1999

Advanced Concepts and Requirements Model and Simulation
Domain Management Plan

CHAPTER 1 - PURPOSE, OBJECTIVES, SCOPE

1-1. Purpose and Objectives. This management plan describes the Army's "blueprint" to provide model and simulation (M&S) core capabilities essential for Advanced Concepts and Requirements (ACR) domain processes. It complies with the Army Model and Simulation Master Plan (AMSMP). The primary purpose of this plan is to outline strategic objectives that address core mission needs, and establish the tasks and resources to: sustain core capabilities; curtail redundancy; leverage total Army M&S capabilities; and systematically and sensibly migrate the current baseline to the objective architecture. This plan provides senior leaders and resource managers the underpinning for ACR domain strategic objectives and investment strategy. Army Model and Simulation Executive Council (AMSEC) endorsement of this plan signifies senior Army leadership approval for implementation. A second purpose is to ensure that all players in the ACR domain understand who has lead and supporting responsibilities for key tasks. Lastly, this plan communicates objectives, baseline information and actions to internal and external DoD organizations.

a. Effectiveness. The strategic objectives set forth in this plan focus on providing Army/Joint M&S that credibly represent future land force capabilities in operations most relevant to the National Military Strategy. This plan ensures that the mission needs and strategic objectives for ACR domain M&S are clearly communicated, that effective implementing actions are synchronized and that the baseline ACR domain M&S interact, interoperate and satisfy mission needs for Army/Joint M&S.

b. Efficiency. This plan identifies actions to achieve unity of effort and efficiency, first and foremost, within the ACR domain, and secondly, with M&S in other Army domains and DoD activities. The intent is to identify overlapping and similar requirements with other domain M&S and to field the minimum set of M&S that meet essential mission needs in the most balanced approach.

c. Responsibility. This plan pinpoints organizational responsibility for assigned tasks, defines management procedures to be followed for guiding, measuring, and overseeing actions and programs, and identifies who has authority to direct, redirect or terminate actions or programs approved for execution. The end result will be clear accountability for tasks and resources necessary for successful and timely implementation of the plan.

1-2. Scope.

a. Key ACR domain processes. Developing and preparing land forces for future military operations is a core competency of the institutional Army. It is the principal focus of ACR domain processes providing strategic direction, concept development, requirements determination and force planning. ACR domain activities depend on insights and quantitative data from M&S for analyzing strategic, operational and tactical operations in war, conflict and operations other than war. The primary products of these activities are strategies, warfighting concepts, mission needs, doctrine, requirements, executable plans, and affordable programs. A description of ACR domain processes and their general simulation needs is provided in Chapter 2.

b. Future force operations. The patterns of land force operations include: project the force, decisive operations, sustain the force, shape the battlespace, protect the force, and gain information dominance. Representing the breadth of Joint, Combined, Coalition, and Interagency operations, and the depth of operations from strategic level down to individual platforms and soldier, under all geographic, terrain, weather and infrastructure conditions generates an imposing list of mission needs and requirements for M&S. Detailed requirements are not documented in this plan. Requirements for specific capabilities

will be documented separately for each program and project. This plan contains a high level discussion of mission needs. General needs and strategic objectives are discussed in Chapter 2.

c. Action timeframe. This plan identifies capabilities needed in the near-term (FY98-99) and for the mid-range time period (FY00-03); benchmarks current capabilities; identifies on-going research and development efforts; and provides a six year road map for attaining needed capabilities. This plan addresses M&S objectives specified for the FY98-FY03 period. The plan is a living document, with major updates published at the beginning of odd numbered fiscal years (i.e., 97, 99, etc.) and modified as needed during the interim. Each major update will extend the planning horizon by two years.

d. Joint M&S. This plan identifies actions for improving Joint M&S representation of land warfare operations in Joint M&S across the spectrum of conflict. Army M&S, especially those representing power projection and campaign operations, must represent full spectrum capabilities in joint campaigns and unified operations, often in concert with allies and coalition forces.

e. Army M&S. ACR domain M&S will: meet the objectives of AMSMP; maximize M&S commonality with the Research, Development and Acquisition (RDA) domain, Training, Exercise and Military Operations (TEMO) domain and with functional area models; and comply with M&S standards and architectures. Interdependencies with the RDA domain, TEMO domain and Army activities are addressed in Chapter 2.

f. Infrastructure. The principal focus of this management plan is research, development and sustainment of ACR domain simulations and simulators. However, this plan will also address pertinent needs, requirements and actions associated with models, simulation centers, hardware, software, facilities, communications, data, and people. These resources are generally described as infrastructure.

CHAPTER 2 - MISSION NEEDS, AND STRATEGIC OBJECTIVES

2-1. Definition of ACR Domain Processes.

a. Key ACR domain processes are:

(1) Strategic Direction - The processes of developing and assessing Army plans, strategic concepts and major programs for achieving National Military Strategy and Defense Planning and Policy goals and objectives; and developing the Army's investment strategy for obtaining, allocating and optimizing use of resources to meet strategy.

(2) Concept Development - The processes of developing strategic, warfighting, operational and functional concepts. These concepts describe how the full range of Army capabilities can be used on future battlefields and in future operations. Representative concepts include: Forward Presence, Dominant Maneuver, Precision Engagement, Division Operations, Information Operations, Battlefield Visualization, Space Support to Land Warfare, Full-Dimensional Protection, Focused Logistics and Velocity Management.

(3) Requirements Determination - The processes of identifying changes in strategic, battlefield and institutional military requirements. Representative requirements include: doctrine, training, leader development, organizations, materiel, soldiers, installations, strategic lift, force stationing, consumables, and services. Force (i.e., force level and force mix) and organization requirements (e.g., unit design) are included in the force planning process described in the next paragraph.

(4) Force Planning - The processes of determining capabilities, requirements and risks for force levels, force design, force structure and Army units. The products of force planning support strategic direction and requirements determination; ensure that forces are sized, balanced, and stationed to meet strategy; provide the basis for acquiring and distributing materiel and provide the basis for acquiring,

training and distributing personnel in the Army. Force manning includes elements of force management, force development, force integration, force modernization and combat development (organization design).

b. M&S are key for the following ACR domain activities: studies, analyses, warfighting experiments, and force development tests/experimentations. Key processes and products resulting from ACR domain processes are shown in figure 2-1.

A summary of M&S needs for key activities is provided below.

(1) Strategy, Strategic Environment and Concept Studies. These studies: develop strategic, theater, corps/division and brigade/battalion scenarios; assess improvements in strategic and operational capabilities due to changes in warfighting concepts, broad military options, doctrine, force level and force composition; and identify international trends in military, economic, political, and technology areas and assess their implications on Army capabilities and requirements mobilization, deployment, employment of joint/combined forces and sustainment are examined in strategic and operational level scenarios. Representative issues are: Total Army design, capabilities of Joint/Combined/Coalition/Interagency forces in theater/campaign/major operations and operations other than war; impact of weapons of mass destruction; space operations impact on ground warfare; requirements for stationing, prepositioning materiel, industrial base, war reserves and technological concepts impact on operations. M&S used include: campaign and operational level simulations, military-political games, technology war games, mobilization models, deployment models and specific functional models.

(2) Force and Organization Design Studies. These studies: assess effectiveness of alternative force levels, composition, and mix to achieve National Military Strategy; provide insights for capabilities, requirements, priorities and risks of alternative forces and support concepts; and assess capabilities of alternative unit designs. Representative issues are: strategic, operational, tactical operations effectiveness; battlefield operating systems contribution to combined arms operations; force structure needed for full spectrum of operations under expected peacetime and wartime conditions. Campaign, operational and tactical level simulations, force structuring models, mobilization/deployment models, unit design models, and management information systems are principal M&S used.

(3) Mission Needs and Materiel Operational Requirements Analyses. These analyses assess system and sub-system level (e.g., radar) performance to: identify mission needs, determine materiel requirements; support Integrated Concept Teams and user's role in Integrated Process Teams (IPTs); conduct performance and cost trade-off analyses (including cost as an independent variable analyses); and conduct analysis of alternatives for materiel acquisition milestones. Operational/tactical/system/battlefield operating system/engineering simulations and system simulators are main M&S used.

(4) Functional Area Analysis (FAA) and Battlefield Operating Systems (BOS) Analysis. Functional area analyses focus on specific warfighting implications and requirements for war reserves, industrial base, mobilization, deployment, and installations. Battlefield operating system analyses focus on mounted and dismounted operations, theater missile defense, fire support, aviation, air defense, engineer, battle command and logistics operations. Primary purposes are to determine requirements and evaluate capabilities. M&S tools for these analyses include force structuring models, force management models, specialized BOS simulations and simulators.

(5) Experimentation and Demonstrations. Activities include experiments in the field (e.g., Advanced Warfighting Experiments (AWEs)) or in the laboratory (e.g., virtual) to support concept formulation, requirements generation, force planning or Advanced Technology Demonstrations (ATDs). Constructive simulations and system simulators used as part of a Distributed Interactive

Simulation/Aggregate Level Simulation Protocol (DIS/ALSP) confederation of models and instrumented live forces are the typical tools.

