Modeling and Simulation for Acquisition, Requirements and Training: The Army SMART Model

Presentation to: The National Summit on U.S. Defense Policy: Acquisition, Research, Test and Evaluation

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26 March 2001
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<th><strong>Report Type</strong></th>
<th><strong>Dates Covered (from... to)</strong></th>
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**Title and Subtitle**
Modeling and Simulation for Acquisition, Requirements and Training: The Army SMART Model

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**Distribution/Availability Statement**
Approved for public release, distribution unlimited

**Supplementary Notes**

**Abstract**

**Subject Terms**

**Report Classification**
unclassified

**Classification of this page**
unclassified

**Classification of Abstract**
unclassified

**Limitation of Abstract**
UU

**Number of Pages**
22

**Classification of Abstract**
unclassified

**Limitation of Abstract**
UU
Simulation Based Acquisition (SBA)

Definition of SBA

An iterative, integrated product and process approach to acquisition, using modeling and simulation, that enables the warfighting, resource allocation, and acquisition communities to fulfill the warfighter’s material needs, while maintaining Cost As an Independent Variable (CAIV) over the system’s entire lifecycle and within the DoD’s system of systems.

...to have an Acquisition Process in which DoD and Industry are enabled by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs.

**Vision**

**Goals**

- Substantially reduce the time, resources and risk associated with the entire acquisition process;
- Increase the quality, military worth and supportability of fielded systems, while reducing their operating and sustaining costs throughout the total life cycle;
- Enable Integrated Product and Process Development (IPPD) across the entire acquisition lifecycle.
SBA is SMART for the Army*

“SBA is an Office of the Secretary of Defense (OSD) initiative to reform the acquisition process so that the acquisition community uses modeling and simulation (M&S) robustly throughout the acquisition life cycle. The goals of SBA are to reduce the time to field systems, reduce total costs, and increase the military utility of fielded systems. These goals are of primary concern to the Army, but we recognize that we cannot achieve them through the efforts of the acquisition community alone. It requires the combined, integrated efforts of the Acquisition Workforce along with the requirements and training communities, hence the name SMART.”

*From an article of the same name by LTG Paul J. Kern and Ellen M. Purdy, RDA Magazine, May 1999
Acquisition Life Cycle: The Traditional View

Major Phase Activities

**PHASE 0**
- CONCEPT EXPLORATION
- MS 0
  - Approval to Conduct Concept Studies

**PHASE I**
- PROGRAM DEFINITION & RISK REDUCTION
- MS I
  - Approval to Begin a New Acquisition Program

**PHASE II**
- ENGINEERING & MANUFACTURING DEVELOPMENT
- MS II
  - Approval to Enter Engineering & Manufacturing Development

**PHASE III**
- PRODUCTION, FIELDING/DEPLOYMENT, & OPERATIONAL SUPPORT
- MS III
  - Production or Fielding/Deployment Approval

- Operational Support, Configuration Management
- Demilitarization & Disposal

- Analysis of Alternatives
- Systems Engineering, DT&E
- Systems Engineering, OT&E

**Mission Area Assessments**

Slide 5
New Acquisition Process

OLD:

MS0  MSI  MSII  MSIII

CE    PDRR   EMD    PDOS

NEW:

A  B  C

Pre-Systems Acquisition  Systems Acquisition (Engineering & Manufacturing, LRIP & Production)  Sustainment

DoDI 5000.2; Operation of the Defense Acquisition System; 23 October 2000
Iterative Acquisition Process

Prove Military Need
Use Suite of Models to Emulate battlefield

Milestone 1
Test Concepts
“Real World” of simulation injecting warfighter into process

Milestone 2
Refine Requirements
- Get user involved
- Prevent “gold plating”

Milestone 0
Pre Milestone

Milestone 3
Transition Smoothly to Field
- Manual Proven
- Trained personnel
- Doctrine Ready
Before Equipment Arrives in field

Reduce Program Risks
- Design
- System Integration
- Transition to Production
- Testing

Simulation and Reform of the Acquisition Process.
Adapted from Shiflett et al. (1995)
The SMART Model

3 Components:

• **Process** - Iterative and ‘model-test-model’ rather than ‘test-fix-test’.

• **Environment** - Collaborative, seamless, web-oriented.

• **Culture** - Integrated teams, changing roles and responsibilities.

