXCIS	AFTADS interface										
Army	HDC	HLA/DIS gateway										
Navy	HLA/DIS gateway	DIS/HLA gateway										
AF	JDT	Reporting responsibility (TADIL)										
Joint	JECS	Data manipulator/C4I interface										
Joint	JLVCDDT/JBUS	Gateway										
MC	LVC game	HLA/DIS gateway										
Navy	MLST3	Link interface										
	Rialito	Lower-to-middle enclave guard										
	RM	Lower-to-middle enclave guard										
Army	RTM	Simulates ABCS										
Army	SIMPLE	C4I interface										
	SMART	Middle-to-upper enclave guard										
	TCSP	Upper enclave guard										

Note 1 for Table 5-2: Interface: Connects different simulation architectures or connects training systems to operational C4ISR devices.

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Table 5-3. Tools See Note 1

Sponsor	Product	Purpose	JLVC (J)	JMRM (J)	ERF (A)	MRF (A)	ASCEE (AF)	NCTE (N)	McFED (MC)	DVTE (MC)	DMOG (AF)	JTSC (SOCOM)
Army	AARS	AAR										
AF	AAT	Analysis										
Army	ARCHER	AAR										
Army	BCIM	Intelligence										
Joint	EDCSS	METOC scenario device interface										
Army	FMT-R	Federation management tool										
AF	GEO VIZ	AAR										
AF	GIAC	GUI										
Army	ISM	MSEL inject to C4I										
Joint	JAARRL	AAR										
Joint	JDAARS	Analysis tool										
Joint	JSPA	HLA data analysis										
Joint	JTDS	Scenario generation										
AF	LOGSIM	AF logistics										
Navy	OASES	Weather tool										
Army	SASS	Network security administration										
AF	SGS	Rapid database generation										
Joint	SITH	Analysis										
AF	STAGE	Environmental generator										

Note 1 for Table 5-3: Tool: A federate that monitors, manipulates, stores, or retrieves simulation data or information but is not a simulation.

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Table 5-4. U.S. USAF Virtuals

Product	Purpose	JLVC (J)	NCTE (N)	DMOC (AF)	JTSC (SOCOM)
A-10	Aircraft	■		■	
AWACS	Aircraft	■	■	■	
B-1	Aircraft	■		■	
B-52	Aircraft	■		■	
C-17	Aircraft				■
C17A	Aircraft	■		■	
CRC	Ground-based control center	■		■	
F-15C	Aircraft	■		■	
F-15E	Aircraft	■		■	
F-16 Block 40	Aircraft	■		■	
F-16 Block 50	Aircraft	■		■	
F-22	Aircraft			■	
IFACT	CAS/CFF trainer			■	■
JSTARS	Aircraft	■		■	
JTC-TRS	CAS/CFF trainer				■
Raven	UAV	■		■	
RC 135 RJ	Aircraft	■		■	

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Table 5-5. U.S. Army Virtuals

Product	Purpose
AVCATT	Collective helicopter training
CCTT	Mechanical and armor collective training
CFFT	Indirect fires and CAS training
Dismounted soldier	Collective dismounted training
EST 2000	Marksmanship training
RVTT/RVS	Convoy and wheeled vehicle training

Table 5-6. USMC Virtuals

Product	Purpose	JLVC (J)	DVTE (MC)
AH-1W	Helicopter		
AV-8B	Aircraft		
CH-46	Helicopter		
CH-53	Helicopter		
EA-6B	Aircraft		
F/A-18	Aircraft		
KC-130	Aircraft		
MAST	CFF trainer		■
MV-22	Aircraft	■	
UH-1	Helicopter		

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Table 5-7. U.S. Navy Virtuals


Product	Purpose	JLVC (J)	NCTE (N)	DMOC (AF)
AEGIS	Ship			
BFTT	Ship trainer			
E-2C	Aircraft			
EA-6B	Aircraft			
EFAAS	Ship trainer			
EP-3 MAST	Aircraft			
F-18	Aircraft			
FAST	Aircraft			
H-60B	Helicopter			
H-60E	Helicopter			
H-60R	Helicopter			
H-60S	Helicopter			
MRT3	Helicopter			
P-3C	Aircraft			
SMMTT	Submarine trainer			
TSTS	Ship trainer			
V-ASTAC	Ship trainer			

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Table 5-8. U.S. SOCOM Virtuals

Product	Purpose	JLVC (J)	DVTE (MC)	DMOC (AF)	JTSC (SOCOM)
AC-130C	Aircraft				
AC-130H/E	Aircraft				
ASDS	Advanced SEAL delivery system				
CV-22	Aircraft				
JMPRS	Mission planning and rehearsal				
MC-130H	Aircraft				
MC-130H/E	Aircraft				
MH-47	Helicopter				
MH-6	Helicopter				
MH-60	Helicopter				
MH-53	Helicopter				
SAGIS	CAS/CFF trainer				
SVS	Ground				
TSS	Tower simulator system				
UAS	UAV				

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Table 5-9. C4I Virtuals

Product	Purpose	JLVC (J)	JMRM (J)	ERF (A)	MRF (A)	ASCEE (AF)	NCTE (N)	McFED (MC)	DVTE (MC)	CACCTUS (MC)	DMOC (AF)	JTSC (SOCCOM)
AADC	Air defense planning											
ADSI	TDL picture											
AF-ATDS	Fire support information exchange											
AMDWS	Air and missile C2											
ASAS-L	Intelligence C2											
BCS3	Logistics C2											
BVI	Intelligence fusion											
C2BMC	Missile defense											
C2PC	COP interface											
C2PC	COP distribution											
CAMPS	Strategic airlift planning											
CCD	Link											
CFAST	Campaign planning tool											
CPOF	Integrated C2											
CSP	AUTODIN message traffic											
DCGS	Intelligence fusion											
D-DACT	Communications terminal											
ESTAT	Execution status and monitoring											
EXSMS	ITV											
Falcon View	Mission planning/C2											
FBCB2	Positioning and communication device											
GALE Lite	Intelligence fusion											
GCCS-A	C2 system											
GCCS-J	Joint C2											
GCCS-M	Maritime C2											
GDSS	Force flow											
GES	Force flow											
IMOM	Analyze EW environment											
IOSv1	SA											
IOSv2	Intelligence fusion											
IPL	Intelligence imagery											
ITS	Target BDA											
JADOCs	Deep operations C2											
JOPES	Planning system											
JSWS	Intelligence imagery											
MCS	COP distribution											
MCS-L	SA											
M-DACT	Mobile communications terminal											
PSS-OSF	Fire support information exchange											
SBIRS	Ballistic missile early warning											
SOMPE	Mission planning											
TBMCS	Air campaign planning											
TIGER AWareE	Intelligence fusion											
TLDHS	Locate/designate/handoff targets											

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6. Training M&S Gaps Assessment

This section discusses the 29 training M&S gaps (see Table 3-2) in context of the M&S communities' DoD-wide enterprise-level gaps and ongoing or completed M&S-CO-funded projects that address the gaps. The training M&S needs discussed in Section 4 were compared to existing capabilities, and the resulting differences are considered to be training M&S gaps. This list provides an update from the original 35 training gaps (renamed "training needs") identified by the 2004 TC AoA. The update process included input from training stakeholders in the TGAF first convened at JFCOM in November 2008 and continued via electronic coordination and VTC meetings during 2009. The stakeholder issues presented and refined at the TGAF provided the group with the basis for updating the original TC AoA training gaps with a new priority ordering. The training stakeholders also identified the top 10 JTE problem areas, by which the training needs and gaps are organized.

6.1 Training M&S Gaps: Overview

The training M&S gaps are listed in the context of the JTE problem areas identified by the training stakeholders and discussed in Section 4. For each JTE problem area, the associated gaps are listed. To see how these gaps relate to the 35 training M&S needs originating from the TC AoA, refer to Table 3-2.

6.1.1 IAMM

1. AMD representations to simulate and stimulate real-world, dynamic systems in training¹⁶
2. Air mission exercises in a multi-echelon, multi-domain LVC environment
3. Stimulations of real-world display systems with portable, scalable, dynamic, affordable capabilities

6.1.2 EDI

4. Common object model
5. Rapid correlated terrain data
6. Rapid scenario-based individual and small-team training

¹⁶ The numbers (1–29) in Subsections 6.1.1 through 6.1.8 correspond to the numbers in the "M&S Gaps" column in Table 4-2.

7. Operational environments
8. Units and electronic OOB
9. Common general-purpose interface
10. Modular, tailorable JLVC Federation to support both large exercises and home-station training
11. Low-overhead, easy-to-operate JLVC capability for individual and collective applications
12. Shortened JELC and more quickly trained individuals and small teams
13. Data and specification of common procedures for initializing data for simulations

6.1.3 CDIS

14. Cross-domain security and multi-national information sharing
15. IO, including IW, cyber network exploitation, and defense and attack
16. Network warfare – net-centric environments, including cyber
17. EW and information warfare
18. Ability to share C2ISR data and training environment data with coalition partners at different activity levels
19. Secure network interface structure

6.1.4 Integrated Joint Logistics

20. Logistics and infrastructure representations across the full ROMO, including humanitarian relief and peacekeeping
21. Representations to allow end-to-end ITV by maintaining TCN integrity
22. Support for TRANSCOM migration to IGC
23. Enhanced force flow capabilities, including retrograde operations

6.1.5 JTF Training

24. Integrated JTF training
25. Second-order effects for planning and operations, including humanitarian relief, peacekeeping, law enforcement, insurgency, and conventional war

6.1.6 IW and PMESII

26. Mission environment – economic, diplomatic, political, and indigenous civilian
27. Mission environment – medical, public health, and related

6.1.7 Intelligence Training Strategic to Tactical

28. HUMINT

6.1.8 CBRNE Environment

29. CBRNE detection and effects environment

6.2 Training Community Gaps in Context of M&S Community Gaps

Table 6-1 shows how community-specified gaps are distributed across the M&S goals. The training M&S gaps contribute approximately 11.8% to the aggregate total of gaps in the M&S communities DoD-wide.

Table 6-1. M&S Goals by Community Gaps

Community/ Elements	Standards, Architectures, Networks, Environments	Policies	Management Processes	Tools	People	Total
Analysis	15	9	4	18	1	47
Acquisition	7	8	8	0	3	26
Experimentation	9	0	8	25	0	42
Planning	27	10	31	16	7	91
Testing	4	1	1	5	0	11
Training	16	3	0	10	0	29
Aggregate Total	78	31	52	74	11	246

Eight of the 29 training gaps have been addressed, at least in part, by the FY06–09 projects funded by M&S CO and sponsored by the training community. Each project is summarized in Subsection 6.3 in the context of the gap it most closely addresses. Some of the projects address part of one or more of the gaps. Additional project details and documents are accessible through the M&S CO. Table 6-2 (see Subsection 6.4) lists the FY06–09 training community projects funded by M&S CO, with the gap each most closely addresses, the estimated project end date, and other COIs.

6.3 Training M&S Gaps and Relevant Projects

This subsection provides a brief description of the 29 training gaps and relevant M&S-CO-funded projects in FY06 through FY09. Some of the gaps are not currently being pursued directly with M&S CO funds; however, relevant projects not listed in this document may have been completed or are ongoing and funded by individual agencies, Services, or COCOMs.

6.3.1 AMD Representations

STRATCOM and NORAD/NORTHCOM do not have the required models of sensors to stimulate C2 systems that allow training of integrated air and missile missions at all levels and consistent with operations. Existing simulations are engineering centric, crew-specific, uncoordinated, not interoperable, and do not support training in the multi-command, operational AMD missions. AMD representations should allow simulation and stimulation of real-world, dynamic systems in training.

6.3.2 Air Mission Exercises

The end-to-end information flows and decision processes to replicate AMD cannot be created in the existing training simulations. These simulations do not support training in the multi-command, operational AMD missions. A multi-echelon, multi-domain LVC environment would enhance air mission exercises and facilitate training in the area of IAMM.

6.3.3 Stimulations of Real-World Display Systems

Stimulations of real-world display systems need to be portable, scalable, dynamic, and affordable.

6.3.4 Common Object Model

A common object model is software that provides a commonly understood mechanism for specifying the exchange of public data and the general coordination among members of a federation of simulations. Its purpose is to improve interoperability and communication between objects in distributed operating systems and protocols (heterogeneous networks) in the exercise. It also improves the reuse of these objects in other simulations. The model should operate independently of hardware type and facilitate users' compatibility with all other devices.

Implementation of a common object model would facilitate realistic training in rapidly evolving environments that require a continual assessment of plans, policies, and procedures for lessons-learned reviews. It would also advance the development of simulation training for individuals and staffs across most—if not all—of the TC AoA gaps that can be addressed by joint training M&S. It is especially important in training that requires communication and interoperability among federated simulations, such as staff operations; interagency, intergovernmental, and multi-national operations; C4I; logistics; AC/RC integration; global strike; and other continuing operations.

Project: M&S CO funded the FY08 JCOM project led by the JFCOM. The goal of the JCOM project was to standardize a set of common object models to provide a neutral mechanism for documenting object models at the conceptual level. The project team also implemented a pilot object model library to determine its potential for rationalizing investments across DoD by promoting reuse across different architectures.

6.3.5 Rapid Correlated Terrain Data

Capabilities being developed are designed to shorten the time to incorporate new terrain data into simulations, thus making it possible to shorten the JELC and train individuals and small teams more quickly in CAP and JUO. Preparing visual terrain data is typically a manual process in which development teams spend several months and thousands of dollars creating small sections of a simulated environment. Techniques for rapidly producing correlated data, which may cover land, ocean, air, and space, are especially important in distributed simulations, where each node is responsible for maintaining its own model of the environment. Inconsistent data among the separate nodes can produce unrealistic simulations and interfere with training operations and interoperability. Improvement in this area will provide faster and more agile mission rehearsals, level the training field for all participants at all levels, and allow more ready use of national intelligence systems.

Projects:

- The FY07 Space Environment Impact System (SEIS), funded by M&S CO, led by the USAF, and executed by the National Geophysical Data Center (NGDC), is a Web-based tool that merged space weather data with impact rules to create an effects matrix that can be accessed by simulations to replicate space-based systems and performance.
- The FY08 Common LVC Terrain Database Evolution project team, funded by M&S CO, continued modification of the Rapid Unified Generation of Urban Databases (RUGUD) and development of the Objective Terrain Format (OTF) database. RUGUD is a government off-the-shelf (GOTS) data processing framework capable of exporting correlated and formatted data, including OTF, for representing the SNE used by the OneSAF Objective System (OOS). This effort was led by the U.S. Army Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI) and executed by PEO STRI Project Manager for Training Devices (PM TRADE).
- The FY08 Training for Aviation Urban Operations (TAUO), funded by M&S CO, promotes the development of standards, architectures, networks, environments, and methodology for developing common databases that are

critical to providing the detail necessary for replicating warfare in complex urban environments. This project was led by the United States Coast Guard (USCG).

6.3.6 Rapid Scenario-Based Individual and Small-Team Training

Capabilities being developed in this area should improve the ease with which local staffs in garrison and theater can author or edit types of scenarios and, to some extent, simulations to meet special, local, and short-fuse training needs. These capabilities will provide more realistic training in rapidly evolving environments, such as CAP and local and JUO.

Projects:

- The FY06 JDA Phase I project team, funded by M&S CO, produced 10 recommendations in its final report delivered in September 2007:
 - *Recommendation 1.* Conduct an M&S SC survey and analysis to review ongoing data initialization programs and capabilities in the M&S and C4ISR communities
 - *Recommendation 2.* Conduct an M&S SC survey and analysis of data related tools and utilities
 - *Recommendation 3.* Adopt an SOA for a JDA solution integration framework
 - *Recommendation 4.* Develop the JDA solution using a series of short (6- to 9-month) spirals of evolving capabilities
 - *Recommendation 5.* Develop the JDA solution as part of a comprehensive COI activity, subject to DoD Net-Centric Data Strategy, GIG, and other pertinent DoD issuances
 - *Recommendation 6.* Establish a JDA solution governance body to set M&S data capability vision and to oversee M&S data capability development
 - *Recommendation 7.* Involve C2 programs and communities in governance of a JDA solution capability
 - *Recommendation 8.* Define a JDA solution roadmap to outline near-term solution capabilities and policies
 - *Recommendation 9.* Focus JDA solution investments on those services critical to—not duplicative of—DoD, the M&S community, and C4ISR data management and initialization efforts
 - *Recommendation 10.* Establish a Joint Program Executive Office (JPEO) for sourcing and management of M&S data capability and infrastructure.