(6) Cost Analysis and Resource Allocation. These studies: estimate force, program and systems costs; and evaluate major resource allocation options, affordability assessments and resource allocation prioritization. Warfighting simulations, mathematical programming, optimization, and cost models are representative tools.

2-2. Capabilities Needed. The ACR domain is very diverse and complex. It is important to recognize that M&S differ by type (constructive, virtual, live), by application supported (analysis, training, acquisition, resource allocation), and by scope and level of detail (long theater campaigns to concise small unit combat). The need to model space assets and their contribution must be a capability for the ACR domain to consider in the future. The contribution of space assets is potentially very significant and needs more attention. The capabilities and needs for the ACR domain must be addressed with this in mind. Mission needs and core capabilities for ACR domain models and simulations are summarized below.

a. Models and constructive simulations for the ACR domain activities must represent full-dimensional land forces operations illustrated in figure 2-2. Primary capabilities are driven by Joint military operations for deterring and defeating threats in major theaters of war, for Defense Planning Guidance (DPG) scenarios, for Joint Strategic Planning System (JSPS) planning guidance, and for FM 100-5 Operations. Concepts of operations, doctrine, Tactics, Techniques, and Procedures (TTPs), organization, and systems must represent US Army, Joint, coalition, friendly, neutral and enemy forces. National and international organizations involved in peace operations must also be represented for Military Operations Other Than War (MOOTW). Core capabilities are:

(1) Project the Force. This capability area includes the processes to alert, mobilize and deploy operational forces anywhere in the world.

(a) Mobilization processes for all types of mobilization (i.e., selected call up through total mobilization) include the activation of Reserve forces assembling and organizing all national and military resources (personnel, supplies, materiel, etc.); and all actions to bring Armed Forces to a high state of readiness for war or other national emergency. Activities within mobilization stations, training base logistics support, national medical support, industrial base and transportation must be represented.

(b) Deployment processes include operations involved in moving forces and materiel from origin or home station to destination, including intra-CONUS, inter-theater, and intra-theater. Operations modeled need to represent CONUS installations, CONUS transportation network, ports and airfields and strategic lift assets. The operations also include reception, staging, onward movement and integration (RSOI) in the theater of operations.

(2) Sustain the Force. This capability area includes the processes to sustain operations anywhere in the world. At the strategic and operational levels of war, logistics (sustainment) functions are embedded in mobilization, deployment and reception activities. At the operational and tactical level, logistics involves the traditional Combat Service Support (CSS) functions of arming, fixing, fueling, maneuvering, moving, accounting for and sustaining soldiers, materiel and units. Wholesale logistics models represent logistics functions such as supply and maintenance. General support, direct support and user level logistics functions are embedded in some campaign, tactical and battlefield operating system models and simulations. The evacuation and medical treatment of casualties must be portrayed in this capability area. The ACR domain is working to capture that process and ensure its participation in simulations.

(3) Decisive Operations. This capability area includes: strategic, operational, tactical and engagement operations; Joint concepts of dominant maneuver, precision engagement, and

protect the force; and operations within battlefield functional areas. M&S must represent the effects of unit, system and dismounted soldier/crew performance for the spectrum of dynamic battlefield environments. Battlefield functional operations including intelligence, maneuver, fire support, air defense, missile defense, mobility, logistics, battle command must be represented. MOOTW is another consideration of this capability area that needs some discussion. Peacetime operations include disaster relief, nation assistance, security assistance, counter drug/terrorism operations, arms control, treaty verification, support to civil authority and peacekeeping. These operations are extremely diverse and do not lend themselves to analysis using a single model.

(4) Shape the Battlespace. Shaping the battlespace will be facilitated primarily by sharing "real time" information among all the Services, allies, and coalition partners. This process will be accomplished by effectively exploiting information age technologies that permit: isolating, tagging, and tracking of the most fleeting enemy forces and targets with precision; processing and fusing multiple sources of information from all involved components; and employing the proper force; munitions, or energy before the target is lost. Immediate and accurate battle damage assessment will facilitate reengagement. As future joint forces combine processes to make virtually any enemy force or target accessible, other technologies will enhance the intelligence and precision of the weapons used to engage them. ACR domain M&S supporting studies and analyses in this core capability area must represent described processes in as detailed a manner as possible.

(5) Protect the Force. The approach to force protection will be a holistic one, applying organizational, materiel, and procedural solutions to the challenge of protecting soldiers, information, and equipment across the full spectrum of operating environments. It will complement the capabilities of the other components to assure the joint force freedom of strategic deployment, lodgment, expansion, and maneuver without surprise or significant disruption by any enemy force. These capabilities will include an array of fused sensors and area defenses to protect critical, high-value operational and strategic assets from enemy air, land, and sea attack. Representation of all aspects of this pattern of operations must be captured in the ACR M&S domain.

(6) Gain Information Dominance. Information Operations (IO) conducted to gain information dominance are essential to all the patterns of operations. They consist of both offensive and defensive efforts to create disparity between what we know about our battlespace and operations within it and what the enemy knows about his battlespace. Army IO is conducted within the context of joint IO, including PYSOPS and deception campaigns to ensure the strategic, theater, and tactical efforts are synchronized and collaborative. ACR domain M&S must represent the intricacies of this critical pattern of operations.

b. Virtual simulations and simulators that represent major battlefield systems are needed for getting the soldier-in-the- loop for technology concept exploration, for performance-cost trade-off analyses and for experimentation. Simulators in the ACR domain need computer image generators (CIGS) to create virtual environments in which humans interact with other simulations (local and distributed) and live simulations. Computer generated forces (CGF) are software driven units/entities whose tactical actions are directed either by commanders or leaders (SAF) or automatically. Simulators and CGF must meet DoD and the Army technical and M&S architectures to ensure M&S interoperability, reuse and commonality. New M&S must comply with the emerging HLA standards. General needs, illustrated in figure 2-3, are:

(1) The ability to be quickly reconfigured to assess crew and system warfighting capabilities of new technology concepts, engineering designs for developmental programs, or insertion of new technologies in fielded systems.

(2) The ability to operate in stand alone mode or linked with dissimilar simulators, simulations, and fielded systems (especially C4I systems).

(3) The ability to represent the effects of the complete spectrum of realistic battlefield environmental conditions, especially those that affect target acquisition, system movement, system employment, attrition, communications and IO.

(4) The ability to quickly and easily modify constructive simulation objects based on insights gained from simulators.

(5) The ability to represent operational capabilities of current and projected threat systems.

c. Infrastructure and applications support must provide the following capabilities:

(1) Ability to be quickly modified to represent new concepts, doctrine, tactics, units, and systems.

(2) Ability for quick turnaround including data availability and accessibility, user interface, computer run time, and results presentation.

(3) Ability to operate in distributed simulation environment including requirements associated with HLA, bandwidth, interoperability, real-time operations and connectivity.

(4) Ability to display simulation scenes in Army simulation centers including fusion of information from multiple sources, multi-media transmission and complex computer generated images.

(5) Ability to operate in a secure environment, to include using special access data.

(6) Ability to comply with HLA architecture.

2-3. Strategic Objectives and Goals. See Chapter 4 for Objectives, Actions, and Responsibilities.

a. Joint campaign simulations are routinely used for OSD/JCS studies quantifying force and warfighting capabilities associated with strategies, strategic options, concepts, force design, and modernization programs. A clear understanding and credible representation of Army capabilities in military strategy and national security decision making is critical. This is reinforced by the fact that Joint Vision 2010 states that "Modeling, demonstrations, simulations, technology wargames, and joint exercises will help assess and validate these concepts, as well as assist in developing new operational procedures and organizations."

The key role of M&S in OSD and Joint studies, and the increased use of M&S in Joint Staff/Combatant Command planning makes Joint M&S validity, especially land warfare representation, one of the Army's highest priority objectives for M&S. To achieve this objective, to improve acceptability of Army simulation results in national security deliberations and to achieve standardization and efficiency goals, the ACR domain will use Joint M&S. All ACR domain M&S must be consistent with the DoD HLA, and Army Technical Architecture. Selected ACR domain M&S investments, projects and programs must support, and to the maximum extent practicable, will be common with the Joint Warfare System (JWARS), Joint Analytical Model Improvement Program (JAMIP) models, Joint Simulation System (JSIMS) and designated Service/OSD/DoD models, simulations and simulators.

