Decoupled Test, Evaluation, and Certification of a System of Systems (SoS)

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• This presentation outlines the use of agile testing concepts, decoupled testing, to reduce risk and accelerate a Joint Interoperability assessment/characterization of a highly complex System of Systems (SoS) that does not have an overarching Joint Staff (JS)-approved set of requirements.

• Our example is the Ballistic Missile Defense System (BMDS), which has no JS-approved requirements, and its elements (THAAD, Patriot, JTAGS, AEGIS, etc.), which do have JS-approved requirements.
BMDS - THE BALLISTIC MISSILE DEFENSE SYSTEM

SENSORS
- Space Tracking and Surveillance System
- Sea-Based X-Band Radar
- Aegis BMD SPY-1 Radar
- Forward-Based Radar
- Early Warning Radar

Boost/Ascent Defense Segment
- Potential New Technologies
- Aegis Ballistic Missile Defense Standard Missile-3

Midcourse Defense Segment
- Ground-Based Midcourse Defense
- Terminal High Altitude Area Defense
- Patriot Advanced Capability-3

Terminal Defense Segment
- Sea-Based Terminal

C2BMC
Command, Control, Battle Management and Communications

NMCC  USSTRATCOM  USNORTHCOM  USPACOM  EUCOM  CENTCOM
Background

- Secretary Rumsfeld memo dated 2 January 2002:
  - Directed that the BMDS will not be subject to the traditional requirements generation process
  - Directed a capability-based requirements process for MD
  - Directed the Services to procure the BMDS elements
  - Directed that Service BMDS elements will enter the formal DoD acquisition cycle at MS C
  - Directed use of rapid decision making cycles for MD
• Individual elements of the BMDS have gone through the Joint Capabilities Integration Development System (JCIDS) process and developed applicable architecture documents, etc.

• BMDS has no Joint Staff (JS)-approved requirements and no intention to develop “JCIDS-like” documents

• Assess-to Criteria (AtC) document
  – BMDS Warfighter-developed requirements document
  – Development is on hold and future is unknown
  – Unlikely it would be formally approved by the JS
Decoupled Testing

- **DECOUPLED TESTING:**
  - Each component/element test stands on its own, not dependent upon or being impacted by the results of other tests
  - Identifies the separation of capability blocks whose development shouldn't depend on each other
  - Allows system designers to have as little dependencies as possible
  - Reduces the risk of malfunction in one part of a system of systems when other parts are changed
  - Does not need a detailed requirements specification/speculation
    - Need architecture diagrams
    - Need a scope overview
  - Instead of testing against the specification, the independent testing effort will focus on:
    - production-level system integration testing
    - formal usability testing
  - Supports DoD 5000.02 concept of Integrated T&E
JITC develops an Interoperability Assessment Plan (IAP) to look at System of System BMDS interoperability requirements.

Similar in concept to the JITC Interoperability Certification Evaluation Plan (ICEP)

- Establishes a test and evaluation strategy for evaluating interoperability requirements in:
  - the most efficient and effective manner
  - in an operationally-realistic environment

- Test and evaluation strategy identifies:
  - Data necessary to support an interoperability evaluation
  - Test events/environments planned to produce that data

- Certification vs. Assessment
Elements of the IAP

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Develop T&E Strategy (SoS and Elements)

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Analysis and Reporting (SoS and Elements)

BMDS Test Process

Validate overarching SoS requirements

Decoupled Testing Process

Element #1

Test Planning/Data Collection Planning (SoS and Elements)

Validate Elemental system requirements

Element #2

Element #3

Element #4

Decouple Testing Process

Element #5
Element #1: Validate Overarching SoS Requirements

- JCIDS
- Capability Portfolio Manager (CPM)
- Communities of Interest (COIs)
- Department of Defense Technology Standards and Profile Registry (DISR)
- Concept of Operation (CONOP)
- Concept of Employment (CONEMP)
- Joint Mission Threads (JMT)
- Meta Data Registry (MDR)
- Tactics/Techniques/Procedures (TTPs)
- IMTP
- M&S Plan
Element #2: Validate Elemental System Requirements

- Same as SoS requirements for each elemental system multiplied (times the number of associated component systems)
- Must identify commonality and deltas between each element requirements and the SoS requirements (times the number of associated component systems)
- Must identify commonality and deltas between each element requirements and the requirements of other elements of the SoS (times the number of associated component systems)
Element #3: Develop T&E Strategy (SoS and Elements)

- Test and Evaluation Master Plan (TEMP)
- Combined Test Team (CTT)/Integrated Test Team/Integrated Product Team, etc
- Development Test (DT) Test Organization documents
- Operational Test (OT) Test Organization documents
- Interoperability Test Organization documents
- Modeling and Simulation Analysis (Do models and simulations exist which support test requirements?)
- Major Range and Test Facility Base (MRTFB) analysis (What existing infrastructure exists to support test requirements?)
- Analysis of emerging technologies (What new test methods and equipment might be required to support test requirements?)
Element #4: Test Planning/Data Collection Planning (SoS and Elements)

- Develop IAP
  - Standards Conformance Testing Requirements and testing organizations
  - Interoperability Testing Requirements and testing organizations
  - OT Requirements and testing organizations
  - Service Level Testing and Developmental Testing
  - Test Venues
    - Laboratory (Contractor/Government)
    - Service Level Testing and DT
    - JITC
    - Operational Test
    - Combined/Joint exercises
    - Post fielding assessment in the theater
  - Types/amount/formats of data
  - Use of Design of Experiments
  - Tools (Data Collection & Analysis)
Element #5: Analysis and Reporting (SoS and Elements)

- Information Assurance Results
- Spectrum Results
- Standards Conformance Testing Results
- Interoperability Testing Results
- Capabilities and Limitations
- Data Analysis Group (DAG)/Data Analysis Working Group (DAWG)
- DT Results
- OT Results
- Net Readiness – Key Performance Parameter (NR-KPP) Status
- Status of Interoperability Report (SIR)
- Test Incident Report Database
- System Tracking Program
IAP Data/
Information Sources

• MDA/Element Events
  – FTG
  – FTD
  – GTD/GTI
  – FTT
  – FTM
  – FTP
  – FTO
  – Exercises/Live Events
  – Element LUTs

• JITC Events
  – TDL JIT
  – DICE
  – GCN Testing

• Other Events
  – IA Testing
  – Juniper Cobra

LEGEND:
DICE – DoD Interoperability Communications Exercise
FTD – Flight Test Distributed
FTG – Flight Test GMD
FTM – Flight Test Standard Missile
FTO – Flight Test Operational Patriot
FTP – Flight Test Patriot
FTT – Flight Test THAAD
GCN – GMD Communication Network
GTD – Ground Test Distributed
GTI – Ground Test Integrated
JIT – Joint Interoperability Test
LUT – Limited User Test
TDL – Tactical Data Link
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IAP Test Venues
• Use of decoupled testing will reduce risk and accelerate a Joint Interoperability assessment/characterization of the BMDS System of Systems

• The development of the BMDS IAP will enable JITC to provide a more thorough assessment and characterization of BMDS capabilities and limitations, and provide the BMDS Warfighter a better understanding of the systems they are using.
Questions?

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