Interoperability Developmental
Test & Evaluation Guidance

May 2017

DT&E Interoperability Initiative Team
• **Interoperability DT&E Guidance**
  – Include interoperability as part of overall DT&E strategy, developed early
  – Outline Interoperability DT&E activities in the TEMP at each milestone that
    - Demonstrate mission completion tasks and the critical functions, interfaces, and information exchanges
    - Support interoperability certification
  – DT planning should match limitations and critical information requirements in the Interface Control Document (ICD)
  – T&E resource planning considerations should address contested environment, mission completion, and system-of-systems.
  – Provide early feedback at design reviews (PDR and CDR) - “Shift Left”

• **T&E Resources and Ranges for Interoperability Available**
  – Effective utilization of current interoperability resources will assist in identifying resource and infrastructure gaps

• **Interoperability policy**
  – Guidance distributed across multiple directives and instructions
Interoperability

Milestone C and the Limited Deployment Decision:
• The following general criteria will normally be applied (Milestone B ADM): …, demonstrated interoperability,…

Developmental Evaluation Framework:
• identify key data that will contribute to assessing progress toward achieving …. interoperability

TEMP
• TEMP for all programs must reflect interoperability and supportability requirements
• include evaluation of mission-level interoperability across key interfaces.
• The Program Manager, T&E subject matter experts, and applicable certification stakeholders will assist the user in writing testable measures for cybersecurity and interoperability.

Interoperability
• program managers will design, develop, test and evaluate systems to ensure IT interoperability requirements are achieved.
Interoperability

- The ability of systems, units, or forces to provide data, information, materiel, and services to, and accept the same from, other systems, units, or forces, and to use the data, information, materiel, and services exchanged to enable them to operate effectively together.

- IT interoperability includes both the technical exchange of information and the end-to-end operational effectiveness of that exchange of information as required for mission accomplishment.

- Interoperability is more than just information exchange. It includes systems, processes, procedures, organizations, and missions over the life cycle and must be balanced with cybersecurity.

- JITC will review Test and Evaluation Master Plans (TEMPs) and associated developmental and operational test plans for interoperability.

- AT&L establishes procedures ensuring that the appropriate DT&E authority approves TEMPs… after verifying that adequate levels of DT&E to achieve interoperability certification are planned, resourced and can be executed in a timely manner.
Summary of Policy Applicable to JITC*

**United States Code, Title 10-Armed Forces**
- Sections 2222 and 2223 require the Secretary of Defense and the DoD Chief Information Officer to ensure that defense business systems, information technology, and national security systems are interoperable.

**DoDI 5000.02**
- Provides detailed procedures guiding the operation of the Defense Acquisition System.
- Directs the Program Manager to ensure that interoperability certification is achieved in accordance with DoDI 8330.01.

**DoDI 8330.01**
- Establishes interoperability policy, responsibilities, and procedures.
- Overarching policy.

**IPG**
- Implementation instructions for DoDI 8330.01.
- Actionable procedures.
- Contains list of NR KPP supporting DoDAF products.

**CJCSI 5123.01G**
- Defines JCIDS roles and responsibilities.
- Cancelled and absorbed portions of CJCSI 6212.01F.

**CJCSI 6212.01F**
- Policy moved to JCISIS 5123.01 & 3170.01.
- Procedures moved to JS JCIDS Manual and NR KPP Manual.

**JS JCIDS Manual**
- JCIDS requirements document content.
- DoDAF products not supporting the NR KPP.
- Intelink on-line publication.

**JS NR KPP Manual**
- Extension of the JS JCIDS Manual.
- DoDAF products directly supporting the NR KPP.
- Guidance and procedures for NR KPP development, staffing, and certification.
- Incorporates the NR KPP “how to” procedures from the CJCSI 6212.01F.
- Intelink on-line publication.

