Headquarters U.S. Air Force

Modeling & Simulation and (in)
Development Planning

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Perspective: DP is Shifting the Paradigm

MDD (and Concept Decision before that) widely viewed as opportunity to decide “What are we going to acquire?”

MDD is really an investment decision – “Do we need to acquire anything to address this capability need?”

- An acceptable answer is “Not now; pursue S&T investment(s) and revisit the need in a few years.”
- Another acceptable answer is “More (or different utilization) of what we currently have.”

AoA Report provides information to ask “What could we realistically afford to think about acquiring?”

Sponsor – with materiel support – develops COAs and proceeds to MS A with focus on “What do we want to start down the path to acquire?”

- DP ensures sufficient concept/solution work prior to MDD, AoA, & MS A
- M&S and Early SE form the analytical and technical foundation of DP
Acquisition Milestones, Phases, Events/Tasks, and Products

- Acquisition Milestones, Phases, Events/Tasks, and Products
- U.S. AIR FORCE
  - GAPS
  - MDD
  - Materiel Solutions Analysis (MSA)
  - Technology Development (TD)
  - Engineering and Manufacturing Development (EMD)
  - Production and Deployment (P&D)
  - Operations & Support (O&S)

- GBP
- SRR, SFR, PDR...
- CDR... Build/Test/Fix
- Knowledge-Based Decision Making
- Next Block
- Many concepts to Preferred Concept
- Solutions Maturation / Allocation
- Technology Maturation / Competitive Design & Prototyping
- Emitter D
- Emitter E

- Technology Maturation / Competitive Design & Prototyping
- Design Evolution
- Product
- Risk Reduction
- “ROI”

Events & Tasks

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Levels of Analysis

Scope & Fidelity

- Trades
- MOEs
- MOPs

Data collection
Scenario Context
BOGSAT

Reasonableness Check

“Back-of-the-Envelope” Analysis

Time & Cost

- Days $10Ks
- Weeks <$100Ks
- Months $100Ks
- Years $1000Ks

Product

Constructive Analysis

Virtual Simulation

Man in the Loop

Demo

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System Effectiveness Analysis Process

Authoritative Data
- OSD Analytic Agenda
- Joint CONOPS
- Red/Blue System Data
- Subject Matter Experts

Operational Context
- RED TEAM
- BLUE TEAM

Analysis Hierarchy
- Multi-Day Force on Force
- Single Day Many vs. Many
- Few vs. Few
- One vs. One

Very Detailed System and Subsystem Representations

Air Force Standard Analysis Toolkit

Types of Analysis
- Combat Effectiveness
- Military Worth
- Vulnerability Assessment
- Survivability
- Lethality

Types of Products
- Analysis of Alternatives (AoA)
- Requirements Development
- Live Fire Test Assessment
- Concept Assessments
- Systems Engineering Trade Studies
- DT / OT Planning

End-to-End Assessment of System Effectiveness in a Total Force Context

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M&S Contributions to DP

Trade Space Exploration

- Provide analytical support to JCIDS and CBP processes
  - Effectiveness estimates: one-on-one or one-on-many solutions
  - Feasibility studies: concept exploration, technical evaluation
  - Effectiveness/supportability studies: design evaluation and risk reduction of technical options
- Mission Area Assessments

Concept Development, Refinement, and Analysis

- Support acquisition decision processes through MSA Phase
  - AoA activities – primarily support Effectiveness Analysis Working Group (EAWG) and Threat Working Group (TWG) principals
- Consider options of business processes/models
- Costing (program and life cycle)
General

- Support technology demonstration / transition activities to evaluate concepts
- Evaluate opportunities for integration with other systems, SoS characterization, environment representation
- Live / Virtual / Constructive environments augment and mature early engineering assessments
SE and SoSE Perspectives
Acquisition, Operations, Integration, Architecture

Level 6: Force Structure / System-of-Systems
Level 5: Platform / Weapon System (e.g., F-35)
Level 4: Major Subsystem (e.g., Avionics Suite)
Level 3: Functional Area (e.g., Integrated Core Processing)
Level 2: Hardware / Software Building Block
Level 1: Hardware / Software Component

Inputs:
- OUSD(AT&L)
- JCS / COCOMs
- SAF/AQ, PEOs
- MAJCOMs
- Weapon System CEs & Tech Staff
- Project Engineers (Program & Contractor)
- Operators & Maintainers
- Logistics Centers
- Supplier / OEM
- Supply Chain Mgmt

Views of the “universe”
- Acquisition
- Operational

Test & integration focus (notional)
- DT&E
- M&S / Experimentation
- OT&E

Architecture views
- (spans are not authoritative)
What Models & Tools Can Bring to Development Planning

- First-order discriminators to support early trade space exploration
  - Efficient filtering of ideas identifies those that may warrant further study

- Improved ability to select appropriate analytic environments
  - Sensitivity analyses to find the inflection points (“knees in the curves”) are more significant than domain-specific analyses that establish design details
M&S and DP provide the technical and analytical basis to inform pre-acquisition investment decisions and start high-confidence programs.
STUDIES HAVE SHOWN THAT MANY COST MODELS DON’T PRODUCE NUMBERS THAT ARE ANY MORE ACCURATE OR ANY MORE USEFUL THAN NUMBERS YOU JUST MAKE UP ...