Five of these recommendations were developed as part of the JDA Phase II.

- The FY08 JDA Phase II project was funded by M&S CO and led by the U.S. Army. The first five recommendations from the JDA Phase I were implemented in JDA Phase II.

6.3.7 Operational Environments

The development of operational environments focuses on data and the specification of common procedures for initializing data for simulations. Proper data initialization supports the declaration of sharable objects and their management across federates. As the practice of federating simulations grows, the need for initialization processes common to all simulations also grows. The challenge is that military simulations development is customized by the tools, architectures, and programming languages preferred by the designers and developers. This approach often results in the same data being processed multiple times because data initialized for one simulation cannot be used in another simulation that has different data initialization requirements. Even if a data model is used as a common reference model for information exchange, the composites and aggregates may not be explicit in it. Other data-related issues arise in simulations because of omitting variables, lacking relevant data, using inappropriate data, and using data beyond an applicable range. Another serious issue is lack of documentation about data and data sources.

The development of an HLA, with its standard object model template, simulation object model, and federation object model, was an important step forward. However, a more comprehensive architecture is needed—one that transforms data (numerical, textual, or graphical) for use in distributed, federated applications. This capability would advance data initialization for individual or staff simulation training and would allow more realistic training in rapidly evolving environments that require rehearsals to perform collective C2 tasks by component command staffs. It would also enhance training in logistics for staging and onward movement, adaptive planning and deployment systems, global strike, and COOP.

Projects: The FY06 and FY08 LVCAR, funded by M&S CO, was a multi-phase project led by JFCOM J7 and executed by JFCOM, IDA, the Johns Hopkins University Applied Physics Laboratory (JHU APL), and PEO STRI. Phase I, funded in FY06, produced an April 2008 mid-project report that mapped user requirements, compared the middleware functionality and business models of existing LVC architectures, and contrasted standard management processes for LVC architecture evolution. Phase II, funded

in FY08, produced a final November 2008 report that included a notional definition of the desired future architecture standard, the desired business models, and the manner in which standards should be evolved and compliance should be evaluated.

The architectures included in the LVCAR analysis are the Aggregate-Level Simulation Protocol (ALSP), the Common Training and Instrumentation Architecture (CTIA), DIS, HLA, and TENA. The LVCAR project recommended that near- and mid-term solutions focus on reducing or eliminating the barriers to interoperability between the existing architectures and that the long-term strategy should be an architecture convergence that will produce a single, unified architecture. The LVCAR further recommended that the DoD establish high-level management oversight of all existing distributed simulation architectures (as a unified resource) and architecture development activities.

In FY09, an M&S SC High-Level Task was approved to implement the LVCAR recommendations. The FY09 LVCAR implementation projects, funded by M&S CO, sponsored by JAEC, and managed by JTIEC, included

- Managing the LVC environment (performed by IDA and JHU/APL)
- Developing architecture-independent object model components (i.e., JCOM)
- Developing LVC architecture convergence design and implementation
- Developing common gateways and bridges
- Establishing common LVC capabilities.

6.3.8 Units and EOB

The training community needs M&S training databases that provide information about what other forces, personnel, and equipment participating units might encounter in operations. Such databases might include information on the composition, disposition, strength, training, tactics, logistics, effectiveness, history, and uniforms of other units, along with information on signals intelligence (SIGINT) and communications intelligence (COMINT) emitters, their geographic location or range of mobility, their signals, and their likely role in the broader OOB. EOB information might indicate enemy unit movement, changes in command relationships, and increases or decreases in capability. It would provide more realistic and intense mission rehearsals by using a collaborative environment to exchange information that employs national intelligence systems to identify adversary and friendly force capabilities and the probable COAs and integrating IC training with other force components. Rapid production of these databases would facilitate mission rehearsal for local and short-fuse training needs.

6.3.9 Common General-Purpose Interface

Simulation-based training should not bog down in simulation operating procedures. One way to foster concentration on the training that M&S is providing, rather than on the M&S technology itself, is to develop and enforce common operating processes and procedures that provide joint training—in short, the development of a common, interoperable look and feel for training systems. The capability provided by this investment will apply to any TC AoA gap that can be met with M&S. It may prove particularly important in training individuals and small teams that do not have ready access to technical aids.

Project: The FY07 DSVT, which was funded by M&S CO, is a Web-based tool for managing, developing, and vetting M&S standardization documents and requirements in establishing new standards for joint, DoD, and Service use. The development of the SVT was led by the Space and Naval Warfare Systems Center Pacific (SSC Pacific). It was delivered and became operational in September 2008.

6.3.10 Modular, Tailorable JLVC Federation

In 2009, the TGAF assigned new priority ordering to the original 35 training needs identified by the 2004 TC AoA. The need to provide faster/higher fidelity mission rehearsal was given a priority rating of “3.” Today’s simulations are difficult to develop, maintain, operate, and set up for given training events. Typical exercises require 150 to 200 personnel to operate the models. A modular, tailorable JLVC Federation should be developed to provide faster/higher fidelity mission rehearsal and support to both large exercises and home-station training.

6.3.11 Low-Overhead, Easy-To-Operate JLVC Capability

The cost of an exercise can run as high as \$1M for event preparation and testing alone. An investment plan is needed to improve the efficiency of models and to make them official programs of record. Large training events need simpler tools that support exercise design/integration and scenario generators. Low-overhead, easy-to-operate JLVC capabilities are needed for individual and collective applications.

6.3.12 Shortened JELC

To achieve faster/higher fidelity mission rehearsal, the training environment should allow for rapid database development and shortened JELC.

The simulation should

- Maintain a common SNE (terrain skin, feature data, and targets) among all federate simulations
- Maintain a common scenario database (e.g., OOB data) among all federate simulations
- Maintain a common civil environment (civil infrastructure, political, cultural, and economic data) database among all federate simulations
- Be capable of rapid database development (scenario, civil environment, and SNE) within 96 hours, using 8 qualified database builders for a unified endeavor-sized joint event
- Possess a distributed, Web-based database build capability
- Possess the ability to merge separately developed portions of a database
- Have the ability to access and import data from standardized databases such as the MIDB and CFDB
- Be interoperable with JOPES or its follow-on adaptive planning and deployment system
- Possess a common tool set that automates or semi-automates the 5-phase JELC cycle.

6.3.13 Data and Specification of Common Procedures

Achieving faster/higher fidelity mission rehearsal requires data and specification of common procedures for initializing data for simulations. Training should be based on the JROC-approved ROMO:

- Specified by the OPLAN/OPORD for which the mission rehearsal is required
- Identifying the portion of the plan for rehearsal
- Selecting appropriate rehearsal techniques for staffs and organizations.

Training should

- Incorporate approved individual and unit joint training standards
- Schedule the training support resources (e.g., observer-trainers, models/simulation, and ranges/maneuver areas)
- Establish a “Red Cell” that accurately reflects the military doctrine, political-military approaches, and current capabilities of the belligerent forces.

An assessment plan should be provided to

- Determine individual and unit readiness to execute the standards for tasks that support the OPLAN/OPORD

- Identify mission capability shortfalls
- Plan and conduct corrective individual and unit training to achieve required standards and minimize mission risk.

6.3.14 Cross-Domain Security and Multi-National Information Sharing

A key goal of T2 is the ability to perform joint, interagency, intergovernmental, and multi-national operations successfully. The ability to acquire and share sensitive, timely information across domains, agencies, and nations is vital in meeting this goal, but it remains a serious problem for distributed M&S. Some technical methods exist for sharing classified information across domains, but these methods tend to be inefficient, expensive, or difficult to use in federations. Investment in these capabilities will improve training in IO, realistic interagency or multi-national environments, homeland security, and use of national intelligence systems.

6.3.15 IO

IO are defined as those operations that use integrated employment of EW, computer network operations, PSYOPS, military deception, and OPSEC. IO are used with supporting and related capabilities to influence, disrupt, corrupt, or usurp adversarial human and automated decision-making processes while protecting our processes and those of our allies. In the 2004 TC AoA, these operations included information warfare, computer network exploitation, computer network defense, and computer network attack. They were specifically addressed in the TC AoA as the sixth highest rated gap.

Investment will improve training for EBO, homeland defense, SASO, CM operations, and intelligence and special operations personnel who work with command staffs.

6.3.16 Network Warfare – Net-Centric Environment

Investment in network warfare is crucial because of the vulnerability and importance of networks. Network warfare includes network attack, defense, and exploitation. The focus is on computer networks but may cover other areas, such as telephone networks, which have their own computer networking capabilities. Training to address all three areas (i.e., attack, defense, and exploitation) relies on simulation, which provides the most realistic and credible representation of the network warfare environment. The network software can be used in various training environments, and the outer shell with which participants interact should simulate environments in which decisions must be made about attacking, defending, exploiting, or dealing with the network.

Investment in net-centric M&S capabilities will improve training for information warfare, assist with training for homeland defense operations, crisis-management planning, EBO, SASO, and CM operations and will help train intelligence forces and SOF working with command staffs.

6.3.17 EW and Information Warfare

EW and information warfare include electronic attack, electronic protection, and electronic security. Electronic attack uses electromagnetic energy to degrade, neutralize, or destroy enemy capability. Electronic protection involves actions taken to protect against allied or enemy use of electromagnetic energy that may degrade, neutralize, or destroy friendly capability. Electronic security allows an operational commander to locate, intercept, and identify intentional and unintentional sources of electromagnetic energy for immediate threat recognition and for planning and conducting operations.

Developing these capabilities will improve training for IO and related areas, such as staff activities, crisis actions, homeland defense, C4I using collaborative information, SASO, intelligence operations, CIP, and CM operations.

6.3.18 Ability To Share C2ISR Data and Training Environment Data

The ability to share C2ISR data and training environment data with coalition partners at different activity levels is needed to support the following gaps identified by the TC AoA for CDIS (see Subsection 4.2.3 for details):

- Develop an environment to conduct JIIM training
- Train Forces on IO including Information Warfare, computer network exploitation, computer network defense and computer network attack
- Train theater/strategic force to conduct C4I operations using the CIE
- Train the JIACG
- Train Forces on strategic information assurance.

6.3.19 Secure Network Interface Structure

Interagency, intergovernmental, and coalition M&S capabilities need to be integrated with our national training capabilities. Coordination with and connectivity to our secure systems would save valuable resources, result in interoperability, and enhance our ability to create common operational procedures to train our partners. A unified solution incorporating a secure network interface structure for CDIS would allow us to seamlessly integrate our training partners and would have a dramatic impact on communications and

interoperability, manning, common techniques and procedures, and other training requirements. It would also enable the development of partner capacity and the ability to conduct interagency and coalition exercises with realistic information exchange.

6.3.20 Logistics and Infrastructure Representations

M&S training capabilities should cover the full range of support for military operations—from moving forces and supplies to infrastructure that support that movement (e.g., ports). Logistics and infrastructure support is critical for all operations—from humanitarian relief and peacekeeping to conventional war and stability and support missions. M&S development is needed to improve training in logistics and infrastructure that support warfighters in training and in combat operations.

Project: The FY07 joint targeting and battle damage assessment (BDA) simulation capability, funded by M&S CO, led by the JFCOM Joint Transformation Command for Intelligence (JTC-I), and executed by Applied Research Associates (ARA) and General Dynamics (GD), provides the BDA training audience a simulation capability that can produce realistic and timely raw ISR and unmanned aerial vehicle (UAV) products actually used to conduct BDA in real-world combat operations. The ISR and UAV products represent post-strike damage generated from the physics-based analysis of weapon-target interactions as planned and executed by the training audience. This capability was delivered to the JFCOM JTC-I Joint Intelligence Laboratory (JIL) in October 2008 and was demonstrated in July 2009.

6.3.21 Representations To Allow End-to-End ITV

Logistics training models are needed to fully support simulation of the full, integrated, realistic logistics process. Such models would enhance the training value associated with COCOM and Service logistics training capabilities that replicate ITV of “factory-to-foxhole” end-to-end logistics force flow, deployment, distribution, sustainment, and retrograde operations. Representations should allow end-to-end ITV by maintaining TCN integrity.

6.3.22 TRANSCOM Migration to the IGC

Currently, a gap in training exists to support TRANSCOM migration to the IGC.

6.3.23 Enhanced Force Flow Capabilities

Force flow capabilities should be enhanced to include retrograde operations. Training should

- Balance logistics planning and execution with CCDR's priorities in support of operational requirements
- Sustain the force during long-term execution, including joint deployment and distribution operations
- Enable commands to continually assess plans, policies, and procedures
- Integrate lessons learned to improve logistics readiness while employing the three overarching principles CCDRs consider in joint logistics planning and execution including JRSOI operations: unity of command, synchronization, and balance.

6.3.24 Integrated JTF Training

With the ever-increasing importance of jointness at the tactical level, more traditional COCOM and Service exercises require significant joint enablers (e.g., functional head quarters, higher headquarters, cross-Service participation, interagency participation, coalition participation, and so forth). Vertically integrated training events also require multiple echelons to stress the full flow of information and decision making. Simulations are needed to support the full range for these types of exercises, requiring large exercise control groups and hundreds of role players per exercise. Representations of joint C2ISR are needed to support home-station training environments in joint TTP.

Integrated JTF training should address the following needs initially identified by the 2004 TC AoA and subsequently updated by the stakeholders at the TGAF in 2009 to reflect new priority ordering (see Subsection 4.2.5 for details):

- Combined JTFs
- Standing JTFs
- Use national intelligence systems (operations and tactical levels)
- Integration and mobilization of ACs and RCs
- Crisis action procedures.

6.3.25 Second-Order Effects for Effects-Based Planning and EBO

The development of capabilities in second-order effects will help train the full ROMO, including humanitarian relief, peacekeeping and peacemaking, law enforcement, insurgency, and conventional war. These capabilities focus on the effects produced by military operations rather than the operations themselves, and this focus helps establish a perspective for tracing and anticipating direct and indirect effects as they propagate through political, military, economic, sociological, and information infrastructures.

Capabilities will also enhance training for JSs and task forces; crisis management; JUO; information warfare; interagency, intergovernmental, and multi-national operations; homeland defense operations; intelligence center battle staff integration; and CM operations.

6.3.26 Mission Environment (Economic, Diplomatic, Political, and Indigenous Civilian)

In the current environment, civilian factors are inseparable from military operations and need to be included in joint training M&S. However, doing so raises many new challenges for the M&S training community and requires new approaches, such as behavioral moderators and realistic models of culture, religion, civilian activities, reactions, and beliefs. The issues involved in creating these capabilities are quite different from those involving terrain and weather, and they are more diffuse and less constrained than military domains that involve unit capabilities, tactics, and operational plans.

Development of these capabilities will enhance joint training M&S for interagency operations, homeland defense, the full range of EBO involving civilian populations, SASO, military assistance to civil authorities, and CIP.

6.3.27 Mission Environment (Medical, Public Health, and Related)

The improved production of M&S databases that cover medical and public health issues affects several training areas and, consequently, a variety of TC AoA gaps. These databases need to be developed and routinely integrated with other M&S capabilities to improve training for task force staffs, JUO, homeland defense, EBO, SASO, military assistance to civil authorities, coordinated personnel recovery operations, CM operations, and CIP.

6.3.28 HUMINT

Defense efforts in intelligence have been criticized for emphasizing technological sources too much and human sources too little. The range of HUMINT sources includes military patrols, traveler debriefings, diplomatic reports, newspaper and magazine articles, and espionage. Because HUMINT has unique capabilities that can make contributions to the success of military operations, it should be included in joint training M&S.

M&S training capabilities that include HUMINT can enhance decision making for IO, improve task force staff training, improve training at the operational and tactical level in using the national intelligence systems, help train IC members and strengthen their

participation in staff exercises, and better integrate training for operations and intelligence staffs.

Project: The FY07 HUMINT Wargaming Trainer (HWT), funded by M&S CO and led by JFCOM JTC-I, was developed as a culture and motion capture prototype game for intelligence training for asymmetric warfare. The game is a virtual representation of cultural, behavioral, and environmental elements for learning in the home base and the theater. Threat scenarios are downloaded to the game device on a periodic basis (weekly to monthly), and capabilities' ratings are recorded for individual performance. The prototype software was delivered to the JFCOM JTC-I JIL in October 2008.