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**LEGEND**
- **CJCSI** Chairman of the Joint Chiefs of Staff Instruction IPG
- **DoD** Department of Defense JCIDS
- **DoDAF** Department of Defense Architecture Framework JS
- **DoDI** Department of Defense Instruction NR KPP

*Extracted from JITC NET READY KEY PERFORMANCE PARAMETER (NR KPP) EVALUATION GUIDEBOOK, v 1.0, 22 May 2015, page 7*
Cybersecurity & Interoperability Authorizations/Certifications for MDAPs/MAIS

Materiel Solution Analysis

- JCIDS
  - ICD
  - AoA
  - CDD Draft

- NR KPP
  - For joint programs the official NR KPP will be in the JCIDS documentation; for non-joint programs the official NR KPP will be in the ISP.

- Interop (DoDI 8330)
  - ISP Draft

- RMF (DoDI 8510)
  - SP
  - SAP Draft

- T&E
  - TEMP Draft
  - DT Assessments
  - TRRs as needed

Technology Maturation & Risk Reduction

Requirements Decision Developmental RFP Decision Demonstrated Interoperability by MS C *

- Full Rate Production Decision Review

Engineering & Manufacturing Development

Production and Deployment

O&S

Cybersecurity & Interoperability Authorizations/Certifications for MDAPs/MAIS

- IC - Interoperability Certification
- IATT - Interim Authority to Test
- IATC - Interim Authority to Connect

- ATO - Authority to Operate
- ATC - Approval to Connect
- IC - Interoperability Certification
- ITC - Interoperability Test Certification

- Green – Authorization or Certification official

This means that T&E must be performed in EMD to demonstrate interoperability. This does not mean certification. The interoperability certifier, however, can leverage work done during DT&E.

* 5000.02, 1/7/2015, page 27:
Milestone C and the Limited Deployment Decision are the points at which a program or increment of capability is reviewed for entrance into the P&D Phase or for Limited Deployment. Approval depends in part on specific criteria defined at Milestone B and included in the Milestone B ADM. The following general criteria will normally be applied: …demonstrated interoperability.

"Net-Ready" Certification

- Joint programs – Joint Staff (J6)
- Non-Joint programs - Component

- Interoperability DT&E focusing on infrastructure, data, and services interoperability

- ATO - Authority to Operate
Authorizations/Approval

DoDI 8510.01, Cybersecurity, March 12, 2014

Authorizing Official (AO): Interim Authority To Test (IATT)
- Temporary authorization to test an information system in a specified operational information environment within the timeframe and under the conditions or constraints enumerated in the written authorization. (CNSSI 4009)

Authorizing Official (AO): Authority to Operate (ATO)
- The official management decision given by a senior organizational official to authorize operation of an information system and to explicitly accept the risk to organizational operations (including mission, functions, image, or reputation), organizational assets, individuals, other organizations, and the Nation based on the implementation of an agreed-upon set of security controls. (CNSSI 4009)

DoDI 8330.01, Interoperability, May 21, 2014

Connection Approval Office (CAO): Authority To Connect (ATC)
- A formal statement by the appropriate Connection Approval Office (CAO) granting approval for an information system to connect to a DoD network.

Connection Approval Office (CAO): Interim Authorization To Connect (IATC)
- Temporary approval granted by the appropriate Connection Approval Office (CAO) for the connection of an information system to a DoD network under the conditions or constraints enumerated in the connection approval.

Interoperability Steering Group (ISG): Interim Certificate To Operate (ICTO)
- A temporary authorization to proceed to connection without completing full interoperability certification. Issued by the ISG to PMs who have an urgent need to operate IT, have not completed interoperability certification, but are making satisfactory progress towards that goal (as determined by the ISG).
- ICTOs must only be granted when the system is undergoing interoperability certification testing and there is a documented need to operate the system before completing interoperability test and certification.