STRATEGIC OBJECTIVE (SO) 1. To the maximum extent possible the ACR domain will use Joint M&S. The Army intends to provide a basic structure for land warfare in Joint M&S. This will allow specific Army legacy models to be replaced by the Joint M&S models. The Army must ensure that Joint M&S accurately represent Army capabilities in C4ISR, mobilization, strategic deployment, air, land and space operations, force projection and logistics. The Army must be responsible for definition, design and configuration management of Army "objects" represented in Joint M&S.

b. The broad spectrum of M&S capabilities required across all domains results in overlapping and common needs. To ensure interoperability and to enhance reuse opportunities the ACR domain will operate in full compliance with DoD/Army architectures, standards, object orientation and authoritative data sources. Additionally, the work of the Army M&S standards category coordinators will be integrated into key ACR domain M&S development. However, the quest for efficiency involves more than publishing effective standards sharing and reuse policies. Commonality can only be achieved through a concerted effort to integrate and trade-off requirements and design. The analysis of strategic issues addressed within the ACR domain processes requires high and low resolution, representation of the exceptionally broad spectrum of Joint operations, detailed representation of all major US and foreign BOS operating in complex battlefield environments, and complex applications needs (e.g., rapid modification, very fast run times, interactive, distributed). These numerous requirements make it impossible to satisfy all ACR domain needs with a single simulation or even a few models. Therefore, it is imperative that the ACR domain capitalize on M&S developed and used within other domains.

STRATEGIC OBJECTIVE 2. Working with the RDA domain, identify common M&S, especially simulations/simulators for tactical operations, to support integrated and distributed activities such as ICTs and IPTs. The tactical level simulations should both meet the Block III/IV requirements for land force operations in the JWARS Operational Requirements Document (ORD) and have maximum commonality with OneSAF.

c. The Army's reengineered requirements determination and materiel acquisition processes place increased emphasis on experimentation, earlier demonstration of technology and concepts, and earlier consideration of costs. Successfully meeting the goals and objectives of the reengineered processes is dependent on compressing the time for defining and integrating requirements and engineering designs for major acquisition programs. This requires interactive and reconfigurable simulations/simulators that address doctrine, organization, soldier, battlefield environment and engineering issues across all battlefield operating systems for the full spectrum of operations. Constructive simulations are, and will continue to be, a primary tool for concept evaluation. However, the increased emphasis on performance cost trade-offs and cost as an independent variable can significantly impact requirements thresholds and objectives. This increased interaction between operational capabilities, requirements definition and baseline design requires common models, simulations and simulators to facilitate communication, enhance collaboration and improve understanding of the battlefield implications of technical and operational concepts. Common M&S will also provide the capability to cope with rapid change. The use of simulators, especially in combination with simulations and field experiments, is expected to increase. These applications will frequently involve federations of models and greater interdependence among RDA and TEMO domain activities. Although common requirements for distributed applications across the domains are being addressed by the Army's DIS program, the ACR domain must identify and field simulations and simulators that should be used by all domains.

STRATEGIC OBJECTIVE 3. The ACR domain needs to identify key M&S that satisfy DIS and HLA requirements for compliance.

d. The TEMO domain includes Joint Operation Planning and Execution System (JOPES) activities that address operations planning and execution processes for peacetime operations, exercises, hostilities other than war and war. JOPES addresses mobilization, deployment, warfighting and sustainment operations similar to the operations addressed in ACR domain activities. Although the conduct of operations may differ because of differences in doctrine (doctrine vs concepts), in organization (Army Of Excellence vs Force XXI), or in capabilities (Army TACtical Missile System (ATACMS) vs ATACMS Pre-planned Product Improvement (P3I)), the ACR and TEMO domains should identify common models, simulations and objects for these processes.

STRATEGIC OBJECTIVE 4. Working with TEMO domain identify M&S that should be common for ACR and TEMO domain needs. This assessment will determine commonalties between and

unique capabilities for the Advanced Regional Exploratory System (ARES), Army Warfare System (AWARS), Warfighter Simulation (WARSIM) 2000 and JWARS. The assessment will also identify common models to be used for mobilization and deployment planning. The assessment will identify common objects.

e. Studies and activities which cannot wait for the next generation M&S or long-term promised improvements to M&S must use legacy M&S. Although some question the efficiency of modifying/extending legacy M&S capabilities, there are no feasible alternatives. Legacy M&S must be maintained, sustained and modified only to the extent possible to support Force XXI activities, force development, materiel acquisition and critical national security studies conducted during the period addressed by this plan.

STRATEGIC OBJECTIVE 5. Legacy models must be modified, enhanced and supported until the next generation models with equal or better capabilities are fielded. Identify the most important legacy simulation enhancements that need to be resourced.

f. ACR domain processes focus on the future. The need to study, analyze and develop concepts, force and systems for long-range planning ten to twenty years in the future presents a unique challenge for ACR domain M&S. The nature of future threats, potential missions, potential foreign force coalitions, warfighting concepts, doctrine and systems' performance are uncertain, unpredictable, and ill-defined. This means that baseline M&S in the ACR domain are continuously modified as the state of knowledge about future Army concepts, doctrine, organizations, tactics and technology evolves. This evolutionary development has important implications for planning and management. It requires that baseline M&S be readily and quickly adaptable for representing emerging concepts, ideas and technologies. More importantly, ACR domain M&S are on the leading edge of intellectual thought, and the resulting representations provide valuable research, development and standards for M&S used within the RDA and TEMO domains. One effort underway is the Functional Description of the Battlespace (FDB). Although this is a TEMO effort, it will have applications for the ACR domain. The FDB will function as a repository for doctrinally correct and traceable data and algorithms to be used by software engineers in the development of WARSIM and eventually other Army and Joint simulations.

STRATEGIC OBJECTIVE 6. Develop a strategy that leverages the evolutionary development of simulators and simulations that originate, evolve and are improved through continuous use and modification in support of ACR domain activities.

g. The increased use of object oriented design and object management provide significant opportunity for improving commonality and reuse. The development and maintenance of "objects" and the definition of object interactions requires a new way of doing business in the Army. Recently, a Standards Category for Object Management was established with Army Materiel Systems Analysis Activity (AMSAA) as the lead agency.

STRATEGIC OBJECTIVE 7. Identify key objects that are core for the ACR domain M&S. Ensure that organizational responsibilities and adequate resources are allocated for developing and maintaining objects.

h. Concepts, requirements, designs, organizations and doctrinal issues will surface in ICTs or IPTs. Addressing and resolving these issues quickly requires M&S that allow distributed teams to collaborate and quickly assess issues associated with requirements definition, system baseline definition and costs. Gaining leadership agreement on concepts and capabilities of emerging technologies requires common understanding of operations and how to fight. Gaining this consensus can be facilitated by computer visualization of the simulated battlefield. Powerful computer workstations, virtual reality, multi-media transmission, global networking, object oriented management, information fusion and computer visualization will continue to evolve at a rapid pace outside of DoD. This means that ACR domain

activities need to be aware of and understand commercial off the shelf (COTS) products that offer important capabilities.

STRATEGIC OBJECTIVE 8. Improve computer visualization techniques and use including data visualization, visualization of the battlefield, and cause effect relationships. Establish procedures to ensure that high potential state-of-the-art COTS products are identified and used.

i. The necessity to understand the function and role of the simulation centers is quite clear. In order to gain a better cognizance of their potential use, it is apparent that the centers be managed in such a way that innovation is not hindered. The TEMO domain uses a decentralized manner of management and the ACR domain may want to consider the same. There are many centers to review, including the Army Research, Development and Engineering Centers (RDECs), and use for the capability to identify specific systems and concepts that provide a high-payoff within Joint operations. It is essential that the ACR domain get a handle on these assets and use them to their maximum potential.

STRATEGIC OBJECTIVE 9. Define organizational and operational concept for ACR domain simulation centers and interfaces with key Army/DoD centers.

CHAPTER 3 - CURRENT AND EVOLVING CAPABILITIES - THE BASELINE

M&S used by the ACR domain must support the key domain processes of strategic direction, concept development, requirements determination and force planning for the Army as it seeks to "fulfill its role in achieving full spectrum dominance as the land component member of the joint team" (Army Vision 2010, page 10). Such a broad diversity of processes requires an extensive set of M&S. This chapter discusses current and future ACR domain M&S in terms of their support of the six patterns of operations identified in Army Vision 2010. The domain infrastructure, along with several M&S which do not fit neatly into any of the six patterns of operations, are addressed at the end of the chapter, as shown in Figure 3-1. Figure 3-2 represents the "roadmap" for the ACR domain; in other words, the development paths the domain will follow into the twenty-first century.

3-1. Project the Force.
3-2. Decisive Operations.
3-3. Sustain the Force.
3-4. Shape the Battlespace.
3-5. Protect the Force.
3-6. Gain Information Dominance.
3-7. Battle Lab Reconfigurable Simulator Initiative (BLRSI).
3-8. Resource Allocation, Cost, and Force Structuring Models.
3-9. Infrastructure.

Chapter 3 Organization

3-1. Project the Force. This pattern of operations deals with the process of mobilizing and deploying a "versatile, tailorable, modular Army from points of embarkation around the world" (Army Vision 2010, page 11) as part of a joint force. This section addresses M&S in support of the mobilization and deployment/redeployment phases of force projection.

a. Mobilization.

