Modeling, Simulation and Analysis: 
Enabling Early Acquisition Decisions

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We claim M&S provides both cost efficiencies and enhanced capabilities

USD (AT&L) has DoD lead for M&S

M&S has made significant advances in interoperability and reuse but is …

Still not an integral part of AT&L portfolio

Acquisition community can leverage the enabling benefits of M&S in every stage of the systems process
M&S in AT&L – Short History

• 1988 - DSB led by Dr. Anita Jones
  – Computer applications for training
  – Advocated interoperable and reusable distributed training environments

• 1990s - USD (AT&L) becomes responsible agent and DMSO formed under DDR&E

• 2000s Simulation Based Acquisition (SBA) incorporated in Def Acq Guidebook

“We must make far greater use of M&S to cut costs, as well as shorten development cycles …”
Hon. Jacques S. Gansler, USD(AT&L) Sep 22, 1999
M&S in Industry – Short History

• Aircraft design and development
  – Boeing used computer models to develop airframes for 767 and 777
  – Boeing could test far more designs on the computer than it ever could with wind tunnels

• Auto industry now uses computers for model based designs – target to reduce cost ($4B+) & time (by 50%) to introduce new models
  – Virtual models avoid costly and time consuming clay physical “models”

• Architects and Engineers have used CAD / CAM software for more than 2 decades

• Daimler Chrysler and Boeing claim M&S benefits in design, market forecasting, & training
Streamlining Acquisition

• Some perceptions on Defense acquisition
  – Slow, need to shorten development cycles
  – Significant labor requirements to satisfy the “process”
    • Services report they are spending too much time and money producing acquisition documents which no one reads
  – Capabilities frequently reach concept decision and enter into Milestone A or A/B without sufficient “concept refinement”
  – Senior managers request need for analysis driving decisions for program start up or go – no go earlier in concept process

• SBA Goals
  – Reduce time, resources, and risk associated with entire acquisition process
  – Increase quality, military worth, and supportability
  – Reduce ownership costs over system life
  – Enable integrated product development
Target Applications for M&S

- Requirements refinement and management
  - Models / prototypes can pin down and refine system requirements early in the product life cycle
  - Simulations can mimic performance characteristics of hardware as well as software components
  - Early prototypes can carry forward into design development and test phases

- Project Management
  - Simulation can enable more accurate predictions of cost and schedule
  - M&S is inherently more accurate than cost models based on historic data since it accommodates specific process dynamics

- Process Improvement
  - Simulation supports all levels of software Capability Maturity Model
  - Forces manager to address metrics and process behavior
Target Applications for M&S (2)

- **Systems Design and COTS Integration**
  - Many weapons systems require very complex software systems to perform effectively
  - Building software systems usually begins with addressing system architecture
  - Models allow some optimization of competing attributes (reliability, supportability, maintainability, reusability, survivability, mobility, etc) and their interdependencies

- **Risk Management**
  - Simulation can identify project risks and help design less risk-prone strategies
  - Quantitatively predict consequences of alternate decisions

- **Acquisition Management**
  - Simulation can help validate contractors estimates of costs and schedules and provide insights into system performance
State of Simulation Technology

• Evolution of model building environment
  – In the past programmers developed models by textual coding
  – Graphical simulation tools are now available
    • Rapid model development though drag & drop icons
    • Graphic element linking
    • Syntactic constraints on linking elements

• Network-based simulation tools
  – Facilitates rapid development of large detailed models
  – Supports up-front systems engineering
  – Requires significantly less training of the workforce
  – Focus more on the model’s semantic validity
  – Additional incremental costs may be incurred for reuse
Future Environment

- Tight budget, short timelines, rapidly changing events, increased uncertainty
- Requirements for interoperable systems and tools for planning, training, and testing applications
- Net-centric operations with joint, inter-agency and multi-national information sharing
- Cross domain information sharing with increased needs for security assurance and cyber protections
Pre-Milestone A

- Systems Engineering & Systems Analysis sand box
- Target rich environment for early M&S applications
- Build systems prototypes early and extend into model based design and model based development

RFP = Request for Prototype?
Summary

• M&S can be used as a key enabler to meet goals of acquisition reform

• Combination of constructive simulations and virtual simulators can be introduced early to refine user needs and technology opportunities

• Is the acquisition community ready now to expand use of M&S?
Questions?