6.3.29 CBRNE Detection and Effects

CBRNE events are concerned with the deliberate or inadvertent release of CBRNE devices that can cause massive damage and extensive human casualties. The number of nations, non-nation organizations, and even small groups of individuals that possess CBRNE devices and are capable of staging CBRNE events rapidly is steadily increasing. Therefore, the need for training to manage and deal with CBRNE events is also increasing. The impact of such attacks may reach much further than the scene of the disaster. Injured and contaminated victims may depart the scene and return to their neighborhoods and residences.

Investment in M&S capabilities for CBRNE detection and effects will improve training in the detection, interdiction, isolation, or mitigation of CBRNE weapons and in the CBRNE environments. This investment will also help integrate CBRNE effects into other training, such as CAP, JUO, intergovernmental and multi-national operations, homeland defense, military assistance to civil authorities, use of national intelligence systems, CM, and CIP.

6.4 Summary

Table 6-2 lists the FY06–09 TC projects that were funded by M&S CO and includes the gap each most closely addresses, the estimated project end date, and other M&S COIs. During FY09, additional progress was made directly with the stakeholders to provide the necessary details to enter into the requirements and funding processes. For the IAMM gap, an All Things Missile (ATM) Working Group was formed to provide and flesh out the requirements for a Tier 1–4 training capability. Working directly with the

Table 6-2. FY06–09 TC Projects Funded by M&S CO

FY06 Projects	M&S Gaps Addressed	Project End Date	Other M&S COIs
LVCAR Phase I	7	May 2008	Acquisition, experimentation, testing
JDA Phase I	6	Sept. 2007	Analysis, acquisition, experimentation, planning, testing
FY07 Projects	M&S Gaps Addressed	Project End Date	Other M&S COIs
SEIS	5	May 2008	Analysis, acquisition, experimentation, planning, testing
Joint Targeting and BDA Simulation Capability	20	July 2009	Analysis, services
HWT	28	Oct. 2008	Analysis, experimentation
DSVT Independent Verification and Validation (IV&V). Project 07-TR-131	9	Oct. 2008	Analysis, acquisition, experimentation, planning, testing
FY08 Projects	M&S Gaps Addressed	Project End Date	Other M&S COIs
JDA Phase II	6	May 2009	Analysis, acquisition, experimentation, planning, testing
JCOM	4	Oct. 2009	Experimentation, testing
TAUO	5	Dec. 2009	Experimentation, testing
Common LVC Terrain Database Evolution	5	June 2009	Analysis, experimentation, testing
LVCAR Phase II	7	Nov. 2008	Acquisition, experimentation, testing
FY09 Projects	M&S Gaps Addressed	Project End Date	Other M&S-Related COIs
<i>LVCAR HLT includes the following projects:</i>			
Managing the LVC Environment	7	Sept. 2010	Analysis, acquisition, experimentation, planning, testing
Architecture Independent Object Model Components	7, 4	Mar. 2010	Analysis, acquisition, experimentation, planning, testing
LVC Architecture Convergence Design and Implementation	7	Apr. 2010	Analysis, acquisition, experimentation, planning, testing
LVC Common Gateways and Bridges	7	Apr. 2010	Analysis, acquisition, experimentation, planning, testing

training stakeholders, STRATCOM conducted a functional needs analysis to establish an ATM training architecture. The intent of this initiative is to provide the necessary justification to compete for resources outside of both the training and M&S communities. Additional work will be done in FY10 to capture the outcome of those training enhancement projects beyond those funded by the M&S SC.

7. Findings and Recommendations

The 2009 TMSBP is the next in the series of documents that provide annual snapshots for what has become an evolutionary process for enhancing the DoD M&S training capabilities. This and future updates will continue to incorporate training capabilities, including those with Service-oriented architectures, Web-enabled M&S, net-centric data integration, and a distributed environment that will allow LVC training capabilities to interoperate seamlessly. This plan identifies and discusses the M&S project efforts, key enablers, and joint federations' upgrades that are currently underway.

The investment strategies identified in the 2007 TMSBP provided a first look at the detailed M&S projects that were needed to fill the training gaps identified in the 2004 TC AoA. Today, we continue to make progress in building a persistent, distributed training environment comprised of more affordable and effective capabilities for training U.S. forces in the JMETs to meet the needs of the component commanders, JTF staffs, SJFHQ, component commands, and the military Services. As operational performance objectives change, and with them the proliferation of a variety of military missions, M&S capabilities can help train U.S. forces as they are intended to operate. M&S capabilities can help the DoD train forces to meet the challenges posed by advances in technology and, in many cases, train in situations where training in a live-only environment is not feasible. M&S training capabilities contribute greatly to integrated joint and Service operations—not only for traditional test and training facilities, but also in integrating these facilities with other areas of defense planning (e.g., acquisition, logistics, personnel, professional development, and C2 processes).

Investing in M&S training capabilities will be a key factor in the training program goal of global presence—provide training and education anytime, anywhere, to a wide spectrum of training needs and audiences.

The investment strategies discussed in this 2009 TMSBP satisfy several cross-cutting M&S capability gaps identified by the 2008 DoD M&S C&CC BP. These strategies will play a key role in developing an integrated set of DoD-wide M&S capabilities that allow the operators to employ M&S in the most effective and efficient manner—one that benefits the DoD total force.

The training M&S gaps identified in this plan concentrate on several key areas for improvement to enhance reuse and interoperability:

- Common tools
- Common data
- Common interests within DoD (e.g., underlying standards, architectures, and VV&A processes).

Finally, executing the plan to address the JTE problem areas will also help the DoD M&S SC focus future efforts and funding on addressing the following DoD-wide capability gaps, as stated in the Draft 2010 update of the DoD M&S C&CC BP:

- Web-enabled M&S
- CDIS
- Persistent and reusable LVC environments
- Workforce development.

7.1 Key Findings

- The TC AoA training gaps (needs) have been updated, with the assistance of training stakeholder organizations. Several of the training needs have been addressed during the last 5 years, and new needs have emerged to change the training priorities during FY09.
- Several long-standing training needs previously identified are being progressively corrected by joint and Services development programs, while other functional areas remain as unfunded issues.
- The use of M&S in training continues to evolve and to provide improved training capabilities in preparing forces for operational missions.
- Some projects funded by the M&S SC continue to contribute to training capabilities and to the DoD-wide M&S enterprise.

7.2 Recommendations

- Continue the update process initiated in FY09 by the Joint M&S TGAF conducted by JFCOM to arrive at formal coordination and validation of training needs at senior leadership levels in each stakeholder organization.
- Continue to update the OSD-provided training capabilities, which were used as the start point for 2009 TMSBP capabilities baseline.
- Work to resolve long-standing training issues surfaced by the TGAF, including IAMM, CDIS, and Integrated Joint Logistics.

- Continue to fund the research and development (R&D) efforts at JFCOM to facilitate support for large joint training exercises. The TGAF identified a series of issues that have been grouped as exercise design and integration.
- The training stakeholders should participate with the JS J7 to formally staff the training problem areas and training needs that serve as an updated requirements baseline for future training M&S efforts.
- Provide increased accommodation of the “live training” needs in the LVC training environments.

Since training needs and technologies are constantly changing, the TMSBP will continue to evolve as a living document. The 2007 TMSBP provided the training community “investment strategies” for participation in the M&S SC project call for M&S projects submitted by the “communities enabled by M&S.” The intent of these future TMSBP updates is to further address the mid- to long-term efforts and provide justification for major investments in training capabilities funded by future M&S in future Program Objective Memorandum (POM) submissions.

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Acronyms¹⁷

2D	two-dimensional
3D	three-dimensional
AADC	Area Air Defense Command
AAR	after action review
AARS	After Action Review System
AAT	Architecture Assessment Tool
ABCS	Army Battlefield Command System
AC	Active Component
ACC	Air Combat Command
ACE	Air and Space Constructive Environment
ACRES	Adaptive Communications Reporting Simulation
ACSIS	AEGIS Combat System Interface Simulation
ACTD	Advanced Concept Technology Demonstration
ACTF	Army Constructive Training Federation
ADSI	Air Defense Simulation Integrator
AFATDS	Advanced Field Artillery Tactical Data System
AFB	Air Force Base
AFMSTT	Air Force Modeling and Simulation Training Toolkit
AFSERS	Air Force Synthetic Environment for Reconnaissance and Surveillance
AIS	Automated Identification System
ALSP	Aggregate-Level Simulation Protocol
ALTOS	Acoustic Transmission Loss Server
AMC	Air Mobility Command
AMD	air and missile defense
AMDWS	Air and Missile Defense Workstation
AMPS	Automated Mission Planning System
AoA	Analysis of Alternatives
AOR	area of responsibility
API	Application Programmers' Interface
APL	Applied Physics Laboratory
ARA	Applied Research Associates

¹⁷ This is a comprehensive acronym list for the main body of this report and for the appendixes.

ARCHER	Archiving and Enhanced Retrieval System
ASAS	All Source Analysis System
ASAS-L	All Source Analysis System–Light
ASCC	Army Service Component Command
ASCCE	Air and Space Cyber Constructive Environment
ASCCE-CSI	Air and Space Cyber Constructive Environment–Command and Control Systems Interface
ASCCE-IOS	Air and Space Cyber Constructive Environment–Information Operations Suite
ASCOT	Airspace Control and Operations Trainer
ASDS	Advanced SEAL Delivery System
ASOC	Air Support Operations Center
ASSET	Automated Script Simulator Exercise Training
ASTI	Army Secure Tactical Initiative
ASUW	anti-surface warfare
ASW	anti-submarine warfare
AT&L	Acquisition, Technology, and Logistics
ATCCS	Army Tactical Command and Control System
ATLOS	Acoustic Transmission Loss Server
ATM	All Things Missile
ATO	air tasking order
AUTODIN	Automatic Digital Network
AVCATT	Aviation Combined Arms Tactical Trainer
AWACS	Airborne Warning and Control System
AWarE	Advanced Warfare Environment
AWSIM	Air Warfare Simulation
BCS	Battlefield Command System
BCS3	Battle Command Sustainment Support System
BCTP	Battle Command Training Program
BDA	battle damage assessment bomb damage assessment
BFA	battlefield functional area
BFTT	Battle Force Tactical Trainer
BFV	Bradley Fighting Vehicle
BICM	BCTP Intelligence Collection Model
BLOS	Beyond-Line-of-Sight
BMD	ballistic missile defense
BMDS	Ballistic Missile Defense System
BVI	Battlespace Visualization Initiative

C&CC BP	Corporate and Crosscutting Business Plan
C2	command and control
C2BMC	Command, Control, Battle Management, and Communications
C2ISR	command and control, intelligence, surveillance, and reconnaissance
C2PC	Command and Control Personal Computer
C3	command, control, and communications
C3I	command, control, communications and intelligence
C4I	command, control, communications, computers, and intelligence
C4ISR	command, control, communications, computers, intelligence, surveillance and reconnaissance
CACCTUS	Combined Arms Command and Control Training Upgrade Systems
CAMPS	Consolidated Air Mobility Planning System
CAN	Combined Arms Network
CAP	crisis action planning
CAS	close air support
CATS	Conflict and Tactical Simulation
CB Sim Suite	Chemical Biological Simulation Suite
CBDP	Chemical and Biological Defense Program
CBITS	Chemical Biological Instrumented Training System
CBRNE	chemical, biological, radiological, nuclear, and high-yield explosives
CBS	Corps Battle Simulation
CCB	Configuration Control Board
CCD	Common Connectivity Device
CCDR	combatant commander
CCIR	Commander's Critical Information Requirement
CCTT	Close Combat Tactical Trainer
CDIS	Cross-Domain Information Sharing
CDR	commander
CDS	cross-domain solution
CeAG	Certification Advisory Group
CENTCOM	U.S. Central Command
CENTRIX	Combined Enterprise Regional Information Exchange
CFACC	combined force air component commander
CFAST	Collaborative Force Analysis, Sustainment, and Transportation

CFDB	Conventional Forces Database
CFE	CENTRIX Four Eyes
CFF	call for fire
CFFT	Call-for-Fire Trainer
CIDNE	Combined Information Data Network Exchange
CIE	Collaborative Information Environment
CIP	critical infrastructure protection
CIS	Combat Intelligence System
CJCS	Chairman of the Joint Chiefs of Staff
CJCSM	Chairman of the Joint Chiefs of Staff Manual
CJOA	Combined/Joint Operations Area
CJTF	Combine Joint Task Force
CM	consequence management
CNO	Chief of Naval Operations
CO	coordination office
COA	course of action
COCOM	combatant command
COI	community of interest
COMINT	communications intelligence
COMJTF	Commander Joint Task Force
COMPT	USD(COMPT) Program and Budget
CONOPS	Concept of Operations
CONPLAN	Concept of Operations Plan
CONUS	Continental United States
COOP	continuity of operations
COP	common operational picture
COTP	common operational tactical picture
CPOF	Command Post of the Future
CPX	Command Post Exercise
CRC	Control and Reporting Center
CSA	Chief of Staff of the Army Combat Support Agency
CSAF	Chief of Staff, United States Air Force
CSAR	Combat Search and Rescue
CSI	Command and Control Simulation Interface
CSP	Communications Support Processor
CSSCS	Combat Service Support Control System
CTAPS	Contingency Theater Automated Planning System

CTF	Combined Task Force
CTIA	Common Training and Instrumentation Architecture
CTP	common tactical picture
CV/CVN	aircraft carriers
DACT	Data Automated Communications Terminal
DARPA	Defense Advanced Research Projects Agency
DASD/RA	Deputy Assistant Secretary of Defense (Reserve Affairs)
DCE	Dynamic Communications Environment
DCGS	Distributed Common Ground System
D-DACT	Dismounted Data Automated Communications Terminal
DDMS	Department of Defense Discovery Metadata Specification
DDR&E	Director Defense Research and Engineering
DDS	Digital Data System
DIA	Defense Intelligence Agency
DICE	Distributed Incremental Compiling Environment
DIR R&T	Director, Readiness and Training
DIR	Director
DIS	Distributed Interactive Simulation
DISA	Defense Information Systems Agency
DISCO	Deployable Simulation for Collaborative Operations
DJS	Director of the Joint Staff
DL	Distance Learning
DMO	Distributed Mission Operation
DMOC	Distributed Mission Operations Center
DMS	Defense Message System
DMT	Distributed Mission Training
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DOT&E	Director, Operational Test and Evaluation
DPA&E	Director, Program Analysis and Evaluation
DRRS	Defense Readiness Reporting System
DSCA	Defense Support to Civil Authorities
DSEEP	Distributed Simulation Engineering and Execution Process
DSVT	DoD Standards Vetting Tool
DTEN	Defence Training and Experimentation Network
DTS	Defense Transportation System
DTSS	Digital Topographic Support System

DUSD/R	Deputy Under Secretary of Defense for Readiness
DVDT	DoD VV&A Documentation Tool
DVTE	Deployable Virtual Training Environment
EAC	Echelons Above Corps
EADSIM	Extended Air Defense Simulation
EBC	Embedded Battle Command
EBO	effects-based operations
EDCS	Environmental Data Coding Standard
EDCSS	Environmental Data Cube Support System
EDI	Exercise Design and Integration
EFAAS	Effective Active Acoustic Simulation
ELINT	electronic intelligence
EOB	electronic order of battle
EPLRS	Enhanced Position Location Reporting System
ERF	Entity Resolution Federation
ESC	Electronic Systems Center
ESG	Executive Steering Group
EST 2000	Engagement Skills Trainer 2000
ESTAT	Executing Status and Monitoring (Theater Battle Management Core System)
eTSIU	Enhanced Tactical Simulation Interface Unit
EW	electronic warfare
EWO	electronic warfare operations
ExCIS	Extensible C4I Instrument Suite
EXSMS	Exercise Single Mobility System
FAC	forward air controller
FAST	Fidelity Assessment Simulator Tool
FBCB2	Force XXI Battle Command, Brigade and Below
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FIRESIM	Fires Simulation
FMT-R	Federation Management Tool–Reloaded
FO	forward observer
FOM	Federation Object Model
FTX	Field Training Exercise
FUNCPLAN	Functional Plan
FY	Fiscal Year
GALE	Generic Area Limitation Environment