(1) Models/Simulations of Choice. No comprehensive mobilization model currently exists in completed/production form. There are two mobilization modeling tools under development. Both currently exist in prototype form. These are Forces Command's (FORSCOM's) Force Generation/Mobilization Station Assessment Model (FORCEGEN/MOBSAM) (which are components of the Mobilization and Deployment Capability Assurance Project (MADCAP)), and the US Army Concepts Analysis Agency's (CAA's) Mobilization Capabilities Evaluation Model (MOBCEM). MADCAP includes

two models that are meant to address the questions of where to mobilize and how long it takes. MOBSAM addresses the first question and FORCEGEN the second. MOBCEM will allow for mobilization analysis of capabilities and issues independent of the theater combat models with the intent of evaluating and improving mobilization capability.

(2) Assessment of Current Tools.

(a) MADCAP is an operational/crisis reaction (execution planning), quick turnaround system, with an aggregate level of detail. It consists of several decision support tools which determine the required forces, mobilize them, move them to Ports of Embarkation (POEs), conduct strategic deployment, and move the forces from Ports of Debarkation (PODs) to the Corps rear area. The goal of MADCAP is to provide a feasible, resourced course of action that represents a coordinated 85% solution and is transportation supportable in a 6 to 12 hour time-frame.

(b) MOBCEM is a deliberate planning tool which will accept outyear input data from the Structure and Manpower Allocation System (SAMAS). When completed, this tool will allow CAA, the Army Staff (ARSTAF)/Major Commands (MACOMs), and OSD to respond to requests for studies and analyses of various aspects of the mobilization process. It will allow the performance of the range of Planning, Programming, Budgeting and Execution System (PPBES) supporting analyses and policy analyses asked of CAA by Headquarters, Department of Army (HQDA). It will also provide, as part of CAA's suite of models and as a component of JWARS, the projected availability of deployable units in place of the planning factor estimates currently used.

(3) Future Developments. FORCEGEN and MOBSAM are being developed under JCS sponsorship and are intended to interface with U.S. Transportation Command (USTRANSCOM) models. FORCEGEN and MOBSAM will become an integral part of the Army Global Command and Control System (GCCS). MOBCEM is being developed under ODCSOPS and OSD sponsorship and is funded through the JWARS project. MOBCEM will interface with the Global Deployment Analysis System (GDAS) in place at CAA as well as with the deployment model chosen for use in JWARS. Full-scale MOBCEM development is now in the latter stages of Phase I of three phases of development. Phases I and II will complete the Army version of MOBCEM and Phase III will incorporate the mobilization processes of the other services. The Army version is projected for completion near the end of 1997. Phase III requirements and estimated completion date will be determined concurrently with Phase II development.

b. Deployment/Redeployment.

(1) Models/Simulations of Choice. Like the mobilization aspect of force projection, there is no current, comprehensive model for deployment/redeployment. There are a number of fielded and developmental tools focusing on various areas of deployment and redeployment.

(2) Assessment of Current Tools. There are a number of fielded and operational tools for analysis of pieces of the deployment puzzle. The major shortcoming of current tools is that they do not capture a detailed, integrated picture of the Defense Transportation System (DTS). Current deployment tools include:

(a) Equipment Characteristics Master Data File (ECMDF). A system incorporating detailed dimensional data for major end items with photographs, computer assisted design images, engineering drawings, and lifting and tiedown instructions.

(b) Transportability Analysis Reports Generator System (TARGET). A system which manipulates data and produces reports in line item number level of detail for unit movement requirements.

(c) Dynamic Analysis Replanning Tool (DART). An integrated set of automated processing tools and database management systems providing users with transportation feasibility, time-phased force deployment data (TPFDD) editing, and analysis capability.

(d) Air Load Module (ALM). A knowledge-based expert system which assists air load planners in loading military aircraft for deploying units.

(e) Joint Flow and Analysis System for Transportation (JFAST). A high-speed analytical tool used for making detailed estimates of the resources required to transport military forces.

(f) Model for Inter-theater Deployment by Air and Sea (MIDAS). A system providing detailed estimates of transportation scheduling, air and sea lift, port selection, and port capabilities simultaneously in multiple theaters.

(g) Enhanced Logistics Intra-theater Support Tool (ELIST). A system that uses discrete event simulation to evaluate a planned course of action for transportation feasibility within a theater of operations, and addresses the question of whether infrastructure and transportation lift allocations are adequate to support movement of specified ground forces and supplies to their respective destinations on time.

(h) Global Deployment Analysis System (GDAS). GDAS is a deployment model, from home station to employment. It uses dynamic programming algorithms to program trade-offs for airlift versus sealift. It maintains linkages between combat and support units, and represents transportation system constraints such as delays and disabled carriers.

(3) Future Developments. Force Projection Modeling (FPM) is an integrated suite of existing and new deployment M&S tools being developed by the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) under Office of the Deputy Chief of Staff for Logistics sponsorship and in conjunction with USTRANSCOM's Analysis of Mobility Platform. FPM will model in detail the interaction of infrastructure and transport systems with the transportability characteristics of the force and the throughput capabilities of ports and installations. When completed, planners and analysts can use FPM to evaluate the force projection of units (personnel, equipment, and supplies) from their base or installation, to the port of embarkation, through the port of debarkation, to the tactical assembly area in theater. FPM will also interface with mobilization, logistics and warfighting simulations.

3-2. Decisive Operations. In combat operations, decisive operations "are defined in terms of victories in campaigns, battles or engagements. In other operations [Military Operations Other Than War (MOOTW)], decisive operations are defined in terms of accomplishing the military objectives (Army Vision 2010, page 12)." This plan puts decisive combat operations into three categories: Theater/Campaign, Operational, and Tactical. We discuss M&S for each category of combat operations separately, and then address M&S for MOOTW.

a. Theater/Campaign

(1) Models/Simulations of Choice. There are two primary simulations used for analysis at this level. The first is the Concepts Evaluation Model (CEM), used by CAA. CEM helps assess the effectiveness of different mixes of forces or resources within a theater and estimates ammunition, equipment and personnel requirements. The second simulation is Tactical Warfare (TACWAR), used by CAA, the TRADOC Analysis Center (TRAC), and a number of warfighting CINCs. CEM and TACWAR are theater-level, deterministic combat models that represent forces at the brigade/regimental level or higher on a joint, AirLand battlefield.

(2) Assessment of Current Tools. The current set of M&S used by the ACR Domain does not realistically represent an information operations oriented force or portray Command, Control, Communications, Computers and Intelligence (C4I) systems realistically. Most assume perfect communications and shared perfect knowledge of the battlefield. These models also do not represent Force XXI operations.

(3) Future Developments. Both TACWAR and CEM will eventually be replaced by JWARS. CAA is developing the Advanced Regional Exploratory System (ARES) to supplement its use of JWARS. ARES will support post-cold war regional military situational analysis in joint and combined force environments.

b. Operational

(1) Models/Simulations of Choice. The four primary models used for analysis at this level are: Vector in Commander (VIC), Computer Assisted Map Exercise (CAMEX), Eagle, and Corps Battle Simulation (CBS). VIC is a mid-to-high intensity corps level combat model. CAMEX provides a quick turn around front-end analysis of scenario courses of action, and supports a variety of analyses of force structuring, parametric ranging, and AirLand Battle tactics and concepts. Eagle is a corps/division level, deterministic, time-stepped combat model with resolution to battalion or company. It is used for assessments, combat developments, as an exercise driver and as a staff trainer. CBS is a training simulation (managed by the TEMO domain) used to drive collective training for joint, combined, corps and division commanders and battle staffs, command posts and headquarters. Although not an analytical model, it is also used as an exercise driver for certain AWEs and ATDs.

(2) Assessment of Current Tools. Operational level models share the same general limitations as strategic models, in terms of limited C4I and situational awareness representation. In addition, these models do not play logistics in a complete and realistic manner. Not all battlefield environmental or atmospheric conditions are well represented.

(3) Future Developments. The Army Warfare System (AWARS) will merge VIC and Eagle and become the operational land warfare representation in JWARS. The Warfighter Simulation (WARSIM) 2000 will replace CBS and both its training and experiment functions, and become the land warfare component of JSIMS. The projected continued role of TEMO-managed models in experiments makes it important for the ACR domain to maintain its awareness of TEMO developments.

c. Tactical

(1) Models/Simulations of Choice. The major simulations used for tactical analysis include the Combined Arms and Support Task Force Evaluation Model (CASTFOREM) and the JANUS combat model. JANUS and CASTFOREM represent individual platforms in up to brigade level scenarios. CASTFOREM is a high-resolution, force-on-force, combat model. JANUS is a multi-purpose, near real-time interactive simulation used to examine combat and tactical processes, evaluate weapon system performance, develop scenarios, and conduct battle focused leader development.

(2) Assessment of Current Tools. Tactical simulations do not replicate the complete spectrum of battlefield operating systems, information operations, or changing environmental conditions.