Interoperability Certification Authority: (JITC (Joint), Component (all others)): Interoperability Certification
- A formal statement of adequacy, provided by the responsible interoperability certification authority agency, that a system has met its interoperability requirements.
NR KPP*

Three NR KPP Attributes

- Support Military Operations
- Enter and be Managed in the Network
- Effective Information Exchange

- From Appendix E to Enclosure D of the Manual for the Operation of the Joint Capabilities Integration and Development System (JCIDS Manual), 12 February 2015
- NR KPP scoped for all IT and NSS that contain joint interfaces or joint information exchanges
- NR KPP definition is required at MS B for applicable systems
- Testing is planned using an Integrated Architecture Traceability Matrix

* From JCIDS Manual February 12, 2015 (including errata as of 12/18/2015)
## JITC Integrated Architecture
### Traceability Matrix Data Sources

<table>
<thead>
<tr>
<th>NR KPP Attribute</th>
<th>Other Sample Data Sources</th>
<th>Notional Examples of Information from Architecture viewpoints</th>
</tr>
</thead>
</table>
| **Support to Military Operations** | JMETL, JMT, UJTL, and METL | OV-1: Missions (MOEs)  
OV-3: Missions and scenarios (performance measures)  
OV-5b: Operational activities (MOPs)  
OV-6c: Operational activities (MOPs)  
OV-6c: Resource flows and operational threads (Stressing thread)  
SV-5a/SvcV-5: Operational activities (MOPs)  
SV/SvcV-7: Operational mission metrics (MOE & MOP criteria)  
OV-2 Performers ~ OV-5b Activities  
OV-2 Resource flows ~ OV-6c Events |
| **Entered and managed on the network** | CDD/CPD, ISP, ICA, CONOP, and ILSP | SV/SvcV-2: System resource flows (MOPs)  
SV/SvcV-7: Performance metrics (MOP criteria)  
OV-3 Operational resource flows ~ SV-6 System resource flows (Measures)  
OV-3 Operational resource flows ~ SvcV-6 Service data element (Measures)  
SV/SvcV-1 System/Service interfaces ~ SV/SvcV-2 Link, networks, communication (Information exchange path)  
SV/SvcV-1 System/Service resources ~ SV/SvcV-7 Metrics (Performance measures and associated criteria)  
SV/SvcV-2 Links, Networks, communication ~ SV/SvcV-7 Performance parameters |
| **Effectively exchanges information** | CDD/CPD, ISP, and CONOP | SV/SvcV-7: Performance metrics (MOP criteria)  
OV-3 Operational resource flows ~  
SV/SvcV-6 System/Service resource flows (IEs)  
OV-3 Resource flows ~ OV-5b Information flows (IEs)  
SV/SvcV-1 Interfaces ~ SV/SvcV-6 Data elements (IEs)  
SV/SvcV-1 System/Service interfaces ~ SV/SvcV-2 Link, networks, communication (Information exchange path)  
SV/SvcV-6 Performance attributes ~ SV/SvcV-7 Performance parameters (Threshold and objective values) |

* Extracted from JITC NET READY KEY PERFORMANCE PARAMETER (NR KPP) EVALUATION GUIDEBOOK, v 1.0, 22 May 2015, page C-4
Interoperability DT&E Guidance

• **Early feedback – “Shift Left” – Interoperability in DT**
  – Include interoperability in DT strategy
  – Test planning should match limitations and critical information requirements in the ICD
  – When available, use the Information Support Plan (ISP) to validate RFP requirements for T&E and inform government T&E planning
  – Consider interoperability requirements in a System of Systems environment, including infrastructure, data, services, and threat actors
  – Identify interoperability DT&E events in Developmental Evaluation Framework at MS B to provide timely interoperability feedback to Program Managers and decision makers at PDR and CDR
  – Plan interoperability testing to ensure the program supports mission threads

• **JITC to leverage DT&E data for Interoperability Certification**
  – Coordinate with JITC when planning test events

• **Provide feedback at design reviews (PDR and CDR)**

• **Demonstrate interoperability by MS C decision**
Interoperability in a System of Systems (SoS) Context

• **Considerations for Interoperability T&E in a SoS environment**
  
  – T&E Planning should be conducted using DoD AF Operational (OV), Systems (SV), Services (SvcV) and Technical Standards (StdV) Viewpoints; particular emphasis on Systems Viewpoints, e.g., SV-1, Systems Interface Description, etc.
  