GCC	geographic combatant commander
GCCS	Global Command and Control System
GCCS-A	Global Command and Control System–Army
GCCS-J	Global Command and Control System–Joint
GCCS-M	Global Command and Control System–Maritime
GCSS	Global Combat Support System
GD	General Dynamics
GDF	Guidance for Development of the Force
GDSS	Global Decision Support System
GEF	Guidance for Employment of the Force
GEG	GPS Environment Generator
GES	GTN Exercise Server
GIAC	Graphical Input Aggregate Control
GIG	Global Information Grid
GOTS	government off-the-shelf
GPS	Global Positioning System
GTN	Global Transportation Network
GUI	graphical user interface
HDC	HLA-DIS Converter
HITI	High-Interest Training Issue
HITL	human-in-the-loop
HLA	High Level Architecture
HQ	headquarters
HUMINT	Human Intelligence
HWT	HUMINT Wargaming Trainer
IAMM	Integrated Air and Missile Missions
IAP	integrated air picture
IAS	Intelligence Analysis System
IBSS	Independent Basic Service Set
IC	Intelligence Community
ICAO	International Civil Aviation Organization
ICCOG	Intelligence Community Coordination Group
IDA	Institute for Defense Analyses
IDE	Integrated Data Environment
IED	improvised explosive device
IEEE	Institute of Electrical and Electronics Engineers
IEW	intelligence electronic warfare

IEWTPT	Intelligence Electronic Warfare Tactical Proficiency Trainer
IFACT	Indirect Fire–Forward Air Control Trainer
IGC	IDE/GTN Convergence
III MEF	III Marine Expeditionary Force
IIR	Imagery Interpretation Report
IMETS	Integrated Meteorological System
IMOM	Improved Many on Many
IO	information operations
IOS	Information Operations Suite
IPB	intelligence preparation of the battlefield
IPE	individual protective equipment
IPIR	Initial Photo Interpretation Report
IPL	Imagery Product Library
IPT	Integrated Process Team
ISM	Independent Stimulation Module
ISR	intelligence, surveillance, and reconnaissance
IT	Information Technology
ITK	Infantry Tool Kit
ITS	Interim Targeting Solution
ITV	In-Transit Visibility
ITW/AA	Integrated Tactical Warning and Attack Assessment
IV&V	Independent Verification and Validation
IW	Irregular Warfare
IWEG	Information Warfare Effects Generator
J7	Joint Training Directorate
JAARRL	Joint AAR Resource Library
JADOCS	Joint Automated Deep Operations Coordination System
JAEC	Joint Assessment and Enabling Capability
JBUS	Joint Bus
JCAS	joint close air support
JCASR	Joint Combat Search and Rescue
JCATS	Joint Conflict and Tactical Simulation
JCOM	Joint Composable Object Model
JCS	Joint Chiefs of Staff
JDA	Joint Data Alternatives
JDAARS	Joint Deployable After Action Review System
JDLM	Joint Deployment Logistics Model

JDT	Joint Data Translator
JECEWSI	Joint Electronic Combat Electronic Warfare Simulation
JECS	Joint Exercise Control System
JELC	joint event life cycle
JEM	Joint Effects Model
JFACC	joint force air component commander
JFAST	Joint Flow and Analysis System for Transportation
JFC	joint force commander
JFCOM	Joint Forces Command
JFRG	Joint Force Requirements Generator
JHU	Johns Hopkins University
JIACG	Joint Interagency Coordination Group
JIATS	Joint Interagency Training Specialists
JIIM	Joint Interagency Intergovernmental, Multi-national
JIL	Joint Intelligence Laboratory
JIPT	Joint Integrated Process Team
JITC	Joint Interoperability Test Command
JKDDC	Joint Knowledge Development and Distribution Capability
JLCCTC	Joint Land Component Constructive Training Capability
JLOD	JCATS Low Overhead Driver
JLVC	Joint Live, Virtual, and Constructive
JLVCDT	Joint Live Virtual Constructive Data Translator
JLVC-TE	Joint Live Virtual Constructive Training Environment
JMD	Joint Manning Document
JMECS	Joint MSEL Event Control Station
JMECS-NS	Joint MSEL Event Control Station–No Sim
JMET	joint mission essential task
JMPRS	Joint Mission Planning and Rehearsal System
JMRM	Joint Multi-Resolution Model
JNEM	Joint Non-Kinetic Effects Model
JNETS	Joint Network Simulation
JNTC	Joint National Training Capability
JOA	Joint Operations Area
JOEF	Joint Operational Effects Federation
JOISIM	Joint Operations Information Simulation
JOPEs	Joint Planning and Execution System
JPEC	Joint Planning and Execution Community
JPEO	Joint Program Executive Office

JQUAD+	Suite of five computer simulation models (of which JQUAD is one) for warfare command and control ¹⁸
JRE	Joint Range Extension
JROC	Joint Requirements Oversight Council
JRSG	Joint Rapid Scenario Generation
JRSOI	joint reception, staging, onward-movement, and integration
JS	Joint Staff
JSAF	Joint Semi-Automated Forces
JSCP	Joint Strategic Capabilities Plan
J-SIGSIM	Joint SIGINT Simulation
JSIMS	Joint Simulation System
JSOFT	joint special operations task force
JSPA	JLVC Simulation Protocol Analyzer
JSTARS	Joint Surveillance Target Attack Radar System
JSWS	Joint Service Workstation
JTC	Joint Training Confederation
JTC-I	Joint Transformation Command for Intelligence
JTC-TRS	Joint Terminal Control Training and Rehearsal System
JTDS	Joint Training Data Services
JTE	Joint Training Enterprise Joint Training Environment
JTEN	Joint Training Experimentation Network
JTF	Joint Task Force
JTIEC	Joint Training Integration and Evaluation Center
JTIMS	Joint Training Information Management System
JTLS	Joint Theater Level Simulation
JTRG	Joint Training Requirements Group
JTS	Joint Training System
JTSC	Joint Training Support Center
JUO	joint urban operations
JWARN	Joint Warning and Reporting Network
LAN	Local Area Network
LCC	amphibious command ships
LHA, LHD	amphibious assault ships
LLDR	Lightweight Laser Designator Rangefinder
LOGFED	Logistics Federation
LOGSIM	Logistics Simulation

¹⁸ JQUAD+ consists of four related sub-models: JECEWSI, JCAS, JOISIM, and JNETS

LVC	live, virtual, and constructive
LVCAR	Live, Virtual, and Constructive Architecture Roadmap
M&S CO	Modeling and Simulation Coordination Office
M&S SC	Modeling and Simulation Steering Committee
M&S	Modeling and Simulation
MAF	Mobility Air Force
MAGTF	Marine Air-Ground Task Force
MAST	Mission Avionics Systems Trainer
MCE	Modular Control Element
MCFED	Marine Corps Federation
MCS	Maneuver Control System
MCS-L	MCS-Light
M-DACT	Mounted Data Automated Communications Terminal
MDST	Missile Defense Space Tool
MEF	Marine Expeditionary Force
MET	mission essential task
METOC	Meteorological Operations
MIDB	Modern Integrated Database
MLST3	Multi-Link System Test/Training Tool 3
ModSAF	Modular Semi-Automated Forces
MOE	measure of effectiveness
MOOTW	Military Operations Other Than War
MOUT	military operations on urban terrain
MRF	Multi-Resolution Federation
MSC	Mission Support Center
MSEL	Master Scenario Events List
MTACCS	Marine Corps Tactical Command and Control System
MTT	Mobile Training Team
MTWS	MAGTAF Tactical Warfare Simulation
MUSE	Multiple Unified Simulation Environment
NAR	Non-conventional Assisted Recovery
NATO	North Atlantic Treaty Organization
NCA	National Command Authorities
NCES	Net-Centric Enterprise Services
NCTE	Navy Continuous Training Environment
NDS	National Defense Strategy
NFDD	NSG Feature Data Dictionary
NGDC	National Geophysical Data Center

NGO	non-governmental organization
NGTS	Next Generation Threat System
NII	Networks and Information Integration
NITF	National Imagery Transmission Format
NMS	National Military Strategy
NMSG	NATO Modeling and Simulation Group
NOFORN	Not Releasable To Foreign Nationals
NORAD	North American Aerospace Defense Command
NORTHCOM	Northern Command
NRO	National Reconnaissance Office
NSA	National Security Agency
NSG	National System for Geospatial Intelligence
NWARS-NG	National Wargaming Simulation Next Generation
NWDC	Navy Warfare Development Command
OASES	Ocean, Atmosphere, and Space Environmental Services
OCONUS	Outside of the Continental United States
OFT	Office of Force Transformation
OMT	Object Model Template
OneSAF	One Semi-Automated Force
OOB	order of battle
OOS	OneSAF Objective System
OOTW	Operations Other Than War
OPFOR	opposing force
OPLAN	Operation Plan
OPORD	Operation Order
OPSEC	Operations Security
OSA	Operational Support Airlift
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
OTB	OneSAF Testbed Baseline
OTF	Objective Terrain Format
OTH	over-the-horizon
OUSD(P&R)	Office of the Under Secretary of Defense for Personnel and Readiness
PA&E	Program Analysis and Evaluation
PC	personal computer
PDM	Program Decision Memorandum
PDU	portable data unit

PE	program element
PEO STRI	Army Program Executive Office for Simulation, Training, and Instrumentation
PFED	Pocket-Sized Forward Entry Device
PM TRADE	Project Manager for Training Devices
PM TRASYS	Program Manager for Training Systems
PMESII	Political, Military, Economic, Social, Infrastructure, and Information
POD	port of debarkation
POE	port of embarkation
POM	Program Objective Memorandum
PRO	personnel recovery operations
PSS-SOF	Precision Strike Suite for Special Operations Forces
PSYOP	Psychological Operations
QDR	Quadrennial Defense Review
R&D	research and development
RC	Reserve Component
RCC	Rescue Coordination Center
RE	Remote Environment
RECCEXREP	Reconnaissance Exploitation Report
RESA	Research, Evaluation, and System Analysis
REXREP	Radar Exploitation Report
RFF	Request for Forces
RJ	Rivet Joint
RM	Radiant Mercury
ROE	rules of engagement
ROMO	range of military operations
RPG	Recommended Practices Guide
RSOI	reception, staging, onward movement, and integration
RT&PP	Readiness and Training Policy and Programs
RTI	Run-Time Infrastructure
RTM	Run Time Manager
RUGUD	Rapid Unified Generation of Urban Databases
RVS	Reconfigurable Vehicle Simulator
RVTT	Reconfigurable Vehicle Tactical Trainer
RWS	remote workstation
S&M	scheduling and movement
SA	situational awareness
SAAM	Special Assignment Airlift Mission

SAF	semi-automated forces
SAG	Senior Advisory Group
SAGIS	SOF Air Ground Interface Simulator
SAR	Search and Rescue
SASO	stability and support operations
SASS	System Administration Security Server
SBIRS	Space Based Intelligence, Reconnaissance, and Surveillance
SCI	Sensitive Compartmented Information
SCOPEs	Space Common Operating Picture and Exploitation System
SDDC	Surface Deployment and Distribution Command
SEAL	SEa, Air, and Land (U.S. Navy Teams)
SEDRIS	Synthetic Environment Data Representation and Interchange Specification
SEIS	Space Environment Impact System
SEP	System Evaluation Plan
SGS	Scenario Generation Server
Shadow UAV	Shadow unmanned aerial vehicle
SIGINT	signals intelligence
SIMPLE	Simulation to C4I Interchange Module for Plans, Logistics, and Exercises
SINCGARS	Single-Channel Ground and Airborne Radio System
SITH	Simulation Interface Test Harness
SITREP	situation report
SJFHQ	Standing Joint Force Headquarters
SMART	Secure Message and Routing Terminal
SMMTT	Submarine Multi-Mission Team Trainer
SNE	synthetic natural environment
SOA	Service-oriented architecture
SOCOM	Special Operations Command
SOF	Special Operations Forces
SOLE	Special Operations Liaison Element
SOMPE	Special Operations Mission Planning Environment
SPOTREP	spot report
SSC Pacific	Space and Naval Warfare Systems Center Pacific
SSG	Senior Steering Group Space System Generator
STOW	Synthetic Theater of War
STRATCOM	Strategic Command

SVT	Standards Vetting Tool
T2	Training Transformation
TAA	Tactical Assembly Area
TACELINT	tactical electronic intelligence
TACREP	Tactical Report
TACSIM	Tactical Simulation
TADIL	Tactical Digital Information Link
TAIS	Tactical Airspace Integration System
TAUO	Training for Aviation Urban Operations
TBMCS	Theater Battle Management Core System
TC	Training Capabilities
TC-AIMS II	Transportation Coordinator's Automated Information for Movement System II
TCN	Transportation Control Number
TCO	Tactical Combat Operations
TCSP	Tactical Communications Support Processor Transportation Community and System Preservation
TDBM	Tactical Database Manager
TDL	Tactical Data Link
TE	training environment
TENA	Test and Training Enabling Architecture
TFCC	Tactical Flag Command Center
TGAF	Training Gaps Analysis Forum
THS	Target Handoff Subsystem
TIFF	Tagged Image File Format
TIGER	Tactical Integrated Geographic Environment
TLDHS	Target Location, Designation, and Hand-off System
TMSBP	Training Community Modeling and Simulation Business Plan
TMW	theater missile warning
TPFDD	time-phased force and deployment data
TPFDDL	Time-Phased Force and Deployment Data List
TS	Top Secret
TS09	Talisman Saber 09
TSS	Tower Simulation System
TSTS	Total Ship Training System
TTP	tactics, techniques, and procedures
U.S.	United States
UAS	unmanned aerial system

UAV	unmanned aerial vehicle
UFL	Ulchi Focus Lens
UN	United Nations
UNDER SECA	Under Secretary of the Army
UNDER SECAF	Under Secretary of the Air Force
UNDER SECNAV	Under Secretary of the Navy
UNSCR	United Nations Security Council Resolution
USAF	United States Air Force
USCG	United States Coast Guard
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
USD(I)	Under Secretary for Intelligence
USD(P&R)	Under Secretary of Defense for Personnel and Readiness
USJFCOM	United States Joint Forces Command
USMC	United States Marine Corps
USMTF	United States Message Text Format
USNORTHCOM	United States Northern Command
USPACOM	United States Pacific Command
USSOCOM	U.S. Special Operations Command
USTRANSCOM	United States Transportation Command
V-ASTAC	Virtual ASW/ASUW Tactical Air Controller Trainer
VBS2	Virtual Battlespace 2
VDT	VV&A Documentation Tool
VFST	Virtual Fire Support Trainer
VMF	variable message format
VoIP	Voice over Internet Protocol
VRSG	Virtual Reality Scene Generator
VTC	Video Teleconference
VV&A	validation, verification, and accreditation
WAN	wide area network
WARSIM	Warfighter's Simulation
WCCS	Wing Command and Control System
WIM	WARSIM Intelligence Module

Appendix A.

2004 Training Capabilities Analysis of Alternatives (TC AoA)

Note: *Because of the evolving nature of training needs and modeling and simulation (M&S) technologies, the TC AoA is dated in several regards. This appendix is provided as a historic artifact to allow for comparison and improvements in training capabilities over the intervening years.*

The Office of the Secretary of Defense (OSD) Program Decision Memorandum (PDM) 1, Joint Simulation System (JSIMS), dated 12 December 2002, directed the TC AoA. The study plan was published in October 2003. This appendix discusses the analysis of the TC AoA that was referenced in this and previous versions of the Training Community Modeling and Simulation Business Plan (TMSBP). The 2004 TC AoA assessed the ability of then-current simulations to meet deficiencies, or gaps, in joint training. Consistent with the theme of constantly evolving threats and needs, the training community has continued to improve the suite of capabilities for conducting joint training. It has identified models and federations that the Services, the Joint Forces Command (JFCOM), and the Intelligence Community (IC) have regarded as relevant to joint training requirements.

TC AoA Base Case

The “TC AoA Base Case,” included the following suite of capabilities:

- Logistics Federation (LOGFED)
- Warfighters Simulation (WARSIM)
- One Semi-Automated Force (OneSAF)
- Army Constructive Training Federation (ACTF)
- Deployable Simulation for Collaborative Operations (DISCO)
- Adaptive Communications Reporting Simulation (ACRES)
- Information Warfare Effects Generator/Dynamic Communications Environment (IWEG/DCE)
- National Wargaming Simulation – Next Generation (NWAR-NG)
- Air Force Modeling and Simulation Training Toolkit (AFMSTT)

- Air Force Synthetic Environment for Reconnaissance and Surveillance/Multiple Unified Simulation Environment (AFSERS/MUSE)
- Suite of five computer simulation models for warfare C2 (JQUAD+)¹⁹
- Joint Semi-Automated Forces (JSAF)
- Joint Theater Level Simulation (JTLS)
- Joint Conflict and Tactical Simulation (JCATS).

Chapter V of the TC AoA, “Assessing Effectiveness,” rated each of these simulations for its contribution in removing the training gaps listed in Chapter III of the report. One observation was that “taken together, current simulations have significant capability for removing the TC AoA training gaps.” Although the 2004 TC AoA is a good reference document, many of the simulations and federations listed previously have evolved or been discontinued.