(3) Future Developments. Currently, the Army plans either to replace CASTFOREM or make it HLA compliant and retain it. The One Semi-Automated Force (OneSAF) model will eventually replace JANUS (See Section 3-9).

d. Military Operations Other Than War (MOOTW).

(1) Models/Simulations of Choice. There are no current analytical models or simulations for this type of operation. The set of tasks, missions, responsibilities, and scenarios may be too diverse and our understanding of how to represent such operations too immature to develop a single constructive simulation.

(2) Assessment of Current Tools. The representation of political objectives, cultural interactions, rules of engagement, non-lethal constraints, and human behavior are not well understood. Certain aspects of MOOTW operations can be represented by a simple simulation supported by mobilization, deployment and logistics models. One such simple simulation is Spectrum, a training tool managed in the TEMO domain. Spectrum is a low-cost, personal computer based system which supports training for combat leaders and staffs to allow them to understand and meet the unique command and control requirements of OOTW. Strategically and operationally, it can play at National Command Authority and joint staff/embassy staff levels. Tactically, it can play at corps down through battalion staff levels.

(3) Future Developments. The JWARS model at full operational capability is supposed to represent the full spectrum of operations, including MOOTW. The JWARS MOOTW capability is not scheduled for fielding until the year 2001 or later. The ACR Domain will evaluate the Spectrum simulation determine if it meets or can be made to meet domain needs in this area.

3-3. Sustain the Force. This pattern of operations fuses [focused] "logistics and information technology, flexible and agile combat service support [CSS] operations, and new doctrinal support concepts ... to deliver precisely tailored logistics packages directly to each level of military operations (Army Vision 2010, page 15). Sustainment functions must be represented both in combat models and in independent or stand-alone models to support analysis.

a. Models of Choice. Sustainment functions are represented with varying degrees of resolution and completeness in all of the models in section 3-2 above. There are limited M&S which independently look at sustainment functions. The Knowledge-Based Logistics Planning Shell (KBLPS) incorporates sophisticated artificial intelligence based algorithms to assist the logistician in planning and analyzing conventional ammunition distribution and inventory systems. The Maintenance Capabilities Attack Model (MACATAK) is an operations support tool that measures the survivability and vulnerability of division-level maintenance elements in conventional, chemical and nuclear environments. The Planning Assistant for Logistics Systems (PALOS) is a user driven tool that queries a communications data base and graphically displays connectivity between units in any battlefield scenario. The Maintenance Model (MAMO) is a discrete event simulation modeling maintenance activity in a division-sized unit.

b. Assessment of Current Tools.

(1) Current models for decisive operations (section 3-2) cannot represent future sustainment operations described above (fused focused logistics and information technology, etc.). Many of these models do not represent current sustainment operations at sufficient resolution to support analysis.

(2) Models such as KBLPS, MACATAK, PALOS and MAMO look at only a portion of the spectrum of sustainment operations, focusing on narrow parts of the battlefield.

c. Future Developments. The Combat Service Support Family of Analytical Models (CSSFAM) is envisioned as an environment into which M&S representing the various CSS functions can "plug and play." The Early Entry Operations Service Support Analysis (EEOSSA) workstation, part of the Battle Lab Reconfigurable Simulator (BLRSIM) program, will provide the environment. The U.S. Army Combined Arms Support Command (USACASCOM) is developing the Simulation of Logistics Systems (SIMULOGS) model as the sustainment component of the BLRSIM EEOSSA variant. SIMULOGS began as an Army Model Improvement Program (AMIP) initiative in FY96. It integrates the supply, transportation, personnel, medical and maintenance functions into one system for concept exploration and

requirements definition. SIMULOGS meets DIS standards and will be HLA compliant. The Army Medical Department Center and School is developing two models, Patient Generator (PATGEN) and Global Requirements Estimator for Wartime Medical Support (GREWMS) which will join the CSSFAM. PATGEN is a stochastic model which simulates the occurrence of medical casualties through a multi-echelon treatment and evacuation system. GREWMS is a deterministic model which uses PATGEN outputs to generate admission rates, intra- and inter-theater evacuations, returns to duty, and deaths in hospitals.

3-4. Shape the Battlespace. "Shaping the battlespace sets the conditions for success - it is directly linked with decisive operations ... [it] is the unambiguous integration of all combat multipliers - mobility/counter-mobility,. and all available fires - with the scheme of maneuver to achieve simultaneity and thus overwhelm the enemy" (Army Vision 2010, page 13). This section discusses M&S representing the fire support and mobility/counter-mobility portions of shaping the battlespace.

a. Fire Support

(1) Models of Choice. Many fire support functions are represented in the models for decisive operations, discussed in section 3-2. These functions are represented with varying degrees of resolution and fidelity. The primary constructive model used for analysis of fire support issues is the Target Acquisition and Fire Support Model (TAFSM). TAFSM is DIS-compliant, and is often linked with more detailed models such as Strike (a simulation of the Brilliant Anti-Armor Submunition), LOCASS (Low Cost Advanced Submunition Simulation), the Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Simulator and the Bi-static Radar Weapon Locating (BRWL) radar model to examine specific aspects of fire support.

(2) Assessment of Current Tools. Current fire support M&S represent the field artillery system performance characteristics and munitions effects at a high resolution and level of fidelity. Target acquisition systems are modeled sufficiently for analysis of employment and performance issues. Interoperability of fire support M&S and C4I systems is limited and such linkages require specific interfaces for each C4I system and M&S.

(3) Future Developments. TAFSM functionality will be incorporated into an Advanced Field Artillery Model (AFAM) which will be HLA compliant. AFAM will form the centerpiece for fire support analysis and experimentation. Battle Lab Reconfigurable Simulator (BLRSIM) simulators will be used for virtual prototyping, concept exploration, and human factors assessments. Through the Modular Reconfigurable C4I Interface (MRCI) program, C4I systems will be linked to simulations which will understand and respond to the tactical messages transmitted from the C4I systems. This will permit warfighter-in-the-loop participation in the synthetic environment (The MRCI program is a Defense Modeling and Simulation Office initiative. The Army's participation is managed by the TEMO domain).

b. Mobility/Countermobility.

(1) Models of Choice. The mobility/countermobility functions are represented in all of the models for decisive operations discussed in section 3-2 above.

(2) Assessment of Current Tools. At theater resolution, TACWAR's representations of engineer functionalities are limited at best. Corps/Division level models like VIC and Eagle have passable representations of these functions, but care must be taken to avoid wishing away terrain realities in the building of the terrain data bases. This often happens, with significant water and dry gap obstacles erased from the data base. Additionally, the VIC feature that degrades main supply routes under weather and traffic has never been turned on in a production study. At the battalion/brigade level, Janus and CASTFOREM's portrayal of mobility/countermobility functionality are adequate, but each model has its own strengths. For detailed comparisons of weapon system contributions, CASTFOREM has the edge over Janus. Janus is better than CASTFOREM for course of action analysis or comparison of TTPs

because it is interactive. Mobility representation in ModSAF is problematic. Basic vehicular maneuver is flawed: vehicles can't follow roads in a turn, they cannot always successfully stay on bridges or in breach lanes (because of the model code, not because of real world data reflecting the difficulties), they cannot travel in opposite directions on two lane divided highways. They bunch up and speed up/down and collide with each other even when road network traffic is light.

(3) Future Developments. There is long-range no plan to create a separate model for mobility/countermobility functions. The Army intends to improve these functions in all M&S. Ongoing near-term efforts to create Janus linked to virtual simulators (JLINK) and CASTFOREM linked to DIS may improve representation in this area.

3-5. Protect the Force. "The Army's approach to force protection will be a holistic one, applying organizational, materiel, and procedural solutions to the challenge of protecting soldiers, information, and equipment across the full spectrum of operating environments" (Army Vision 2010, page 14).

a. Air Defense.

(1) Models of Choice. The Extended Air Defense Simulation (EADSIM) is used for analysis of air and missile defense and C3I issues. The Extended Air Defense Test Bed (EADTB) is a constructive simulation environment used for Theater Missile Defense analysis and experimentation. The Fort Bliss Warfighting Center has two types of simulators, the ARPA Reconfigurable Simulator Initiative (ARSI) Bradley Stinger Fighting Vehicle-Enhanced (BSFV-E) and Reconfigurable Tactical Operations Simulator (RTOS).

(2) Assessment of Current Tools. Both EADSIM and EADTB portray air defense capabilities with high resolution and fidelity. The EADSIM is DIS compliant. Currently, however, C4I systems cannot be linked seamlessly into the synthetic environment. The ARSI BSFV-E and RTOS (Patriot/THAAD) reconfigurable simulators are DIS compliant and are used for prototyping, experimentation, demonstrations, and training applications.

