Modeling & Simulation

How Can M&S Team Better With DT&E?

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Thoughts

- Industry-government teaming—early and often
- Refinement of Live, Virtual, and Constructive M&S capability
- Industry access to government systems
- Organizational support of M&S in DT&E
- Lifecycle perspective
- Open Standards

M&S isn’t a nicety, but a necessity
Complexity drives the need for M&S

Complex Systems of Systems demand M&S in development process.
Roles of Modeling & Simulation

- **SoS/NCO Architecture Design, Development & Implementation**
- **Increasing Fidelity**
- **Modeling & Simulation**

- **Training**
- **Test & Evaluation**
- **Production**
- **Detailed Design**
- **Prototyping**
- **Cost-Performance Trades**
- **Life Cycle Sustainment**
- **Operational Test & Evaluation**
- **Requirements Definition, Concept Development, and Customer Advocacy**

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Building Block SoS Test Approach

- **Systems simulated to comprise subset of SoS**
- **System simulations upgraded and coupled with early emulations comprise subset of SoS with SoS interfaces**
- **System simulations and emulators upgraded and coupled with prototype hardware to comprise SoS**

**Early phases are simulation and emulation based to gain knowledge for Design & Development to set up for Test success**
Organization Matters

- Recognizing the value of M&S, Boeing recently formed an overarching modeling & simulation organization
  - Integrates organizations and functions that cross program boundaries, and
  - Provides analysis of network enabled systems of systems
  - All connected by one knowledge base

- M&S Infrastructure formed around NCO Industry Consortium architecture
M&S Architecture

- **HUMAN INTERFACE**
  - Laboratories / Facilities
- **APPLICATIONS**
  - Models and Tools
- **INFORMATION**
  - Simulation Environment
- **COMMUNICATION**
  - Networks
Three Levels of Military Simulation

Level 1: Systems Level of War
- Flight Sim., Mesa, ITDL, VWC
- Huntsville, Philadelphia, CoS
- Operators
- F/A-18; EA-18G
- Apache
- AWACS
- CRW
- SBR/Space Assets
- UCAV/UAV
- SHORAD
- Weapons

Level 2: Tactical Level of War
- Virtual Warfare Center
- Operators
- CONOPS/TTPs
- Systems-of-Systems
- Interoperability
- Tactical S&R/C2/BM

Level 3: Oper’l Lvl of War
- Boeing Integration Center
- Operators
- ADV NCO C2
- BMC4ISR
- Interoperability
Virtual Warfare Center

- 65,000 square feet
- 23 SCIFs
- Dual operational capability
- Flexible network options
- Video-over-internet capability
- Ability to simulate more than 2,000 digital bodies
- Six F/A-18 cockpits, four F/A-22 cockpits, four F-15 cockpits
- Simulate such platforms as AWACS, AEGIS, Patriot and other ISR systems
- Various patent pending simulation technologies to expand scenario sizes
Government - Industry M&S Connection
Live & Virtual Data Link Integration Demonstration – December 2005

4 X F-16 (Live, airborne) Edwards AFB

Link-16

Boeing Integrated Test Facility

Edwards AFB

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Impediments

- Zealotry
- Different goals
  - Programmatic
  - DT&E
- Intellectual Property
- Security

Notice the lack of technological impediments.
Summary

• M&S is critical for successful DT&E of complex, net-enabled systems of systems
  ➢ Requires robust application of M&S across the entire product life cycle

• M&S is available, today, to provide credible DT&E involving Live, Virtual, and Constructive elements

Partnerships are key – both government/industry, and industry/industry.