Keeping the update of our training capabilities in the context of the detailed analysis found in the TC AoA is useful. Since the summer of 2004, several efforts have been funded to enhance the previous base-case simulations to close the gaps further. In addition, after the publication of the 2004 TC AoA, an OSD PDM identified \$94 million in funding across FY06–11 for work in 3 of the alternatives the AoA recommended:

- **Alternative #3, Modeling and Simulations.** The TC AoA recommendation for achieving the objectives defined in the Alternative 3 course of action (COA) is to produce a joint M&S live, virtual, and constructive (LVC) toolkit. The toolkit was to consist of existing programs of record that can be tailored to meet the needs of the joint user. Enhancements to these existing capabilities will be designed to close the functional gaps in joint training requirements. A major advantage of this approach is that it gives Department of Defense (DoD) the ability to insert an emerging technology or existing system (e.g., specialized models for homeland security training and for joint command and control (C2) combatant command (COCOM) training) into the architecture. The functional capability of the M&S tools in the toolkit, the needs of the training audience, and the training objectives will drive the composition of a simulation federation.

Alternative #3 was funded at \$43 million across FY06–11.

- **Alternative #4, Innovative Acquisition.** The AoA Senior Steering Group (SSG) directed a prototype activity to determine the viability of the business

¹⁹ JQUAD+ consisted of four related sub-models: Joint Electronic Combat Electronic Warfare Simulation (JECEWSI), Joint Close Air Support (JCAS), Joint Operations Information Simulation (JOISIM), and Joint Network Simulation (JNETS).

model described in Alternative 4. The focus of the prototype was to explore the alternative business approach to acquiring training. In simple terms, the prototype is about business efficiencies for providing training. Although the activities funded under this alternative were intended to examine the business aspects of purchasing training products and services, the functional training content provided to sponsoring COCOMs will also be addressed, potentially filling one or more TC AoA training gaps.

Alternative #4 was funded at \$14 million across FY06–11.

- **Alternative #5, Reengineering Training.** This alternative requires the DoD to initiate revolutionary changes in the joint training construct. The near-term objective is to provide COCOMs the personnel, funding, and joint training technology alternatives required to meet joint individual and staff training requirements. The joint training technology alternatives identified in Alternative 5 provide the on-demand and composable capability required by COCOMs to conduct training for individuals and staff serving in joint force headquarters (HQ) from component commands through COCOMs. Several of the alternative technologies are currently being funded in efforts led by the JFCOM:

- Lightweight simulations/federations
- Massively multi-player gaming
- Story-driven training
- Joint community-unique federates
- Instructor support tools
- Embedded training.

Alternative #5 was funded at \$37 million across FY06–11.

In addition to this list of projects funded in response to the TC AoA, changes to the base-case federates have resulted because of new requirements articulated by stakeholders and sponsors and because of continuing enhancements under existing Service and JFCOM programs.

The gaps selected for analysis changed during the study. The TC AoA study team initially defined 13 gaps between training capabilities and requirements. These gaps were reviewed further by a Tiger Team composed of people from the Joint Staff (JS) Joint Training Directorate (J7), the COCOMs, and the Services. This review expanded the number of gaps to 35. Table A-1 lists these 35 gaps in order of decreasing priority, as determined by the Tiger Team. The JS J7 reanalyzed the 35 gaps in 2006, which led to changes in the priority of some of the gaps and the addition of 5 new gaps. This effort

was not formally staffed, however, so Table A-1 remained the current baseline until the Training Gaps Analysis Forum (TGAF) met at JFCOM in November 2008 and updated the content and provided new priorities the list of 35.

The simulations chosen for analysis also evolved during the study. The TC AoA began by considering 12 models (referred to as “Use Cases”). It became apparent, however, that these cases did not adequately represent the totality of use in joint and Service training. A list of 70 simulations, federations of simulations, and tools was first compiled for consideration. For information purposes, some of the tools are listed in Table A-2. The subset of 14 simulations listed in Table A-3 was eventually selected for analysis. (For convenience, we will use the term “simulations” for training models, tools, simulations, and federations of simulations.)

Table A-4 was a major product produced from the TC AoA gap analysis, in which a “stoplight” scale was used to describe how well the 14 simulations addressed the 35 training gaps.

Table A-1. Training Gaps Identified by the 2004 TC AoA Gaps

Gap No.	Gap
1	Train combined Joint Task Force (JTF) staffs (includes need for Individual joint training)
2	Train Standing Joint Force Headquarters (SJFHQ) staff (includes need for Individual joint training)
3	Train on crisis action planning (CAP) and deployments
4	Provide faster/higher fidelity mission rehearsal
5	Train forces on joint urban operations (JUO)
6	Train forces on information operations (IO) (including information warfare, computer network exploitation, computer network defense, and computer network attack)
7	Train forces in a joint interagency intergovernmental, multi-national environment (including IC participants)
8	Provide homeland defense training
9	Provide multi-command missile defense training
10	Train forces in enemy chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) exploitation and destruction
11	Train to operate in CBRNE environments
12	Train on effects-based planning and effects-based operations (EBO)
13	Train theater/strategic forces to conduct command, control, communications, computers, and intelligence (C4I) operations using the Collaborative Information Environment (CIE)
14	Train forces on realistic logistics requirements (including reception, staging, onward movement, and integration (RSOI))
15	Practice Active Component (AC)/Reserve Component (RC) integration and mobilization training
16	Train forces on stability and support operations (SASO)
17	Train forces on military assistance to civilian authorities operations
18	Train Special Operations Forces (SOF) and conventional forces for integrated operations
19	Train forces (operational and tactical level) to use national intelligence systems
20	Train routinely with the Joint Operation Planning and Execution System (JOPES)
21	Train routinely with new adaptive planning and deployment systems
22	Train the IC as they fight (including all levels as a tactical participant)
23	Train the Joint Interagency Coordination Group (JIACG)
24	Train staff to coordinate personnel recovery operations (PRO)
25	Train Global Ballistic Missile Defense (GBMD)
26	Conduct global strike training
27	Train critical infrastructure protection (CIP)
28	Operations/intelligence center training, integration, and command education
29	Strategic information assurance
30	Continuity of Operations (COOP)
31	Train on operational systems (dedicated bandwidth)
32	Train on consequence management (CM) operations
33	Provide special operations crisis action procedures training
34	Provide the IC SOF-specific training at the operational level
35	Plan, coordinate, and practice mission assurance

Table A-2. Some of the M&S Tools Analyzed in the TC AoA Base Case

Acronym	Name	User	Description
ABCS C4I Adapter	Army Battle Command System C4I Adapter	JFCOM	Interface for C4I.
ADSI	Air Defense Simulation Integrator	JFCOM	Display tracks from C4I.
ARCHER System	Archiving and Enhanced Retrieval System	U.S. Army	ARCHER captures data from the simulation and the C4I systems to answer the question relating to what happened during command post exercises.
ASCOT	Airspace Control and Operations Trainer	JFCOM	ASCOT is a Distributed Interactive Simulation (DIS)-compliant, new radar systems trainer. It interfaces with the Airborne Warning and Control System (AWACS), the Modular Control Element (MCE) V1, the MCE V2, the Battle Force Tactical Trainer (BFTT), the Electronic Systems Center (ESC), the AEGIS Combat System Interface Simulation (ACSIS), the Air Warfare Simulation (AWSIM), and Distributed Mission Training (DMT) to provide the theater air picture.
ASTI	Army Secure Tactical Initiative	U.S. Army	Radio communications
AWSIM	Air Warfare Simulation	JFCOM, United States Air Force (USAF)	AWSIM simulates air warfare. It models all aspects of the forces that the United States Air Force (USAF) employs (air and ground) and the targets and threats that it opposes. Administrative and logistics functions are modeled, in addition to warfare.
BFTT	Battle Force Tactical Trainer	U.S. Navy	An integrated system to tie in short trainers and certain classes of ships to allow realistic tactical training while ships are in port.
BICM	Battle Command Training Program (BCTP) Intelligence Collection Model	U.S. Army	The BICM provides Corps Battle Simulation (CBS) users the means to exercise all-source intelligence functions. It integrates meaningful intelligence functions into a free-play, force-on-force exercise.

Table A-3. Simulations Analyzed in the TC AoA

Acronym	Name	User
ACRES	Adaptive Communications Reporting Simulation	National Security Agency (NSA)
ACTF	Army Constructive Training Federation	U.S. Army
AFMSTT	Air Force Modeling and Simulation Training Toolkit	USAF
AFSERS/MUSE	Air Force Synthetic Environment for Reconnaissance and Surveillance/Multiple Unified Simulation Environment	USAF
DISCO	Deployable Intelligence Simulation for Collaborative Operations	Defense Intelligence Agency (DIA)
IWEG/DCE	Information Warfare Effects Generator/Dynamic Communications Environment	NSA
LOGFED	Logistics Federate	U.S. Army
CATS	Joint Conflict and Tactical Simulation	JFCOM
JQUAD+	Suite of five computer simulation models for warfare C2	USAF
JSAF	Joint Semi-Automated Forces	U. S. Navy and JFCOM
JTLS	Joint Theater Level Simulation	JFCOM
NWARS-NG	National Wargaming Simulation Next Generation	National Reconnaissance Office (NRO)
OneSAF	One Semi-Automated Force	U.S. Army
WARSIM	Warfighter's Simulation	U.S. Army

Note for Table A-3: *JQUAD+* consisted of four related sub-models: *JECEWSI*, *JCAS*, *JOISIM*, and *JNETS*.

Table A-4. How Well the Simulations Cover the Training Gaps

Priority	Job Training Requirement	LOGFED	WARSIM	OneSAF	ACTF	DISCO	ACRES	IWEG/DCE	NWARS-NG	AFMSTT	AFSERS/MUSE	JOSEF	JTLS	CATS	JQUAD+
1	Train combined JTF staffs (includes need for Individual joint training)	●	●	●	●	○	●	●	●	●	○	●	●	●	○
2	Train SJFHQ (includes need for Individual joint training)	●	●	●	●	○	●	○	●	●	○	●	●	●	○
3	Train on CAP and deployments	●	○	○	●	○	●	○	○	○	○	●	●	●	○
4	Provide faster/ higher fidelity mission rehearsal	●	●	●	●	○	●	●	●	●	●	●	●	●	●
5	Train forces on JUO	●	●	●	●	○	●	●	●	○	○	●	●	●	○
6	Train forces on IO (including information warfare, computer network exploitation, computer network defense, and computer network attack)	○	●	●	●	○	●	●	○	○	●	●	○	○	●
7	Train forces in a joint inter-agency intergovernmental, multi-national environment (including IC participants)	●	●	○	●	●	●	●	●	○	○	●	●	●	○
8	Provide homeland defense training	●	○	●	○	○	●	●	●	●	●	●	●	●	○
9	Provide multi-command missile defense training	○	●	○	●	○	○	○	○	○	○	●	●	●	○
10	Train forces in enemy CBRNE exploitation and destruction	○	●	●	●	○	●	●	●	○	○	●	●	●	○
11	Train to operate in CBRNE environments	○	●	●	●	○	●	●	●	○	○	●	●	●	○
12	Train on effects-based planning and EBO	●	●	●	●	○	●	●	●	○	○	●	●	●	○
13	Train theater/ strategic forces to conduct C4I operations using the CIE	●	●	●	●	○	○	○	●	○	○	●	●	●	●
14	Train forces on realistic logistics requirements (including RSOI)	●	●	●	●	○	○	○	○	○	○	●	●	●	○
15	Practice AC/RC Component integration and mobilization training	○	●	●	○	○	●	○	○	○	○	●	●	●	○
16	Train forces on SASO	●	●	○	●	○	●	●	●	○	○	○	○	●	○
17	Train forces on military assistance to civilian authorities operations	●	○	●	●	○	●	●	○	○	○	○	○	●	○

Legend for Table A-4:

- – The simulation fully supports the training requirement.
- – The simulation partially supports the training requirement.
- – The simulation does not support the training requirement.

Table A-4. How Well the Simulations Cover the Training Gaps (Continued)

Priority	Job Training Requirement	LOGFED	WARSIM	OneSAF	ACTF	DISCO	ACRES	IWEG/DCE	NWARS-NG	AFMSTT	AFSERS/MUSE	JOSEF	JTLS	CATS	JQUAD+
18	Train SOF and conventional forces for integrated operations	○	●	○	●	○	●	●	●	○	○	●	●	●	○
19	Train forces (operational and tactical level) to use national intelligence systems	○	●	○	●	○	●	●	●	○	○	●	●	○	○
20	Train routinely with JOPES	●	●	○	●	○	○	○	○	○	○	●	●	○	○
21	Train routinely with new adaptive planning and deployment system	●	●	●	●	○	○	○	○	○	○	●	●	○	○
22	Train the IC as they fight (including all levels as a tactical participant)	○	●	○	●	●	●	●	●	○	○	●	●	●	○
23	Train the JIACG	○	○	●	○	○	●	●	○	○	○	●	○	●	○
24	Train staff to coordinate PRO	○	●	○	●	○	●	●	●	○	○	●	●	●	○
25	Train GBMD	○	○	○	○	○	○	○	○	○	●	●	●	●	○
26	Conduct global strike training	○	○	○	○	○	○	○	●	○	○	●	●	●	○
27	Train CIP	○	○	○	○	○	●	●	○	○	○	●	●	●	○
28	Operations/intelligence center training, integration, and command education	○	○	○	●	●	●	●	●	●	●	●	●	●	●
29	Strategic information assurance	●	○	●	○	○	●	○	○	○	○	○	○	○	○
30	COOP	○	○	○	○	○	○	○	○	○	○	○	○	○	○
31	Train on operational systems (dedicated bandwidth)	○	●	●	●	●	●	●	●	●	●	●	●	●	●
32	Train on CM operations	●	○	●	○	○	●	●	○	○	○	●	●	●	○
33	Provide special operations crisis action procedures training	●	○	●	●	○	●	●	○	○	○	○	●	●	○
34	Provide the IC SOF-specific training at the operational level	○	○	○	●	○	●	●	○	○	○	●	●	●	○
35	Plan, coordinate, and practice mission assurance	○	○	○	○	○	●	●	○	○	○	○	●	●	○

Legend for Table A-4:

- – The simulation fully supports the training requirement.
- – The simulation partially supports the training requirement.
- – The simulation does not support the training requirement.

Appendix B.

Glossary

Acoustic Transmission Loss Server (ATLOS). Used to model acoustic effects in a sonar environment.

Adaptive Communications Reporting Simulation (ACRES). Formerly part of Joint SIGINT Simulation (J-SIGSIM), ACRES simulates signals intelligence (SIGINT) collection and dissemination and provides SIGINT product reports via means defined in the event planning. Does not output portable data units (PDUs) but requires Entity State, Transmitter, Electromagnetic Emitter, and Signal PDUs on the Top Secret/Sensitive Compartmented Information (TS/SCI) Distributed Interactive Simulation (DIS) Local Area Network (LAN) from environment generators such as Air Warfare Simulator (AWSIM), Information Warfare Effects Generator/Dynamic Communications Environment (IWEG/DCE), and Distributed Incremental Compiling Environment (DICE).

Advanced SEAL Delivery System (ASDS). Simulates a submarine training system for providing stealthy submerged transportation for insertion into Special Operations Forces (SOF) teams during covert operations.

Advanced Field Artillery Tactical Data System (AFATDS). A network of computer workstations that process and exchange information from the forward observer (FO) to the fire support element for all fire support assets (field artillery, mortars, naval gunfire, attack helicopters, and close air support (CAS)). Features include automatic processing of fire requests, generation of multiple tactical fire solutions for missions, monitoring of mission execution, and support for the creation and distribution of fire plans.

After Action Review System (AARS). Collects data from the Entity Resolution Federations (ERFs). Provides the AARS operators the ability to manage (reduce and analyze) the collected data and develop visual products (slides, charts, graphs) that provide useful information to facilitate the commanders' after action review (AAR) process.

Aggregation. The ability to group entities while preserving the collective effects of entity behavior and interaction.

Air and Missile Defense Workstation (AMDWS). A digitized tool for monitoring and managing air and missile defense (AMD) operations. Allows integration of the AMD plan with the ground scheme of maneuver. Receives air situational information from the Air Defense System Integrator (ADSI). Ground situation and intelligence information are received from the Maneuver Control System (MCS), All Source

Analysis System (ASAS) remote workstation, and other sources. Maintains a comprehensive database of the tactical situation and also has mission-planning capabilities that can provide overlays of sensor and weapons coverage, airspace control measures, threat locations, and planned unit positions. AMDWS is integrated into air defense command and control (C2) systems at all echelons.