(3) Future Developments. The EADTB will be DIS/HLA compliant. Continued development of the EADTB will enhance representations of air and missile defense systems performance and effects. Simulators will be reconfigurable as well as specific to accommodate a wide set of applications. Instrumented live systems, virtual simulators of weapon and C2 systems, and constructive simulations will be geographically distributed yet interoperable through HLA over the Defense Simulation Internet (DSI).

b. Chemical/Biological Protection.

(1) Models of Choice. Detailed representation of chemical weapon effects for analysis is currently achieved in engineering level models. Several models used to represent decisive operations (See section 3-2 above) have rudimentary depictions of chemical warfare. The only simulation that has demonstrated a representation of biological warfare is CBS, which plays it in a very simple way. Janus can represent biological warfare because it has a link to the detailed propagation model, but this link has not been formally tested.

(2) Assessment of Current Tools. Accurately representing propagation of chemical agents is currently a large problem. The engineering level models referred to above have been shown to be quite accurate, but are very slow, require too much computing power, and are too detailed for use in conjunction with other simulations. The major simulations currently used for analysis (i.e., TACWAR, VIC, and Eagle) use a series of matrices to obtain their chemical data. These matrices are barely adequate in discrete representations of the physical world, but are not sufficient in a continuous environment.

(3) Future Developments. The Chemical School is working to develop representations of chemical and biological warfare in WARSIM 2000 and JWARS.

3-6. Gain Information Dominance. "Information operations (IO) conducted to gain information dominance are essential to all the patterns of operation. They consist of both offensive and defensive efforts to create a disparity between what we know about our battlespace and operations within it and what the enemy knows about his battlespace" (Army Vision 2010, page 17).

a. Models of Choice. The communications portion of IO is represented in most of the models used to represent decisive operations (Section 3-2). The U.S. Army Signal Center (SIGCEN) uses the Network Assessment Model (NAM) to model the performance of all current communication systems on the battlefield at force levels from battalion to corps. System traffic loading is calculated using Army-approved databases. There is no analytical model which focuses on the intelligence aspect of IO. The Intelligence Center uses decisive operations models and training models to look at the intelligence BOS. The Tactical Simulation (TACSIM) and Battle Command Training Program (BCTP) Intelligence Collection Model (BICM) replicate intelligence collection assets and electronic warfare.

b. Assessment of Current Tools. NAM is not interoperable with models used by the Communications Electronics Command (CECOM). NAM is not able to easily represent future systems. TACSIM and BICM were designed as exercise drivers and have little utility for analysis.

c. Future Developments. SIGCEN will replace NAM with the Team Signal Communications Analysis Model (TSCAM). TSCAM will be used by both SIGCEN and CECOM to analyze communications networks. TSCAM uses commercial-off-the-shelf software, and will be compliant with both HLA and ATA. The WARSIM Intelligence Module will replace TACSIM and BICM, and will be used to support training and analysis.

3-7. Battle Lab Reconfigurable Simulator (BLRSIM) Program.

a. Current Virtual Simulators. The ACR domain currently uses both Simulation Network (SIMNET) and Battlefield Distributed Simulation-Developmental (BDS-D) virtual simulators. SIMNET simulators are primarily training simulators. BDS-D simulators are networked with emulator workstations and Modular Semi-Automated Forces (ModSAF) suites.

b. Assessment of Current Simulators. The current family of virtual simulators are not expandable, easily upgraded, or reconfigurable. Experimentation with new technologies and systems requires extensive and expensive modifications to the current "family" of simulator hardware and software.

c. Future Developments. SIMNET and BDS-D virtual simulators will be replaced by Battle Lab Reconfigurable Simulator (BLRSIM) simulators. They will provide Battle Labs the ability to develop, evaluate and analyze warfighting TTP, refine materiel requirements, and help define future operational capabilities. The BLRSIM will provide a solution to the Army's long-range need to develop and field reconfigurable simulators into the synthetic environment. TRADOC Battle Labs require a wide range of simulator functionality including ground vehicles, C4I systems, rotary wing aircraft, dismounted soldiers, and early entry operations and service support analytic model simulators. These soldier-in-the-loop simulators will be HLA-compliant.

3-8. Resource Allocation, Cost, and Force Structuring Models. This final group of M&S represents the variety of models with which the ACR domain performs the strategic direction and force planning functions for the Army. This category of analytical M&S includes cost models, resource allocation models and resource management models.

a. Resource Allocation Models.

(1) Models of Choice. The Force Evaluation Model (FORCEM) simulates AirLand activities in a theater of operations over an extended period (up to 90 days). It represents combat operations at the division level and most combat support and combat service support functions from the port to forward line of troops for studies and analyses of force planning and resource allocation issues. The Value Added Analysis (VAA) is a tool to assist the ADCSOPS for Force Development and the Director, Program Evaluation and Analysis in developing the Army program objective memorandum(POM) submission. As such, it is run every two years and updated on the off year. It addresses the RDTE and procurement profiles for about 40 major systems, compromising 40-60% of the total obligation authority (TOA) available. In a nutshell, the VAA process attempts to solve the capital budgeting problem for Army procurement to include production line considerations, lot size implications, force structure requirements and funding constraints.

(2) Assessment of Current Tools. Limitations of the VAA process are the number of systems included (only about 40), the number of timeframes explicitly addressed (two at present; end of the POM, end of the extended planning period (EPP)), and the scenarios included (three, for VAA V supporting POM 00-05). These limitations are a function of the time required to complete the experimental design supporting the building of the objective function for the eventual capital budgeting problem.

(3) Future Developments. Efforts at CAA are focused on how to extend the scope of the VAA process, while still maintaining a procedure that is defensible from an operations research standpoint and while remaining responsive to the needs of the study sponsors.

b. Cost Models.

(1) Models of Choice. The Automated Cost Estimating Integrated Tools (ACEIT) is the standard Army automated framework designed to increase productivity of cost analysis work. The Army Manpower Cost System (AMCOS) is a personnel costing model. Force and Organizational Cost Estimating System (FORCES) is a suite of cost and reduction models.

(2) Assessment of Current Tools. ACEIT automates detailed costing functions, supports cost estimation for risk analysis, and is updated constantly with new cost data. AMCOS addresses costs of active military, reserve, and civilians by grade and specialty/skill. FORCES includes a force cost model, military end strength reduction model and civilian manpower reduction model.

(3) Future Developments. ACEIT is under continual improvement. Its planned updates include linkage to the AMCOS model. The Cost and Economic Analysis Center (CEAC) plans to improve its models with new data, tools, algorithms and techniques for accurately costing all elements portrayed in M&S.

c. Resource Management Models.

(1) Models of Choice. The Force Analysis Simulation of Theater Administration and Logistics Support (FASTALS) model is used to develop the balanced, time-phased support force requirements for a specified combat force. FASTALS is used for analysis supporting the Defense Planning Guidance Illustrative Planning Scenarios. Force Builder is a collection of models and decision support systems used by the Army DCSOPS for support of the Total Army Analysis, personnel and equipment distribution planning, determining support unit requirements for major theaters of war, building the Program Objective Memorandum and Army Acquisition Objective, and scheduling new equipment distribution.

(2) Assessment of Current Tools. Force Builder does not yet handle Force Modernization production data. Force Builder is a stand-alone model with one major user. It is not (and will not be) DIS compliant. It will not be made HLA compliant.

(3) Future Developments. Force Builder will improve its integration with other Army planning systems (personnel and logistics planning tools), and be modified to provide analytical support for the Quadrennila Defense Review (QDR).

3-9. Infrastructure.

a. Programs.

(1) Distributed Interactive Simulation (DIS). The DoD DIS program has produced sets of approved standards and protocols for linking distributed simulations. Some of the models in the ACR domain comply with these standards and protocols, allowing them to be linked with other DIS-compliant models for study and analysis. The ACR community is also able to achieve a degree of interoperability through use of ALSP to tie legacy M&S together. Although primarily used for training, limited use has been made of the ALSP confederation for experimentation and analysis.

(2) Defense Simulation Internet. The DSI was developed under an initiative of the Defense Advanced Research Projects Agency (DARPA). The DSI is a wide band telecommunications network operated over commercial lines with connectivity to both military and civilian satellites allowing users to be linked on a worldwide wide area network.

(3) Semi-Automated Forces (SAF). There are many SAFs currently in use throughout the Army. The Army Materiel Systems Analysis Activity (AMSAA) was tasked by the Deputy Under Secretary of the Army for Operations Research to evaluate the seven most widely used SAF engines: Interactive Distributed Early Entry Analysis Simulation (IDEEAS), Close Combat Tactical Trainer SAF (CCTT-SAF), Interactive Tactical Environment Management System (ITEMS), JANUS Linked to BDS-D (JLINK), Joint Conflict Model (JCM), Joint Tactical Simulation (JTS), and Modular SAF (ModSAF). As a result of the AMSAA assessment, the Army decided to maintain multiple SAFs in the near term while seeking to develop a single SAF to meet the needs of all three M&S domains.