  – Mission completion tasks and the critical functions, interfaces, and information exchanges that support those tasks should be identified and used to design testing
  
  – Changes to any system in the SoS should be analyzed to determine the effect on mission threads and testing

• **T&E data contributes to assessing progress toward achieving SoS interoperability**
  
  – Evaluation of key information exchange architectures (system, network) and mechanisms for data exchange
    
    – DODAF 2.0: Operational Viewpoints (OVs), Services Viewpoints (SvcV) Technical Standards (StdV)
  
  – T&E of SoS in mission context using OMS/MP or CONOPs
  
  – T&E of critical functions and components as defined in the Program Protection Plan
  
  – T&E of critical interfaces and mission threads that support military operations as defined in SV Viewpoints

Conveys the general, high level, description of the systems that may perform in this mission, and that there may be some form of communication between them.

**Interoperability T&E should focus on Mission Accomplishment**
Interoperability DT&E in the MS A TEMP

- **Interoperability requirements are understood (compiled and analyzed for measurability, testability, and achievability)**
  - Understand T&E Implications of interoperability requirements in the Capabilities Development Document (CDD), System Requirements Documents, ICD, Draft ISP, etc.

- **T&E data that contributes to assessing progress for achieving interoperability requirements is identified**
  - Key information exchange architectures (system, network) are identified as well as the data to be exchanged
    - DODAF 2.0: Operational Viewpoints (OVs), Services Viewpoints (SvcV) Technical Standards (StdV)
    - OMS/MP or CONOPs is reviewed to understand intended use.
    - Program Protection Plan is reviewed to understand critical functions and components
    - Critical interfaces and mission threads that support military operations are identified

- **Test resource requirements are identified (e.g. Facilities, People, Test Environment, Funding, etc.)**

- **T&E Strategy describes**
  - The overall approach to mitigate interoperability risks
  - Methods of testing key interfaces, functions, and mission threads
  - The DT&E approach for interoperability (if possible, include Developmental Evaluation Framework), including infrastructure, data, and services interoperability
  - Timelines and resources required (including the testing environment)

- **Key Outcomes**
  - DT&E strategy based on interoperability requirements included in MS A TEMP, including test resources
  - Interoperability requirements and DT&E strategy provide input to Request For Proposals and Preliminary Design Review
Review of Interoperability at the Preliminary Design Review

- At PDR, as input to the MS B TEMP, T&E WIPT or subgroup reviews interoperability requirements

- Early analyses to identify
  - Threat actors and attack surface
  - Any changes to interfaces, mission, and conditions as design matures (Preliminary Design Review)
  - Key information/data exchanges testing needed to evaluate performance and impact on mission success.
  - Test resources for interoperability events (e.g. Facilities, People, Test Environment, Funding, etc.)

- Feedback is provided to the program on interoperability requirements and whether they are measurable, testable, and achievable
Interoperability DT&E in the MS B TEMP

• Ensure that MS B TEMP includes
  – T&E Strategy that describes DT&E for infrastructure, data, and services interoperability in as close to a mission environment as possible (i.e. systems-of systems, etc.)
  – Developmental Evaluation Framework (DEF) that defines interoperability T&E events
  – Test resources for interoperability events are documented (e.g. Facilities, People, Test Environment, Funding, etc.)
  – Plans to obtain an Interim Authorization To Test (IATT) are documented (post CDR) (demonstrate interoperability prior to MS C)

• The Draft Milestone B TEMP is used as a source document when developing the Engineering & Manufacturing Development (EMP) RFP
  – Ensure contractor T&E activities and deliverables are included
  – Ensure alignment between TEMP and ISP at RFP Decision Point

• Key Outcomes: Interoperability DT&E planned in the MS B TEMP and conducted during EMD will
  – Support a DT&E assessment of system interoperability
  – Provide feedback to developers
  – Provide input to Critical Design Review
# Developmental Evaluation Framework (DEF) in the TEMP

## Decisions

Decision points within the program are listed across the top row of the table, with Decision Support Questions directly beneath.