**HOW?**

**WHERE?**

**WHO?**
SMART Process

• Integration of:
  - Requirements
  - Functional Design
  - Implementation Design

  Throughout the Lifecycle
  Technology Insertion at Any Point
  Reusing Data from Previous M&S

• Rapid Evaluation of Multiple Options
• Electronic Exchange of System Models
• Iterative, spiral process
Spiral Development

Improved Model Provides More Realistic Data
Test Input Further Refines Model, Making Possible Improved Hardware Design
Component Hardware Introduced

Test Data Used to Make a More Realistic Model
More Realistic Data Leads to More Effective and Efficient Testing
Interactive Testing Validates/Authenticates Model
Testing Focus Can Be Narrowed to Save Time and Resources

LTG Paul J. Kern Presentation to Army Test and Evaluation Days, 7/26/00
SMART Environment

- Collaborative, distributed engineering
- Information Repository
- User Transparent Web-style Access

Crusader Example:
Integrated Data Environment:

The Army’s Next Generation Self Propelled Howitzer (SPH) and Resupply Vehicle (RSV)
SMART Culture

• Changing Roles and Responsibilities
• Enabled Integrated Process Teams
• Using M&S Data Through the Acquisition Lifecycle

Comanche (RAH-66) Example:
Integrated Data Teams

Boeing/Sikorsky/Government
SMART Difference

Traditional Mock-up & Full Scale Prototyping
- Employs excessive personnel and facilities
- Time consuming & expensive

Collaborative Virtual Prototyping
- Employs latest technology
- Investigates unlimited design options
- Reduces cost & improves time to first article
The Cost of a system is set before most people ever see that system in the field.
M&S in Acquisition
Pre-Milestone A

**Mission Area Assessments**
Use suite of models & simulations

**Mission Need Statement (MNS)**
Use campaign & theater level models in conjunction with results of lower level models

Extended Air Defense Simulation (EADSIM)

EADSIM is an example of a constructive model at the mission level.
**M&S in Acquisition**

**Concept and Technology Development**

- **ORD Generation**
  - Use operational effectiveness & supportability models
  - Use threat models

- **Analysis of Alternatives**
  - Use cost & operational effectiveness models
  - Use support models

- **RFP**
  - Specify government-owned M&S products
  - Identify M&S requirements

- **System Cost Elements**
  - Use cost models (program & life cycle)

- **Program Planning**
  - Use schedule, risk, plans models

BRAWLER, a constructive model at the engagement level, can be used in all phases of acquisition to predict system performance.

iac.dtic.mil/surviac/prod_serv/model_guide/brawler.html
M&S in Acquisition
System Development & Demonstration

Acquisition Strategy
M&S Strategy
Use repository
VV&A

Systems Engineering
Use Engineering M&S of proposed systems for specification development
Use HW/SW-in-the-loop for design evaluation & risk reduction
Use CAD/CAM for design & producibility planning
Use support & operational models to evaluate logistics/combat support concepts & plans

TEMP
Plan M&S applications to be used in DT&E, OT&E
Plan use of DT&E to validate models
Establish test facility M&S compatibility requirements

The Dynamic Analysis and Design System (DADS) permit engineers to completely design, model and test a vehicle before it is ever built.

http://www.fmtvtruck.com/
M&S in Acquisition
Production and Deployment

Review M&S Requirements & Products Being Used

T&E
Use M&S to quantify test conditions,
Design tests, and
Predict, quantify & extrapolate test results

“Continue” VV&A Activities
Coordinate with repository for M&S
Use production planning
Use manufacturing process and DPD models
Use factory simulations

Logistics Planning
Use M&S to identify logistics support tasks & requirements
Complete support plans

STORM (Simulation Training Operations Rehearsal Model) a federation of 14 models allowed test size to expand from Brigade minus to Division plus through simulation

www.cdt.com/fs31pr.html
M&S in Acquisition

Operations and Support

Update manufacturing process models & factory simulations

Use operations, support tracking & prediction models

Update M&S tools for FOT&E

Provide M&S applications descriptions to repository

Evaluate operations & support deficiencies

Analyze alternative corrective actions

Training and Education

The Optimum Stockage Requirements Analysis Program (OSRAP) quantifies tradeoffs in cost/weight/cube versus readiness when planning contingency packages for fielded equipment

SMART GUIDELINES

- Overview of SMART
- Simulation Support Plan
- How SMART is applied in Functional Areas
- Special Considerations
  - High Level Architecture
  - Using M&S to Stimulate C4I Systems
  - Synthetic Natural Environment
  - Contracting Implications
- Configuration Management (CM)
- Verification, Validation and Accreditation (VV&S)

Army Model and Simulation Office (AMSO) Homepage:
Sources of Information

- Modeling and Simulation Information Analysis Center (MSIAC) http://www.msiac.dmsa.mil
- Simulation Interoperability Standards Organization (SISO) http://www.sisostds.org
  - Simulation Interoperability Workshops (SIW) - March and September in U.S., June in Europe; Computer Generated Forces Conference, more.
- Industry/Interservice Training Simulation and Education Conference (I/ITSEC) http://www.iitsec.org
- International Test and Evaluation Association (ITEA) http://www.itea.org/events/index.html
Summary

• Several types of simulations, including virtual, constructive, and live can be used alone or in combination to support acquisition.

• Modeling and Simulation can support acquisition tasks in all phases of the acquisition cycle.

• SMART is the Army model for Simulation Based Acquisition, and requires changes in the culture, environment and processes of the Acquisition lifecycle.