Air Defense Systems Integrator (ADSI). Provides Tactical Data Link (TDL) picture (i.e., Link 11/Link 11B, Link 16, Beyond-Line-of-Sight (BLOS) Link 16 (Satellite Tactical Digital Information Link (TADIL) J, Joint Range Extension (JRE)) to other locations aboard CV/CVN/LCC/LHA/LHD class ships (e.g. Tactical Flag Command Center (TFCC), Flag Plot, Warfare Cell) for a fused situational awareness (SA) capability to the strike group staff. ADSI also provides TDL information to Global Command Control System–Maritime (GCCS-M) for generation of the common operational tactical picture (COTP)/SA that can be disseminated to the participants of a common operational picture (COP) network.

Air and Space Cyber Constructive Environment–Command and Control Systems Interface (ASCCE-CSI). Provides automated support for loading a Theater Battle Management Core System (TBMCS) air tasking order (ATO) into AWSIM, producing AWSIM mission order stacks and a mission editing capability. CSI also supports the communication of mission takeoff times, landing times, and mission results from AWSIM to TBMCS.

Air and Space Cyber Constructive Environment–Information Operations Suite (ASCCE-IOS). A suite of multiple simulations that provide the information operations (IO) portion of ASCCE, which is the constructive foundation that supports and integrates with United States Air Force (USAF) live, virtual, and constructive (LVC) components in a Distributed Mission Operation’s (DMO) environment and the Joint National Training Capability (JNTC). ASCCE-IOS provides the IO supporting USAF LVC and JNTC during joint/Service battle staff training exercises. The current ASCCE-IOS component models consist of the electronic warfare (EW) module, C2 module, network module, sensor module, ground game module, virtual message editor and distributor, Space Common Operating Picture and Exploitation System (SCOPES), and the Joint Data Translator (JDT). Integrates and facilitates the constructive command and control and intelligence, surveillance, and reconnaissance (C2ISR) components within the training environment. Simulates electronic warfare operations (EWO), space, ground and surface orders of battle (OOBs), IO, fixed targeting adjudication, bomb damage assessment (BDA), and provides intelligence reports and data feeds on these effects using real-world command, control, communications, computers, and intelligence (C4I) systems and devices. Also models air-breathing sensors (Rivet Joint, U2, Global Hawk, Predator, EP-3), national sensors, sensor coverage and limitations, and produces intelligence products.

Air and Space Cyber Constructive Environment (ASCCE). The constructive element and integrator for the Air DMO capability, which combines LVC simulations to

support training, mission rehearsal, and operations. Provides air and space simulation of a full theater of war environment. A collection of modeling and simulation (M&S) capabilities that provide the foundation for USAF LVC components in a DMO environment.²⁰ Provides the air and space power representation and enables joint air component headquarters (HQ) and other elements of the C2 constellation to create an air and space synthetic environment for training and operations.

Air Warfare Simulation (AWSIM). Models all aspects of USAF employment (air and ground) and the targets and threats that it opposes.

All Source Analysis System–Light (ASAS-L). The ASAS is the Department of Army intelligence management system. ASAS is not just one system but a family of systems and components that allow large amounts of intelligence data to be gathered, correlated, and processed. ASAS-L is a variant of the standard ASAS remote workstation (RWS). Provides intelligence support to Battalion S-2, the intelligence and EW component of the Army Battle Command System (ABCS). Automates intelligence electronic warfare (IEW) asset management, intelligence preparation of the battlefield (IPB), and dissemination of intelligence.

Architecture. The structure of components in a program/system, their interrelationships, and principles and guidelines governing their design and evolution over time.

Archiving and Enhanced Retrieval System (ARCHER). Captures data from the simulation and the C4I systems to answer the question relating to what happened during command post exercises.

Automated Scripter Simulator Exercise Training (ASSET). Personal computer (PC)-based electronic intelligence (ELINT) simulator that simulates national source tactical electronic intelligence (TACELINT) reports or a scripted ELINT OOB as from a generic satellite constellation collector. Will inject scripted TACELINT messages into the broadcast system. Can generate Automated Identification System (AIS) reports for transmission via an Independent Basic Service Set (IBSS).

Aviation Combined Arms Tactical Trainer (AVCATT). A mobile, transportable, multi-station virtual simulation device designed to support unit collective and combined arms training. Provides six cockpits that can be configured to any combination of attack, reconnaissance, lift, and/or cargo helicopters. Also has four role-player stations for battalion/squadron staff or combined arm elements, integrated threat and friendly semi-automated forces (SAF); and exercise record/playback and simultaneous AAR.

Base Case. A list of those joint and Service federations that best describe current training capabilities.

²⁰ DMO is the Air Force initiative supporting the Department of Defense (DoD) Strategic Plan for Training Transformation.

Battle Command Sustainment Support System (BCS3). A technological insertion into the Combat Service Support Control System (CSSCS). Technical insertion is created by merging limited aspects of CSSCS functionality with the current functionality of the Joint Deployment Logistics Model (JDLM) and In-Transit Visibility (ITV), dramatically enhancing improvements in database management.

Battle Command Training Program (BCTP). Intelligence Collection Model (BICM). Provides Corps Battle Simulation (CBS) users the means to exercise all-source intelligence functions. Integrates meaningful intelligence functions into a free-play, force-on-force exercise.

Battle Force Tactical Trainer (BFTT). An integrated simulation system to tie in shore trainers and certain classes of ships to allow realistic tactical training while the ships are in port.

Business Strategy. The approach designed to achieve the most effective use of resources and the best return on investment. Includes an emphasis on modern business practices to make the most of available defense dollars. Included in this concept is the use of competitive sourcing.

Call-for-Fire Trainer (CFFT). A lightweight, rapidly deployable, observed fire training system that provides simulated battlefield training for fire support specialists, joint fires observers, and soldiers at the institutional and unit level.

Chemical Biological Simulation Suite (CB Sim Suite). Serves to integrate LVC systems to help meet identified capability gaps and deficiencies in the chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) training environment. At the completion of the project, CBRNE M&S tools will be integrated with the Joint Live Virtual Constructive (JLVC) simulation federation, live range instrumentation as part of a mobile Chemical Biological Instrumented Training System (CBITS), and the DoD Chemical and Biological Defense Program (CBDP) programs of record: the Joint Warning and Reporting Network (JWARN), the Joint Effects Model (JEM), and in the future for the Joint Operational Effects Federation (JOEF) (including sensors and individual protective equipment (IPE) that the CBDP is transitioning to the warfighter).

Close Combat Tactical Trainer (CCTT). A family of virtual simulations for collective training. Supports the training of armor, mechanized infantry, and cavalry units from platoon through battalion echelon, including the staff. The primary training audience operates from full-crew simulators, mock command posts, and live battalion command posts to accomplish their combined arms training tasks.

Collaborative Force Analysis, Sustainment, and Transportation (CFAST). A collaboration tool that incorporates campaign planning, forecast predictions, information management, and rapid execution.

Combined Arms Command and Control Training Upgrade Systems (CACCTUS).

Provides a capability to create a training event that facilitates effective realistic fire support training for more than a single echelon of command or element of the Marine Air-Ground Task Force (MAGTF).

Command and Control Personal Computer (C2PC). A Windows-based client software application designed to facilitate military C2 functions by improving SA and to enhance operational and tactical decisions. When connected to a network, exchanges position tactical track data with UNIX-based Tactical Database Manager (TDBM) systems, such as the Tactical Combat Operations (TCO) system, the Intelligence Analysis System (IAS), and the Global Command and Control System (GCCS), and provides a complete geographically based SA capability, including the capability to display the GCCS COP data. Features include a robust TrackPlot, Routes Planning, and Overlay Edit capability and the ability to embed ActiveX objects (MS Word, MS PowerPoint, sound files, and so forth) into the tactical map display.

Command Post of the Future (CPOF). Executive-level decision support system that provides SA and situational understanding for the commander and his staff. Can be tailored to fit specific visualizations and user needs across all warfighting functions and organizations from corps to battalion.

Key CPOF capabilities include the following:

- **Information visualization.** Two-dimensional (2D) and three-dimensional (3D)
- **Information liquidity.** Drag and drop information analysis across visualization products
- **Topsight.** Visibility of evolving understanding among distributed subordinates and team members.

Key CPOF design concepts include the following:

- **Composability.** Commanders can access, view, configure, and tune data, visualizations, and workspace.
- **Collaboration.** Commanders and staff have the ability to collaboratively generate, share, and evaluate visual courses of action (COAs).
- **Operation orders, commanders orders, and more.** The visual workspace supports self-synchronization with little interruption, allowing the commander and his/her staff to manage, maintain, and share their C2 resources and expertise.
- **Visualization.** Users work with live operational data that moves easily across visualization products, automatically taking the appropriate form (geospatial, temporal, textual, and so forth). Information is displayed the way each user thinks about it.

Key CPOF system interfaces include the following:

- AFATDS
- AMDWS
- Automated Mission Planning System (AMPS)/Falcon View
- ASAS
- Battlefield Command System (BCS)
- BCS3
- C2PC
- Combined Information Data Network Exchange (CIDNE)
- DCGS-A (DCGS = Distributed Common Ground System)
- Digital Data System (DDS)
- Digital Topographic Support System (DTSS)
- Force XXI Battle Command, Brigade and Below (FBCB2)
- Global Combat Control System–Army (GCCS-A)
- Global Combat Control System–Joint (GCCS-J)
- GCCS-M
- Information Operations Suite (IOS)
- Integrated Meteorological System (IMETS)
- MCS
- Tactical Airspace Integration System (TAIS)
- TBMCS.

Common Object Model. Software that provides a commonly understood mechanism for specifying the exchange of public data and the general coordination among members of a federation of simulations. Its purpose is to improve interoperability and communication between objects in distributed operating systems and protocols (heterogeneous networks) in the exercise. It also improves the reuse of these objects in other simulations. The model should operate independently of hardware type and facilitate users' compatibility with all other devices.

Consolidated Air Mobility Planning System (CAMPS). As the Air Mobility Command's primary C2 planning and scheduling system, provides mobility mission planners an integrated view for airlift and air refueling requirements management, planning, and scheduling of Air Mobility Command (AMC)/Mobility Air Force (MAF) air mobility resources to support peacetime, contingency, humanitarian, and wartime operations. Provides separate unclassified and classified requirements,

planning, and scheduling capabilities and also provides advanced user capabilities for operational planning and allocation management. Provides a joint capability to gather and manage mobility requirements for all aerial refueling missions, special assignment airlift missions, and U.S. Central Command (CENTCOM) airlift requirements.

Constructive Model or Simulation. Models and simulations that involve simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations but are not involved in determining the outcomes.

Corps Battle Simulation (CBS). A constructive simulation system that portrays ground battle scenarios for theater, corps and division-level training events. Models all battlefield operating systems including Psychological Operations (PSYOP), rotary-wing and fixed-wing operations, logistics, and multi-sided play. Is the cornerstone of the Joint Land Component Constructive Training Capability (JLCCTC) Multi-Resolution Federation (MRF). In the JLCCTC-MRF, is linked with other constructive simulations to provide a realistic presentation of joint battlefield operations.

Data Automated Communications Terminal (DACT). Sometimes called the Defense Message System/Data Automated Communications Terminal (DMS/DACT) input/output battlefield SA system and communication terminal. Handles positional and messaging information for company-sized units and below. Two types of DACT systems are available: the Mounted (M-DACT) for vehicle installations and the Dismounted (D-DACT) for the foot-mobile warfighter. Will be used to receive, store, create, change, and transmit map overlays, tactical messages, and situation reports via tactical radios. Will provide the United States Marine Corps (USMC) an increased digital communications capability at battalion/squadron levels and below for general-purpose data communications and SA. Will use a digital message system to send and receive messages using digital bursts and will provide an internal position location capability. The primary mission is to communicate tactical information directly to and from subscribers within the Marine Corps Tactical Command and Control System (MTACCS) network.

Database. A collection of interrelated data, often with controlled redundancy, organized according to a schema to serve one or more applications. The information is stored so that these data can be used by different programs without concern for the data structure or organization. A common approach is to add new data and modify and retrieve existing data.

Definitive Priority List. A product of work accomplished by the Training Capabilities Analysis of Alternatives (TC AoA) Tiger Team. The purpose of the Definitive Priority List is to identify and prioritize joint training requirements, joint training capability requirements, and baseline current funding levels that support joint training. A memorandum from the Director, Joint Staff (JS) to the combatant commands (COCOMs) initiated the Tiger Team effort by requesting individual COCOM input on a set of joint training areas. The COCOM inputs were assembled, documented,

and consolidated into identified areas of prioritization by the JS Joint Training Directorate (J-7) and subsequently presented to the members of the Tiger Team as a departure point for further definition and analysis.

Deployable Virtual Training Environment (DVTE). A first-person skills sustainment trainer that trains Marines from the individual to battalion staff level by using a simulation network with reconfigurable workstations capable of emulating a vast array of training scenarios. Is a flexible, deployable, training system that provides combined arms, MAGTF and Naval Integration training. The DVTE, which is currently a prototype desktop training network, addresses a significant subset of USMC combined arms training. Provides a custom-built stand-alone Combined Arms Network (CAN) covering most Marine ground and air weapons systems and is a USMC capability for providing interoperability with other Joint National Training Center participants. This interoperability will also enable distributed interactive unit training for widely separated units. Is made up of two components: (1) the Infantry Tool Kit (ITK), which contains several tactical decision-making simulations and (2) the Combined Arms Network (CAN), which is a set of PC-based simulators (FO, FAC, AAV, M1, LAV, AH-1) connected to Joint Semi-Automated Forces (JSAF). The Program Manager for Training Systems (PM TRASY) delivered the Virtual Fire Support Trainer (VFST), which incorporates much of the CAN functionality. VFST interfaces JSAF with AFATDS and the Pocket-Sized Forward Entry Device (PFED) to facilitate training of a variety of fire support platforms using USMC gear. In addition, DVTE can use this virtual environment and the semi-autonomous force model to train other individual MAGTF skills.

Distributed Mission Operations Center (DMOC). Not a training federation but a training center located at Kirtland Air Force Base (AFB) (New Mexico). The DMOC's mission is to develop and support tactical-level synthetic battlespace events for combat air forces. Serves as the Air Combat Command's (ACC) tactical-level synthetic battlespace hub by integrating and scheduling resources, developing scenarios, providing virtual adversary support, linking to operational and strategic-level simulations, and performing lead agent responsibilities for ACC Synthetic Battlespace inter-team training events.

Embedded Training. Training capability (e.g., a simulation embedded in a C2 system for battle staff training or a simulation embedded in a weapon system for gunnery training) that is an inherent part of an operational system. Embedded training capabilities can be linked with each other or with external simulations/training capabilities to support joint training. Recently updated DoD acquisition regulations encourage the use of embedded training to avoid the added expense of separate training systems. However, few current systems have embedded training capability, and it is not a viable solution for the AoA.

Engagement Skills Trainer 2000 (EST 2000). A unit/institutional, indoor, multi-purpose, multi-lane, small arms, crew-served and individual anti-tank training simulation. Enables training across three different modes: individual marksmanship; small unit (collective) gunnery and tactical training; and judgmental use of force (shoot/don't shoot), which includes escalation of force/graduated response scenarios.

Enhanced Tactical Simulation Interface Unit (eTSIU). A two-way link (interface) between simulations and tactical C4I systems. Translates simulation-based activities into tactical events.

Entity Resolution Federation (ERF). JLCCTC-ERF is a high-resolution federation designed for use at the brigade combat team level and below. Is suitable for training functional and multi-functional support brigades that include intelligence, fires, aviation, air defense, and sustainment. The primary training audiences for JLCCTC-ERF are brigade combat team commanders and battle staffs serving in a Joint Task Force (JTF). Can support limited training for brigade internal operations, with representation of supported units only as necessary to create service "demands." ERF is a collection of constructive simulations, interface devices, security systems, and communication nodes designed to allow for battle command training over a distributed network or at individual nodes. It enables stimulation of ABCS, provides a digital COP, and allows for battle command training. Includes a reduced-overhead training system for delivering routine digital training of battle staffs at all levels. Also provides interfaces and models that enable company, battalion, and brigade training audiences to meet their C2 training objectives in a joint, combined environment. Allows realistic replication of military operations on urban terrain (MOUT) and includes detailed intelligence play and fairly robust logistical representation.