(4) Terrain and Environmental Representation. There is no standard terrain/environment representation model. This results in a variety of terrain databases, each of which extracts a different view of the "real world." These views are often so different as to preclude interoperation of heterogeneous simulators. There is no standard data interchange mechanism. Each time different simulators are linked, an expensive database conversion must be performed.

(5) Army Simulation Centers(Examples).

(a) The Space and Strategic Defense Command (SSDC) Battlefield Integration Center (BIC) supports concepts exploration and issue identification/resolution for missile defense concerns.

(b) The Joint Virtual Laboratory (JVL), a cooperative effort between TRAC and MITRE, provides capabilities for supporting concept development and requirements generation.

(c) The Center for Land Combat, an initiative of the Assistant Vice-Chief of Staff of the Army, will provide capabilities for linking key Army simulation centers.

(d) The TRADOC Brigade and Below Virtual Battlefield (TB2VB) addresses integration of C4ISR capability across legacy and projected battlefield command systems.

(e) Each AMC Research, Development and Engineering Center (RDEC) has a modeling and simulation center for technology evaluation, concept exploration, and virtual prototyping efforts.

b. Assessment of Current Infrastructure.

(1) Current distributed simulation confederations must often rely on cumbersome means such as the ALSP to connect dissimilar simulations. The ALSP must be revised each time a new simulation is added or one of the models participating is modified.

(2) The DoD has decided to stop funding of operation of the DSI through DARPA. Beginning in 1998, the DSI will transition to a fee for use structure. Many organizations plan to drop off the DSI. This will reduce opportunities to use networked simulation for studies and analyses. As of this writing, neither the ACR Domain nor the Army have a plan for salvaging or replacing the DSI.

(3) Current DSI network bandwidth is insufficient to allow robust multi-media data exchange, exercises involving large numbers of entities, or real-time transmission of detailed digital images.

(4) It is difficult to rapidly adapt existing SAF engines to represent new operational and organizational concepts (e.g., Information Operations, Total Asset Visibility).

(5) The proliferation and maintenance of the wide variety of SAFs has resulted in continued duplication of effort.

c. Future Developments.

(1) High Level Architecture (HLA). The DoD-sponsored effort to develop a common technical framework, the HLA, represents the highest priority effort within the DoD M&S community. The HLA will be applicable to a broad range of functional areas (e.g., training, contingency planning, analysis, and acquisition). The current linkages of non-homogeneous simulations and simulators will be replaced by service models designed to work together via the HLA or other designated DoD architecture. Due to the growing international recognition of HLA, these models will have the capability to link with models of other countries for combined and coalition force analyses. The ACR Domain supports the development of the HLA with research supporting the development of the HLA run-time infrastructure (RTI) and with participation in efforts to develop standards and protocols.

(2) Defense Information System Network-Continental U.S. (DISN-CONUS). The DISN-CONUS network program is a joint Defense Advanced Research Projects Agency/Defense Information Systems Agency (DARPA/DISA) project to produce an operational network connecting a significant number of sites. DISN-CONUS will use optical fiber transmission links and proprietary Asynchronous Transfer Mode (ATM) switches in a network of significant transfer capability.

(3) One Semi-Automated Force. The OneSAF program will baseline ModSAF, CCTT-SAF, and IDEEAS, taking the best parts from each and reusing them in a new architecture. Once OneSAF is developed, fielded, and proven to meet defined requirements, other SAFs will be retired. The M&S community will leverage the efforts of others to build and develop the common architecture for OneSAF. OneSAF will either be linked to or directly implemented in JSIMS, WARSIM, JWARS, and other applicable simulations. There will continue to be a need for both a research SAF and a fielded SAF, but the engine for both should have common core software. OneSAF could become the cornerstone of analytical modeling as well as training applications. A key to success in this area is development of a common SAF model which is sufficiently robust for ACR applications. The SAF model will include an interoperable and flexible architecture exploiting distributed object management approaches and compliant with the DoD-developed HLA. The ACR domain is represented on the integrated concept team which will define OneSAF and develop a consolidated requirements list for the Army's use of OneSAF.

(4) Synthetic Environment Data Representation and Interchange Specification (SEDRIS) Program. SEDRIS is a DMSO-sponsored program to provide the M&S community with a uniform and

effective mechanism for the complete description and loss-less interchange of synthetic environmental databases. The SEDRIS program seeks to capture, in one place, the complete set of data elements and associated relationships needed to fully represent the environment. SEDRIS will also provide a standard data interchange mechanism and format to support the predistribution of synthetic environmental data and promote the sharing of databases among heterogeneous simulations.

CHAPTER 4 - OBJECTIVES, ACTIONS AND RESPONSIBILITIES

4-1. Objectives for ACR M&S (FY98-FY03). The Army's strategic M&S vision is published in the Army Model and Simulation Master Plan (AMSMP). The strategic objectives, detailed in Chapter 2, and the operating principles discussed below provide actions and responsibilities to achieve this vision, support the evolving needs of the ACR processes and address baseline deficiencies.

4-2. Operating Principles:

a. Support infrastructure initiatives to include unity of effort, control and maintenance.

b. Work within established architectures and standards.

(1) Distributed Interactive Simulation

(2) High Level Architecture

(3) Army Technical Architecture

c. Assign responsibility for actions.

d. Support application of M&S capabilities that meet the requirements spelled out in paragraphs 2-2.a through 2-2.c.

4-3. Actions. Actions to achieve the ACR Domain strategic objectives, and the organizations designated to discharge them, are described in this paragraph.

a. Action 1. Sustain/modify/enhance existing simulations to support near-term National Strategy Reviews, OSD studies, Joint Warfighting Capabilities Assessments (JWCAs), Joint Venture and materiel acquisition milestones for Acquisition Category (ACAT) I and II programs (Supports Strategic Objectives 1,3,5).

(1) Issues.

(a) What are the events that must be supported?

(b) Which baseline M&S must be modified, and what modifications need to be made?

(c) How will these modifications be resourced?

(d) Which M&S will become HLA compliant and be retained?

(2) Sub-actions.

(a) Develop standard algorithms, objects and techniques for modeling sustainment in ACR M&S. Ensure commonality with arm, fix, supply and service battlefield algorithms.

(b) Develop standards that address support for all combat service support functions in M&S.

(c) Establish and implement representations for modern and emerging munitions, weapons, and other systems. Upgrade M&S representations for existing systems, as required within the scope of M&S fidelity needs.

(d) Define battlefield damage criteria.

(e) Develop standard attrition representations. Develop standard modification of attrition calculations as a function of environment/terrain.

(f) Determine representations for IO, to include tactical C4I systems, information exchange, communications procedures, and the impacts of electronic warfare on information operations.

(g) Develop representations for Military Operations in Urban Terrain (MOUT) in legacy systems.

(h) Develop communications data analysis tools that can parse tactical messages and reformat them for analysis.

(3) Suspense: 1st Qtr FY99

(4) Lead: TRADOC Support: CAA, AMC

b. Action 2. Review Army simulation center architecture and its interface with ACR Domain organizations (Supports SO 9).

(1) Issues.

(a) What is the minimum set of facilities (laboratories, core DIS facilities, battle simulation centers, etc.) rwequired to meet the needs of all domains?

(b) How will requirements to enhance/upgrade each simulation center be identified, integrated and prioritized between the domains and the active Army?

(2) Sub-actions.

(a) Identify the current Army simulation centers and their capabilities.

(b) Determine what network does or can connect the simulation centers.

(c) Identify possible efficiencies to be attained by consolidating multiple simulation centers on an installation.

(3) Suspense: 4th Qtr FY97

(4) Lead: TRADOC Support: ODCSOPS, AMSO, SSDC

c. Action 3. Field future simulations and simulators that allow effective user involvement in performance/cost trades and Cost as an Independent Variable (CAIV) analysis. Activities to be supported include: ICTs, IPTs and ORD development. (Supports SO 2,3,6,7)

(1) Issues.

(a) What simulators or simulations will be used to support ICTs and IPTs, especially material requirements trade-off and performance/cost trade-off analyses?

(b) How will Program Managers (PMs) leverage the BLRSIM?

(2) Sub-actions: Work with the RDA & TEMO domains to drive the ACR, RDA and TEMO domains to a common set of M&S for these activities.

(3) Suspense: 3rd Qtr, FY99

(4) Lead: TRADOC Support: CAA, SARDA, AMC, AMSO, CEAC

d. Action 4. Develop simulations capable of representing current and new systems, strategic concepts, operational concepts and doctrine. (Supports SO 3,5,6,7,8)

(1) Issues.

(a) What capabilities need to be added to the current set of ACR Domain M&S?

(b) How will requirements for modifications to current M&S be captured, consolidated, integrated and prioritized?

(2) Sub-actions.

(a) Advance the art of modeling the decision making processes for SAF, computer generated forces (CGF), and constructive models.

(b) Support development of a battle space object model describing the environment, weapons systems and cognitive representations.

(c) Develop a requirements database for the ACR Domain, identifying capabilities required in current and future M&S.