## Evaluation

High level evaluation measures are referenced in the far left columns.

## Test

Test events that “feed” the decision are defined in the cells corresponding to decisions, DSQs, and evaluation measures.

## Resources / Schedule

Resources and schedule are defined in the TEMP, linked to decisions and test events included in the matrix.

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<th>Developmental Evaluation Objectives</th>
<th>System Requirements and T&amp;E Measures</th>
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<th>Decision #2</th>
<th>Decision #3</th>
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<tbody>
<tr>
<td>Decision point</td>
<td>Functional evaluation areas</td>
<td>Technical</td>
<td>DSQ #1</td>
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## Decisions Supported

Identify major decision points for which testing and evaluation phases, activity and events will provide decision supporting information.

1. Test event or phase (e.g. CDT1,...)
2. M&S event or scenario
3. Description of data needed to support decision
4. Other logical data source description

## Developmental Evaluation Framework (DEF) in the TEMP

### Performance

- **Performance Capability #1**
  - Technical Measure #1
  - DSQ #1
  - M&S #2
  - DT #4
  - M&S #2

- **Performance Capability #2**
  - Technical Measure #2
  - M&S #1
  - DT #3
  - M&S #1

### Interoperability

- **Interoperability Capability #3**
  - Technical Measure #1
  - IT #1
  - M#2
  - DT #4

### Cybersecurity

- **SW/System Assurance**
  - Technical Measure #1
  - SW Dev Assess
  - SW Dev Assess
  - SW Dev Assess

- **RMF**
  - Technical Measure #1
  - Cont Assess
  - Cont Assess
  - Cont Assess

- **Vulnerability Assess**
  - Technical Measure #1
  - Blue Team
  - Blue Team

### Reliability

- **Reliability Cap #1**
  - Technical Measure #1
  - M#1
  - M#7

- **Reliability Cap #2**
  - Technical Measure #1
  - M#7
  - M#7
Interoperability T&E events are included in the Developmental Evaluation Framework (DEF) to support acquisition decisions. The DEF is included in the MS B and MS C TEMPs and ideally is drafted in the MS A TEMP.

<table>
<thead>
<tr>
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Interoperability in the DEF (Example)

**Support Military Operations**
- 3xx1: Timely, actionable dissemination of HVT
  - DT #1
  - DT #2
  - JITC Testing

**Network connectivity**
- 3xx1: Time to Connect
  - DT #2
  - DT #3
  - JITC Testing

**Exchange Information: Critical Interface 1 - n**
- 3xx1: Data Latency
  - DT #2
  - DT #3
  - JITC Testing

**Mission threads 1 – n**
- 3xx1: Mission threads 1, etc.
  - DT #1
  - DT #2
  - JITC Testing
Interoperability Test Events in EMD

• As outlined in the MS B TEMP
  – Assemble the mission representative test environment and test architecture for system level (and system-of-systems) Interoperability testing (e.g., Live-Virtual-Constructive)
  – Conduct Interoperability DT&E for infrastructure, data and services interoperability
  – Obtain IATT to support demonstration of interoperability prior to MS C

• To support a Milestone C decision, develop a DT&E Assessment that addresses interoperability requirements
  – NR-KPP - Assess ability to:
    – Enter and be managed on a network (NR KPP)
    – Effectively exchange information (NR KPP)
    – Support military operations (NR KPP)
    – Any other interoperability requirements, e.g., mission thread interoperability analysis

• With appropriate planning and coordination, demonstrate the critical operational missions (i.e. OV-6C) in a representative environment involving multiple systems

• Key Outcomes
  – Input to DT&E Assessment (for interoperability)
  – Input to MS C TEMP
  – Input to JITC interoperability certification