Entity. A distinguishable person, place, unit, thing, event, or concept about which information is maintained for simulation representations.

Environmental Data Cube Support System (EDCSS). Generates and provides a consistent environmental scenario. An EDCSS distributor makes these products available through a Web service and/or Web page. An EDCSS plug-in to Joint Live Virtual Constructive Data Translator (JLVCDT)/Joint Bus (JBUS) publishes weather products to High Level Architecture (HLA) and/or DIS Federates. Is also available as a service through the Joint Training Data Service (JTDS).

Exercise Single Mobility System (EXSMS). Exercises C2/ITV AIS that replicates functions of a single mobility system in an exercise environment. Provides training audience with the transportation information they need to manage logistics. In an exercise environment, provides for planning, visibility of requirements and missions (scheduled and unscheduled), and data visualization. Enables visibility of airlift missions, including the Special Assignment Airlift Mission (SAAM), Channel (periodic logistical) Missions, Operational Support Airlift (OSA), Contingency Missions, the

Denton Program,²¹ Opportune Rescheduling System for Military Airlift Command Cargo, and Exercises and Training Missions. Also provides visibility of ship schedules, booked and manifested cargo, planning tools, Surface Deployment and Distribution Command (SDDC) situation reports (SITREPS) and spot reports (SPOTREPS), port data and decision support tools (e.g., cost calculators, port locators, station and International Civil Aviation Organization (ICAO) workloads) and monitors air, land, and sea conveyances. Provides visualization and analysis of the Joint Operation Planning and Execution System (JOPES) data, exercise planning actions, force movement tracking, leading indicators for performance, executive management visualizations, tools for metrics and monitoring the state of the enterprise. Integrates supply, cargo, forces, and passengers with airlift, air refueling, and sealift schedules and movements.

Extended Air Defense Simulation (EADSIM). Models the effectiveness of ballistic missiles, surface-to-air missiles, aircraft, and cruise missiles in a variety of scenarios. Provides intelligence, surveillance, and reconnaissance (ISR) and target acquisition information to various ABCS.

Extensible C4I Instrumentation Suite (ExCIS). Translates communications between Fire Simulation (FIRESIM) fire support simulation and AFATDS and other legacy fire support systems located in the tactical operations center or fire direction center.

Federate. A member of an HLA federation. All applications participating in a federation are called federates. This nomenclature may include federation managers, data collectors, real-world (“live”) systems (e.g., C4I systems, instrumented ranges, sensors), simulations, passive viewers, and other utilities.

Federation Management Tool–Reloaded (FMT-R). Manages and monitors HLA federates and monitors the DIS LAN federates. Allows exercise control to know when specific federates are connected to the federation.

Federation Object Model (FOM). An identification of the essential classes of objects, object attributes, and object interactions that are supported by an HLA federation. In addition, optional classes of additional information can also be specified to achieve a more complete description of the federation structure and behavior.

Federation. A named set of interacting federates, a common federation object model, and supporting runtime infrastructure that are used as a whole to achieve some specific objective.

Fires Simulation (FIRESIM). Simulates the target acquisition, command, control, communications, and intelligence (C3I), weapons/target allocation, logistics, firing platforms and munitions to a high level of detail.

²¹ The Denton Program allows donors to use space available on U.S. Military cargo planes to transport humanitarian goods and equipment to countries in need).

Force XXI Battle Command, Brigade and Below (FBCB2). A digital battle command information system intended to provide commanders, leaders, and soldiers—from brigade to individual soldier and across all of the battlefield functional areas (BFAs)—improved C2 and enhanced SA information. Systems with existing computers capable of hosting FBCB2 software will receive the Embedded Battle Command (EBC) software (a subset of FBCB2). Embedded systems for the near term include the M2A3 Bradley Fighting Vehicle (BFV), the M1A2 System Evaluation Plan (SEP) ABRAMS Tank, and the Army Tactical Command and Control System (ATCCS). FBCB2's primary functions are to send and receive automatic position-location reports derived from its interface with the Global Positioning System (GPS) and to send and receive C2 message traffic via digital over-the-air radio transmissions. The Tactical Internet is the network of radios and routers that provide linkages to connect the myriad FBCB2 platforms (both vertically and horizontally) across the combined arms force. The Tactical Internet consists of the Enhanced Position Location Reporting System (EPLRS), the Single-Channel Ground and Airborne Radio System (SINCGARS), and the Internet controller router. FBCB2 and the Tactical Internet perform as a network within brigade-sized and smaller units. At the brigade and battalion tactical operations centers, the Tactical Internet interfaces with the ATCCS, an Ethernet-based LAN of computers representing the functional areas of intelligence, maneuver, air defense, combat service support, and fire support. This interface permits information collected and disseminated via ATCCS systems to be passed rapidly through the Tactical Internet to FBCB2 computers. Likewise, the position reports of individual and unit locations are passed upwards through the FBCB2 and Tactical Internet into the ATCCS system for dissemination throughout the force.

Functional Requirements. A description of the end product from the user's perspective, including how the system will be used.²²

Gaps. The difference between current requirements and existing capabilities.

Generic Area Limitation Environment-Lite (GALE-LITE). A subsystem of the Generic Area Limitation Environment (GALE). A client-/server-based analysis and exploitation system for intelligence data. Includes end-to-end processing from the reception, parsing, and storing of contact reports through extensive interactive analysis tools and report generation. The purpose of this interface is to provide GCCS-J/COP the capability to access and analyze the intelligence data provided by the GALE-LITE system.

Global Combat and Control System—Army (GCCS-A). An integrated C2 system that supports the C4I for the Warrior objectives set forth by the JS. Provides an integrated and automated C2 system to Army strategic and theater commanders, to corps, and

²² Ivar Jacobson, *Object-Oriented Software Engineering* (New York: Addison-Wesley, 1992), 119.

to divisions when they perform task force or Army Service Component Command (ASCC) responsibilities in support of joint operations.

Global Command and Control System–Joint (GCCS-J). Provides an infrastructure that effectively controls the flow and processing of information to implement C2 over national agencies and military forces and to facilitate coordination with allies throughout the force projection cycle. This capability extends from the DoD to the combatant commanders (CCDRs), between the supported and supporting CCDRs, from the supported CCDR to the Commander Joint Task Force (COMJTF), and from the COMJTF to the component commands.

Global Command and Control System–Maritime (GCCS-M). The C2 component of the Navy's command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems. Supplies information that aids Navy commanders in a full range of tactical decisions. In functional terms, fuses, correlates, filters, and maintains raw data and displays image-building information as a tactical picture. Operates in near-real time and constantly updates unit positions and other SA data.

Global Decision Support System (GDSS). A United States Transportation Command (USTRANSCOM)-funded system that provides MAF C2 information for the Defense Transportation System (DTS) to CCDRs throughout the full spectrum of military operations. The operational imperative is to deliver robust capabilities to MAF C2 forces using a net-centric environment that allows access and information sharing across classified and unclassified domains. Will interoperate with USAF/Army/joint C2 systems, and is an integral part of the USTRANSCOM's DTS.

GTN Exercise Server (GES). Exercises C2/ITV AIS that replicates functions of the Global Transportation Network (GTN) in an exercise environment. Provides the training audience the transportation information they need to manage logistics. In an exercise environment, integrates supply, cargo, forces, and passengers with airlift, air refueling, and sealift schedules and movements. Passes information to the GCCS and the JOPES scheduling and movement (S&M) module.

GPS Environment Generator (GEG). Creates a machine-to-machine interface through which distributed exercise simulations and players can receive realistic navigational accuracies and damage assessment reports in real time. Is designed to take query PDUs from weapons systems and provide data PDUs to the weapons systems. These data PDUs include navigational accuracy information based on an electronic combat jamming environment.

Graphical Input Aggregate Controller (GIAC). A distributed visualization C2 environment for constructive simulations applications. Creates a distributed environment that uses distributed databases to capture and disperse simulation objects to provide information in a timely manner and to accurately reflect the simulation environment.

High Level Architecture (HLA). Major functional elements, interfaces, and design rules pertaining, as feasible, to all DoD simulation applications. Provides a common framework within which specific system architectures can be defined.

Imagery Product Library (IPL). Supports the storage and dissemination of imagery and imagery products, providing a library of information to imagery customers worldwide. Uses a standard Intelink²³ or Intelink-S²⁴ client to provide user access to this library, and supports both data push and data pull through user profiling. The IPL stores imagery in National Imagery Transmission Format (NITF) Version 2.0, the Tagged Image File Format (TIFF), and other formats.

Independent Stimulation Model (ISM). Provides a comprehensive, integrated tool set for full life-cycle support of simulation-driven, Master Scenario Events List (MSEL)-supported training events.

Intelligence Community Coordination Group (ICCOG). Serves as the ICs forum for M&S exchange, fostering improved communication among community and other government agencies and industry. Promotes the sharing of programs, methodologies, tools, techniques, data, and other information.

Joint Automated Deep Operations Coordination System (JADOCS). A joint mission-management software application. Provides a suite of tools and interfaces for horizontal and vertical integration across battlespace functional areas. Originating as a Defense Advanced Research Projects Agency (DARPA) program, has evolved into the “go-to-war” automated support system for deep operations in several theaters. Is currently installed on over 900 systems worldwide.

Joint Community Unique Simulations. Simulations that specifically target only those functions required to train a joint force commander (JFC) and staff, as opposed to creating a JFC training capability by federating several Service simulations. Depending on the overall training objectives of the exercise, can be used stand-alone or federated with Service simulations. The idea is to create separate simulations for the joint community where possible, reducing the dependence on large Service simulations at the tactical level, which necessitate larger exercises and complicate configuration management and acquisition. Joint community-unique simulations, such as the Joint Theater Level Simulation (JTLS), are a subset of large constructive simulations/federations and light simulations/federations.

Joint Conflict and Tactical Simulation (JCATS). A high resolution, multi-sided, multi-Service, entity level simulation with integrated capabilities used for training, analysis, planning and mission rehearsal. Provides an interactive conflict simulation that models joint, multi-sided air, ground and sea combat on a high/low resolution

²³ The classified and highly secure intranet used by the U.S. intelligence community.

²⁴ The secret-level variant of Intelink.

digitized polygonal terrain. Also models the use of non-lethal weapons and urban environments.

JCATS Low Overhead Driver (JLOD). Provides the low-overhead driver signatures and/or clutter that are generated in the non-kinetic and kinetic exercise support roles.

Joint Flow and Analysis System for Transportation (JFAST). Used by regional COCOMs and the USTRANSCOM to determine transportation feasibility, analyze the transportation requirements for the execution of operations, crisis action plans, Operation Plans (OPLANs), Concept of Operations Plans (CONPLANs) with time-phased force and deployment data (TPFDD), COA development, “what-if” scenarios, and exercises. From mobilization to Tactical Assembly Area (TAA), projects full end-to-end delivery profiles of troops and equipment by all air, land, and sea modes of transportation. Also generates the sustainment required by deployed forces and then determines the transportation requirements for that sustainment. Designed for use by the Joint Planning and Execution Community (JPEC), is the only Joint Strategic Capabilities Plan (JSCP)-approved program to determine transportation feasibility.

Joint Live Virtual Constructive (JLVC) Federation. Integrates constructive entity-level stimuli with virtual and live simulations and simulators in a near-real-time synthetic environment. Its entity-level models and simulations represent Service combat, intelligence, and logistic systems. Enables the integration of virtual simulators with live range instrumentation to support training from COCOM staff and Service components down to tactical units and individual/crew trainers. Also provides training for a range of joint, interagency, intergovernmental, and multi-national audiences, allowing Active Components (ACs), Reserve Components (RCs), the State Police, the Red Cross, and other national and state agencies to train with joint and Service battle staffs.

Joint Live Virtual Constructive Data Translator (JLVCDT). A high-performance, low-cost, open-architecture framework for developing data translators that allow users to easily extend functionality via a public Application Programmers’ Interface (API).

Joint Exercise Control System (JECS). A suite of tools that can be used with an LVC simulation federation. Provides a land, air, and maritime COP feed to GCCS, simulation archive and playback, AAR/analysis capability, HLA/DIS simulation analysis and troubleshooting, MSEL management and synchronization, simulation enumeration checking, and the ability to provide remote-order entry to constructive simulations. Consists of the JLVC Simulation Protocol Analyzer (JSPA), the Joint Deployable After Action Review System (JDAARS), the Joint MSEL Event Control Station (JMECS), and other tools for managing object enumerations and other federation data. In addition, has a stand-alone, no-simulation-required C4I interface in the Joint MSEL Event Control Station–No Sim (JMECS-NS), which combines MSEL support and C4I reporting (with no simulation required) to provide COP feeds.

JLVC Simulation Protocol Analyzer (JSPA). Monitors both HLA and DIS networks and is used to assist in troubleshooting simulation issues and to manage the federation. Has the ability to display network data, filter simulation traffic, capture logs, and conduct playback.

Joint Mission Planning and Rehearsal System (JMPRS). A game-based virtual application linked to the Special Operations Command (SOCOM) mission planning system.

Joint Multi-Resolution Model (JMIRM) Federation. Uses the JTLS and the CATS as its core models. Has been applied to validate the concept of federate selection based on user functional requirements. An entity-level server aggregates units to provide a common template for intelligence federates while offloading some of the entity-level representation requirements from CATS. Its name and capabilities derive from the need to simultaneously provide high-level aggregate simulation to support JTF training events and entity-based representation to simulate tactical forces. The Joint Forces Command (JFCOM) is integrating other federates into the JMIRM federation.

Joint Non-Kinetic Effects Model (JNEM). A simulation that models the satisfaction levels of different population groups relative to specific concerns, calculates the overall mood based on these levels, and causes reactive events based on the results.

Joint Operational Planning and Execution System (JOPES). An integrated C2 system used to support joint conventional military operation planning, including the theater-level nuclear and chemical planning activities and the monitoring requirements for mobilization, deployment, employment, and sustainment. Provides senior-level decision-makers and staffs of the National Command Authorities (NCA), the Joint Chiefs of Staff (JCS), CCDRs, component commands, military Services, and agencies of the DoD an enhanced capability to plan, coordinate, and conduct joint military operations. Has the capability for supported commanders to identify between requirements and capabilities and procedures to conduct risk analysis, resolve shortfalls, and redefine strategic concepts if risks are too great.

Joint Semi-Automated Forces (JSAF). A U.S.-government-owned and -developed simulation system widely used in training and experimentation. Current users include JFCOM, the Navy Warfare Development Command (NWDC), and the USMC DVTE program. Was originally developed as part of the DARPA Synthetic Theater of War (STOW) Advanced Concept Technology Demonstration (ACTD).

Joint Theater Level Simulation (JTLS). An interactive, Web-enabled, multi-sided wargaming system that models a joint and coalition force in a total air, land, and naval warfare environment. Consists of six major programs and numerous smaller support programs that work together to prepare the scenario, run the game, and analyze the results. Operates on a single computer or on multiple computers, either at a single or at multiple distributed sites. Model features include Lanchester attrition algorithms, detailed logistic modeling, and explicit air, ground, and naval force movement.

Joint Training Data Services (JTDS). A set of Web-based scenario-generation services developed to support the needs of the DoD M&S training community. Saves time and money by producing correlated databases used by simulations and federations to support training events and includes OOB, terrain, and weather effects services.

Joint Training Support Center (JTSC). Is not a training federation but an independent SOF training facility and network that provide the C4I necessary to enable pre-deployment training and operational mission rehearsal. The primary objective is to train by enabling SOF C2 elements and warfighters to reach, maintain, and improve combat readiness and to conduct mission rehearsals in realistic operational environments in conjunction with conventional forces when necessary.

Large Constructive Simulations/Federations. Those constructive simulations and federations typically used to support large training exercises (e.g., Ulchi Focus Lens (UFL)). These simulations/federations provide functionality and fidelity but normally require a large amount of time and resources to develop, configure, operate, and maintain.

Light Federation. A group of light simulations federated together to provide the necessary fidelity and functionality to support a given purpose. Are flexible and responsive in that federates can be added and deleted and new technologies can be injected with relative ease, allowing diverse users to customize the federation for their unique needs. Like the light simulations, should be used to provide a targeted functionality or less fidelity than that of a large constructive simulation federation.

Light Simulations. Provide targeted functionality or less fidelity than a large, complex, general-purpose simulation system. Require significantly less time and resources to develop, configure, operate, and maintain.