(3) Suspense: 4th Qtr, FY98

(4) Lead: TRADOC Support: CAA, AMC

e. Action 5. Support development and sustainment of Joint warfighting models and Army models that represent the spectrum of military operations. Ensure that Army doctrine, concepts, systems, and objects are credibly represented in AWARS and JWARS. Identify requirements and a plan for implementing JWARS in the Army. Ensure maximum commonality with JSIMS and other TEMO/RDA M&S (Supports SO 1,2,3,4,5,8,9).

(1) Issues.

(a) Which ACR Domain organization(s) is/are responsible for JWARS requirements submission?

(b) What Army requirements need to be satisfied by JWARS before CEM or VIC can be retired?

(c) What Army organization(s) is/are responsible for developing and maintaining JWARS objects?

(d) How will this be resourced?

(e) How will Army M&S standards categories results be integrated into requirements definition for JWARS?

(f) Can JWARS represent the full spectrum of Army operations (e.g., MOOTW)?

(2) Sub-actions.

(a) Establish an Army JWARS Users Group to capture requirements and submit them to the JWARS Project Office.

(b) Determine the minimum capabilities that JWARS must demonstrate before current M&S can be retired.

(3) Suspense: 4th Qtr, FY97

(4) Lead: ODCSOPS Support: CAA, TRADOC, AMSO

f. Action 6. Coordinate with TEMO and RDA domains to review and recommend actions for achieving commonality and reuse of M&S. (Supports SO 2,4,8)

(1) Issues.

(a) How far can we push commonality for ACR and TEMO mobilization and deployment models and simulations?

(b) Should the TEMO Spectrum model be an ACR Domain model for MOOTW?

(2) Sub-actions.

(a) Provide AMSO with ACR Domain requirements for the HLA. Define the minimum set of specifications needed to promote efficient reuse and interoperability.

(b) Develop ACR Domain-specific standards based on the HLA principles and guidelines provided by the DoD Architecture Management Group.

(c) Support automation of existing data bases and development of new data bases.

(d) Support development of standard data structures, data modeling and visualization tools, data repositories, and data storage and retrieval techniques.

(e) Conduct research in discrimination and search algorithms, and develop standard representations for use in combat models and simulations.

(f) Expand interfaces with TEMO Domain efforts such as the FDB, Modular Reconfigurable C4I Interface (MRCI), and WARSIM 2000 programs.

(3) Suspense: 3rd Qtr, FY00

(4) Lead: ODCSOPS Support: AMSO, TRADOC

g. Action 7. Network key M&S facilities and capabilities to allow distributed participants to operate in a common synthetic environment (i.e., Synthethic Theater of War, or STOW), and to use computer visualization to demonstrate Army capabilities to external audiences. (Supports SO 3,7,8) Action 7a - Canvass all organizations to identify their tools. (Supports SO 2,4,5,9) Action 7b - Identify the minimum essential set of models for the ACR Domain. (Supports SO 3,5,6,7)

(1) Issues.

(a) How will facilities be connected (DSI, DISN-CONUS, leased commercial network, etc.)?

(b) How will this connectivity be resourced?

(2) Sub-actions.

(a) Support the development of a common data base standard for distributed simulations.

(b) Support STOW program development of efficient means to aggregate and deaggregate between platform and/or individual and higher level force representations.

(c) Support battlefield visualization Advanced Concepts and Technology Demonstration in developing standard, correlated terrain representations at multiple levels of detail. Ensure compliance with developed standards for feature data content, resolution, accuracy, and fidelity for terrain representations. Identify standard geographic location requirements.

(d) Support STOW program development of a set of standard synthetic natural environments. Support development of fundamental dynamic environment data to support M&S.

(e) Support development of techniques for rapidly generating terrain data, and for dynamic terrain representation. Promote reuse of standard algorithms, data and techniques which provide all required terrain applications with cartographic consistency.

(f) Define a minimum set of ACR Domain processes to be supported.

(3) Suspense: 2d Qtr, FY01

(4) Lead: AMSO (Action 7) TRADOC (Actions 7a & b) Support: ODCSOPS, AMSO, STRICOM, TEC, AMC

h. Action 8. The Army is moving toward an object oriented architecture. Defining these objects is critical and must be accomplished so that standards are achieved and understood. Work aggressively to ensure that an object oriented capability and maximum commonality and reuse are achieved for ACR Domain M&S where required. To the extent possible, warfighting simulations at the system, tactical, operational and theater/campaign levels should be object oriented and have common objects (Supports SO 1,5,7,9).

(1) Issues.

(a) Is object orientation necessary, or even desirable, for its own sake?

(b) For which model(s) is object orientation needed and beneficial?

(c) How will the Army implement object management?

(d) Will models that are not object oriented be retired or replaced?

(2) Sub-actions.

(a) Identify situations where object orientation is needed and beneficial.

(b) Determine how best to implement object orientation.

(3) Suspense: 2d Qtr, FY99

(4) Lead: TRADOC Support: ODCSOPS, AMSO, CAA

4-4. Procedures and Responsibilities.

a. Procedures.

(1) M&S Requirement Identification and Approval. Army M&S requirements for ACR processes are determined by organizations/users as new technologies arise or new concepts or warfighting requirements are developed. Users assess the tools available in the domain, and identify requirements for new or modified M&S. Users forward requirements to the ACR Domain Agent and Domain Manager for validation. Domain Manager forwards validated requirements to the Requirements Integration Council (RIC) chaired by the DCG, TRADOC, for review, integration and approval. Approved requirements are forwarded to AMSO for implementation (See Figure 4-1).

Figure 4- Domain Requirements Approval Process

(2) Investment Annex Development. The ACR Domain Investment Annex supports the management plan. Costs for meeting approved requirements are submitted to the Domain Manager, reviewed for affordability, prioritized and forwarded to the AMSO in the Domain Investment Annex (See Annex A). The AMSO develops an integrated Army-wide M&S Investment Plan, which is presented to the AMSEC for approval.

b. Responsibilities.

(1) ACR Domain Manager. The Technical Advisor to the ODCSOPS (DAMO-ZD) is the Domain Manager, with responsibilities as described in the AMSMP and in Army Regulation (AR) 5-11, Management of Army Models and Simulations. Responsibilities include:

Validate and prioritize M&S requirements.

Prepare ACR domain investment strategy.

Integrate activities across the domain.

Act as advocate for domain. Justify and defend resources needed.

Develop and maintain Domain management plan and investment annex.

(2) ACR Domain Agent. The TRADOC Assistant Deputy Chief of Staff for Combat Developments (ADCSCD) is the Domain Agent for the ACR Domain. The Domain Agent oversees execution of ACR Domain processes. Domain Agent responsibilities include:

Review and integrate ACR Domain requirements.

Coordinate requirements within the domain, with other domains and services, and with joint commands and agencies.

Provide baseline assessment and recommend ACR priorities for sustainment, development and research.

Justify requirements to the RIC.

Assist Domain Manager in development and maintenance of the management plan and investment annex.

(3) Domain Advisory Group (DAG). The expected membership of the DAG includes representatives from: HQ TRADOC, TRAC, CAA, SSDC, AMC, STRICOM, AMSO, and others by invitation. The DAG is chaired by a representative from HQDA-ODCSOPS, and must:

Ensure technical synergy, compatibility, and quality of domain models and simulations.

Help the ACR Domain Manager express user requirements in sufficient technical detail to allow estimation of costs.

Recommend technical improvements to domain M&S.

Validate needs for changes to ACR M&S.

Coordinate recommendations with the AMSO and with the Standards Category Coordinators (SCCs) listed in the AMSMP.

(4) ACR Domain Users.

Identify requirements for modifications to existing M&S (or new M&S) to the Domain Agent.

Provide data to the ACR Domain Agent for the requirements database.

Assist the Domain Agent in update of the Domain Investment Annex.

c. Schedule. The requirements review and update process will follow the general timetable shown below:

(1) Each quarter: Domain advisory group meets to review current requirements and recommend those to be satisfied with unprogrammed funds if they become available.

(2) First quarter, each fiscal year (FY): Domain Agent and Domain Manager update the ACR Domain Management Plan and Investment Annex.

(3) Second quarter, each odd-year FY: ACR Domain Management Plan and Investment Annex undergo major update.

INTERNET DOCUMENT INFORMATION FORM

A . Report Title: Advanced Concepts and Requirements Model and Simulation Domain Management Plan

B. DATE Report Downloaded From the Internet 1/8/99

C. Report's Point of Contact: (Name, Organization, Address, Office Symbol, & Ph #): **Army Model and Simulation Office**
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D. Currently Applicable Classification Level: Unclassified

E. Distribution Statement A: Approved for Public Release

F. The foregoing information was compiled and provided by:
DTIC-OCA, Initials: VM_ **Preparation Date:** 1/8/99__

The foregoing information should exactly correspond to the Title, Report Number, and the Date on the accompanying report document. If there are mismatches, or other questions, contact the above OCA Representative for resolution.