Live Simulations. Involve real people operating real systems.

Live, Virtual, and Constructive (LVC) Simulation. A broadly used taxonomy for classifying simulation types. The categorization of simulations into live, virtual, and constructive is problematic because no clear division exists between these categories. The degree of human participation in the simulation is infinitely variable, as is the degree of equipment realism. This categorization of simulations also suffers because it does not include a category for simulated people working real equipment (e.g., smart vehicles).

Logistics Federation/Joint Deployment Logistics Model (LOGFED/JDLM). The logistics component constructive simulation model of the Army's JLCCTC and the JLVC federation. Provides commanders and their staffs the complete array of combat support and combat service support functionality required to meet integrated logistics training requirements.

Logistics Simulation (LOGSIM). A computer model that enhances logistics training in computer-assisted exercises. Provides added realism to AWSIM by modeling the

constraining effects of aircraft maintenance on air operations, without impeding exercise training objectives.

Maneuver Control System (MCS). Automates the creation and distribution of the common tactical picture (CTP) of the battlefield. Also creates and disseminates operations plans and orders for combined arms maneuver commanders.

MAGTF Tactical Warfare Simulation (MTWS). Simulates all the Marine Corps' combat activities. Models amphibious landings, ground warfare, and Marine air warfare (rotary and fixed wing).

Marine Corps Federation (MCFED). Provides interactive, multi-sided, force-on-force, real-time M&S with stand-alone tactical combat scenarios for air, ground, surface, and amphibious operations. With interfaces to fielded USMC C4I systems such as C2PC and the IOS, provides the battle staff the ability to seamlessly train with and use their C4I systems during the execution on an MTWS-supported training event. Through the implementation of an HLA interface between MTWS and the entity-level CATS system, high-resolution tactical objectives can be simulated in CATS and reflected within the context of a larger operational scenario conducted in MTWS.

Massively Multi-player Games. On-line simulated environments that allow large numbers of players/trainees to interact while striving to achieve individual or group objectives. Can range from an environment for users to interact in an unstructured manner to games with strictly defined player roles, rules, and game objectives. The chief advantage is the ability to provide a continuous, distributed, online training environment for a potentially large number of trainees. Trainees learn through interactions with each other and the simulated environment. Often use light simulations as the "gaming engine."

Measure of Effectiveness (MOE). A qualitative or quantitative measure of the performance of a model or simulation or a characteristic that indicates the degree to which it performs the task or meets an operational objective or requirement under specified conditions.

Missile Defense Space Tool (MDST). Provides real-time interactive software for simulation of space-based launch detection and early warning assets in a networked simulation environment. Includes the capability to receive threat input messages from external sites and to output messages using operational formats to external sites for exercise purposes.

Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Multiple Link System Test/Training Tool (MLST3). Generates tactical data link messages and outputs them—as a complete tactical exercise scenario—to the system under test. Then receives and interactively processes and displays the output of the system under test. If the interactions comply with the appropriate specifications, the system under test is considered interoperable. By generating data link messages representing a complete battle scenario, provides realistic training exercises that sharpen the skills of the combat system teams. The system’s DIS protocols enable participation in geographically distributed exercises.

Multiple Unified Simulation Environment/Air Force Synthetic Environment for Reconnaissance and Surveillance (MUSE/AFSERS). A visualization model that provides a realistic aerial view of the area of operations as seen from an unmanned aerial vehicle (UAV). Gives real-world view of the exercise (simulation) terrain and permits the UAV operator to obtain intelligence and assist in target acquisition.

Multi-Resolution Federation (MRF). JLCCTC-MRF is a medium-resolution federation designed for use at division level and above, including JTFs. Suitable for training functional and multi-functional support brigades that include intelligence, fires, aviation, air defense, and sustainment. Primary training audiences are divisions and corps commanders and their battle staffs. If used in a smaller composition, can also support training for brigade combat teams. The JLCCTC-MRF’s collection of simulations, interface devices, security systems, and communication nodes is designed to allow for battle command training over a distributed network or at individual nodes. Enables stimulation of ABCS and provides a digital COP. Allows selected small units to realistically replicate high-resolution combat activities, including a non-kinetic event model, and supports detailed log and intelligence play.

National Wargaming Simulation – Next Generation (NWARS-NG). Simulates the tasking and reporting of information from national intelligence collection assets for training and exercise support. NWARS-NG reports are in a standard United States Message Text Format (USMTF) and can be released through the Communication Support Processor (CSP). Provides C2 stimulation with or without the federation. Allows planners and trainers to shape the environment by setting realistic conditions on organic unit C2 devices.

Navy Continuous Training Environment (NCTE). A federation consisting of multiple versions of the JSAF simulation, which represents Navy surface, subsurface, air assets, Navy intelligence simulations, and interfaces to Navy battle command systems.

Radiant Mercury (RM). Automatically sanitizes, guards, and downgrades multi-level classified, formatted information, to allow its release to users (primarily tactical level) not authorized access to highly classified data.

Reconfigurable Vehicle Tactical Trainer (RVTT)/Reconfigurable Vehicle Simulator (RVS). Mobile simulators that provide virtual mounted-maneuver training of medium and light forces for selected wheeled combat and support vehicles. Key features are 360-degree field of view; weapon systems that allow shoot-on-the-move; communications via simulated voice and digital systems; the ability to reconfigure between variants in under 2 hours; enhanced night vision; the ability to operate independently of CCTT fixed or mobile sites. RVTT has its own master control console, power generation, and AAR systems.

Remote Environment (RE). A constructive simulation used to model threat ballistic missile flyouts. Uses a distributed architecture, with the master RE located at Schriever AFB (Colorado). Subordinate REs will be located at other locations that require an inject of the threat missile fly out.

Requirements. Operational needs needed to perform a future military operation or to perform a current military operation better. Speak to capabilities, which are attained through changes to or development of new doctrine, organization, training, materiel, leadership and education, personnel, and facilities, or a combination thereof. (See the Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3170.01A, *Operation of the Joint Capabilities Integration and Development System*, dated 12 March 2004.)

Research, Evaluation, and System Analysis (RESA) Simulation. Simulates naval war fare by modeling all Navy objects (surface, subsurface, and air) and all their threats and targets.

Resolution. The degree of aggregate detail and precision (i.e., granularity) used in the representation of real-world aspects in a model or simulation.

Rialto. A component of a cross-domain solution (CDS) that is used in an HLA distributed simulation environment. A high-performance HLA federate that receives and publishes simulation (and simulation management) data via the HLA Run-Time Infrastructure (RTI) API.

Run-Time Infrastructure (RTI). The general-purpose distributed operating system software that provides the common interface services during the runtime of an HLA federation.

Scalability. The ability of a distributed simulation to maintain time and spatial consistency as the number of entities and accompanying interactions increases.

Scenario Generation Server (SGS). A rapid database generation baseline capability for scenarios to support training. Addresses the need to develop and manage complex data interactions between, within, and throughout simulation models and real-world C2 and C4ISR within the training.

Secure Messaging and Routing Terminal (SMART). Provides classified message distribution throughout the command's organization. Enables the users to send and receive e-mail-like messages to and from the Automatic Digital Network (AUTODIN) over existing networks with complete privacy. Also satisfies the required DoD DMS security services.

Simulation to C4I Interchange Module for Plans, Logistics, and Exercises (SIMPLE). An interface between the virtual battlefield environment in a simulation and the real-world C2 systems used by the military. Provides a database that maps simulation units, platforms, munitions, and supplies to real-world units, platforms, munitions, and supplies. Also contains a message module that correctly generates the tactical messages required by the military C4I systems to report on these units, platforms, and so forth.

Space System Generator (SSG). Provides a space OOB through a DIS interface that leverages the SCOPES to stimulate DMO exercise and training events. Currently has the capability to provide a space OOB and the status of the constellations in the DIS environment using entity state PDUs. Ongoing development will include interaction with collision/detonate PDUs, space launch, and ground sensors.

Special Operations Mission Planning Environment (SOMPE). Designed to assist Army SOF in mission planning. A system of common government and commercial hardware and software brought together for mission planning. Includes four computers, a scanner, a printer, a projector, a networking switch, and a transport case. Also incorporates Falcon View (a software package used as the mapping tool) and a variety of other software.

Spirals. Discrete development periods (or increments) when requirements for a system are refined through demonstration and risk management, with continuous user feedback—all designed to provide the user with the best possible capability. (See Department of Defense Instruction (DoDI) 5000.02, *Operation of the Defense Acquisition System*, dated December 2, 2008.)

Standard. A rule, principle, or measurement established by authority, custom, or general consent as a representation or an example.

Story-Driven Training. A computer-based training environment that immerses the trainee in a situation or series of situations (i.e., a "story") designed to achieve specific training objectives. Can be either video-based or computer-generated imagery-based and is primarily used for training individuals or small teams. Particularly well suited for training aspects of military operations that require cognitive skills, decision-making, and human interaction, such as those that are currently trained with seminar games, political/military games, and so forth.

System Administration Security Server (SASS). A security system designed to meet Defense Information Systems Agency (DISA) requirements for a domain controller, systems audit, and systems backup.

Tactical Communications Support Processor (TCSP). Used by the IC at unified, specified, and major commands worldwide. Is a DMS architecture migration system for secure messaging. The DMS target architecture provides a wide range of interoperable and secure writer-to-reader transactions.

Tactical Simulation (TACSIM). A simulation designed to provide training to intelligence staffs, collection managers, and analysts in a simulated land combat situation. A high-fidelity simulation of intelligence activities that supports training from large scale joint exercises to specific intelligence section tasks. Uses interactive computer based simulation to support intelligence training from MI Battalion through Echelons Above Corps (EAC). Accomplishes this mission by simulating intelligence operations and/or stimulating the entire spectrum of intelligence operations, with the exception of human intelligence (HUMINT). Stimulates the ASAS with a scripted scenario database. Has operated in intelligence missions over enemy forces and has generated reports in USMTF that were provided to ASAS at multiple classification levels. Generates intelligence messages in standard USMTF format: Tactical Reports (TACREPs), tactical electronic intelligence (TACELINT), Reconnaissance Exploitation Reports (RECCEXREPs), Radar Exploitation Reports (REXREPs), and Imagery Interpretation Reports (IIRs)/Initial Photo Interpretation Reports (IPIRs).

Target Location, Designation, and Hand-off System (TLDHS). An integrated, modular, team-portable equipment suite that will provide the FOs/forward air controllers (FACs) the capability to locate and acquire enemy ground forces quickly and accurately and to designate targets for laser-guided munitions. Also provides digital transmission capability to Army and Navy fire support nodes. Consists of two major components: the Lightweight Laser Designator Rangefinder (LLDR) and the Target Handoff Subsystem (THS). Uses variable message format (VMF) messages to accomplish its mission. The Joint Interoperability Test Command (JITC) effort focuses on certifying specific interfaces for applicable message sets to interim VMFs.

Taxonomy. A classification system that provides the basis for classifying objects for identification, retrieval, and research purposes.

Theater Battle Management Core System (TBMCS). Provides joint and Service Combat Air Forces automated C4I systems to plan and execute theater-level air campaigns. An Air-Force-lead program with joint and allied participation. Is the theater air module of the GCCS and includes the Contingency Theater Automated Planning System (CTAPS), Combat Intelligence System (CIS), Wing Command and Control System (WCCS), and the Air Support Operations Center (ASOC) top-level applications. Elements of the TBMCS are planned for every theater air C2 and air weapons system from the joint force air component commander (JFACC) to the executing aircraft squadron. Mission at the force level is to provide the JFACC and the combined force air component commander (CFACC) the automated tools necessary to plan, monitor, and execute the air campaign effectively and efficiently. This capability

includes planning and issuing the ATOs and air control orders that ensure the theater commander's intent is supported through the application of airpower using the latest intelligence. Capabilities should also ensure that air operations are deconflicted. Mission at the unit level is to provide the wing and base commanders and their battle staffs timely and accurate information for effective decision-making. Is also supposed to provide the secure, automated, deployable, and distributed WCCS connectivity to force-level TBMCS systems. Contributes to joint vision by providing information superiority through the integration and distribution of information relevant to the planning and execution of theater air operations. Through the extension of TBMCS to the Army, Navy, Marines, and Allied nations' air forces, the integration of joint and coalition capabilities is also achieved. The scalability and modularity of TBMCS supports rapid strategic mobility while the theater airlift application provides connectivity with theater mobility capabilities. One of the TBMCS applications provides an integrated air picture (IAP) updated from several theater and strategic sensors and organizations. This IAP, along with the fused intelligence provided by interaction with other Service intelligence systems, supports increased situation awareness.

Training. Used within the TC AoA to define the scope of the effort and based upon direction from the Senior Steering Group (SSG), is focused on those M&S systems and tools that support collective and staff functional capabilities. The level of staff training addressed is at the operational/JTF level. The scope of the staff training ranges from one level up (COCOM staff) and two levels down from the operational/JTF to the extent necessary to provide the appropriate context and stimulation supporting the operational/JTF level of training. As used in the context of the TC AoA, does not include entry-level Service/agency training, individual or operator training, or professional military education. These efforts are focused on individual skill proficiency and education that each Service/agency must provide to ensure trained individuals, crews, and leaders. More specific training definitions are as follows:

- **Joint training.** "Training, including mission rehearsals, of individuals, units, and staffs using joint doctrine or tactics, techniques, and procedures to prepare joint forces or JSs to respond to strategic, operational, or tactical requirements that the CCDRs consider necessary to execute their assigned or anticipated missions."²⁵
- **Military training.** 1. The instruction of personnel to enhance their capacity to perform specific military functions and tasks. 2. The exercise of one or more military units conducted to enhance combat readiness.²⁶

²⁵ DoDD 1322.18, *Military Training*, dated 13 January 2009.

²⁶ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, dated 12 April 2001, as Amended Through 19 August 2009.

- **Service training.** Military training based on Service policy and doctrine to prepare individuals and interoperable units. Service training includes basic, technical, operational, and interoperability training in response to operational requirements deemed necessary by the COCOMs to execute assigned missions.²⁷

Use Case. A use case defines a goal-oriented set of interactions between external users and the system under consideration or development. Use cases have become a wide spread practice for capturing functional requirements in software design, especially in the object-oriented community where they originated, but their applicability is much wider.²⁸ For the TC AoA, a use case is a joint or Service training requirement, represented by the exercise, which is designed to meet that requirement.

Virtual Battlespace 2 (VBS2). A first-person shooter simulation, incorporated into the Marine Corps' DVTE ITK, with the objective of helping warfighters focus on thought processes, logic, and decision-making skills in support of individual Service training or collective joint training exercises. A PC-based simulation that can be networked to include several players. Participants can operate virtual personal weapons, weapons stations, vehicles, and aircraft in either a stand-alone mode using artificially intelligent opposing forces (OPFORs) or distributed across a LAN, a Wide Area Network (WAN), and with a combination of artificially intelligent and/or a real OPFOR. Is capable of displaying terrain objects (e.g., buildings, vegetation, diurnal rotation of the earth (day/night), weather patterns, and celestial objects). Also has data logging/AAR functionality and capability.

Virtual Reality Scene Generator (VRSG). Real-time 3D computer image generator that enables the user to visualize geographically expansive and detailed virtual worlds on Windows PCs. Provides real-time, single- or multiple-channel visualization of virtual environments, dynamic moving models, and special effects, using Microsoft DirectX commercial standards.

Virtual Simulation. A simulation involving real people operating simulated systems. Injects a human-in-the-loop (HITL) in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire-control resources to action), or communication skills (e.g., as members of a C4I team).

²⁷ CJCSI 3500.01C, *Joint Training Policy and Guidance for the Armed Forces of the United States*, dated 15 March 2006.

²⁸ Geri Schneider and Jason P. Winters, *Applying Use Cases: A Practical Guide* (Upper Saddle River, NJ: Pearson Education, 2001).

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14. ABSTRACT The purpose of the Training M&S Business Plan (TMSBP) is to provide information to training stakeholders and provide linkages between the functional training community as represented by the Joint Training Senior Advisory Group (SAG) to the DoD Strategic Vision and Goals for M&S. Since needs and technologies are constantly evolving, the TMSBP will continue to evolve as a living document. This 2009 Edition is the third in a series. The 2009 Edition moves to recognize and document the Training Gaps Analysis Forum (TGAF) as the training M&S requirements body and include updated input on TGAF derived problem areas and M&S gaps. This document serves to inform the DoD M&S Steering Committee and the other communities enabled by M&S regarding the training community's M&S needs and capabilities. The next update for this document will be published in 2011.					
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